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(54) **SECURITY DEVICE**

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Description

[0001] The invention relates to a security device and in particular a public recognition security device which is used to give defence against copying and counterfeiting of articles such as security documents including banknotes, travellers cheques, bonds, share certificates, ID cards, passports, security passes, tickets, certificates of authentication, security labels, credit cards, debit cards, etc.

[0002] GB-A-2241668 reveals how latent images can be produced by blind embossing paper or embossing an area of metallic ink. Such latent images are revealed in contrast when the image is tilted.

[0003] EP 0194042B1 describes a latent image system which is applied during foil blocking. These line structures also produce a change in contrast.

[0004] US-A-4124947 describes a method of producing a graphic pattern by providing a line grid or pattern which is substantially uniform at least in given field sections and comprises relatively closely juxtaposed non-intersecting and non-contacting lines. The ratio between the height and the spacing of the colour mounds forming the lines is selected such that when viewing the pattern below a predetermined boundary inclination angle the base of the valleys between the colour mounds or peaks is not visible.

[0005] CA-A-1019012 describes a latent image system which requires the use of two background line colours which are in register with an embossed line structure. These produce an image by occluding certain parts of the design when viewed at a glancing angle. However, it is not possible to use this approach to obtain reproducible effects from document to document using standard production techniques as a very high degree of register is required. This is not available with currently used equipment for the production of security documents. Instead of the highly embossed line structures, a transparent intaglio lined printing can be used or less preferably a pigmented intaglio ink is proposed. The use of a coloured intaglio ink to provide the emboss line was found to markedly reduce the effectiveness of the feature and also suffers from poor reproducibility between background line tints and intaglio.

[0006] EP 0642933A1 uses a related approach (to CA-A-1019012) where a corrugated surface is first produced using an intaglio ink and is overprinted with a lithographic line structure. When viewed at a glancing angle, latent images are apparent. In this case, the intaglio line structures are used as a way of producing an undulating surface. The method also suffers from the difficulty of achieving good register between litho and intaglio so that reproducible latent images cannot be achieved from document to document.

[0007] US-A-4033059 describes a system capable of producing effective images by intaglio printing. A patterned area of intaglio relief structures forms an image which is hidden within a background area of intaglio. This

is overprinted onto a ground design with which the ink contrasts. The image cannot be easily seen when viewed normal to the surface but can be seen when viewed at a glancing angle.

[0008] EP-A-801604 discloses the enhancement of an embossed security element with a printed image or line screen.

[0009] WO-A-2004/022355 also discloses a security device in which embossed lines are provided with coatings such that the device presents a different appearance when viewed normally and at an oblique angle. Complex versions of this concept are described in which different line structures are used in combination with the same coatings so that different areas exhibit different colour effects. Although the security devices may make it difficult to fraudulently copy an article bearing the device, they are difficult to authenticate because of the rather subtle changes in colour which are exhibited.

[0010] US2003151246 describes a security feature that comprises a printed surface and a partial surface both printed with the same ink. The partial surface being apparent as a result of the ink in that area being a substantially thinner ink film thickness than the printed area.

[0011] The problem is to provide a security device which not only is difficult accurately to copy but which is easy for a viewer to authenticate.

[0012] In accordance with a first aspect of the present invention, we provide a public recognition security device comprising a planar substrate providing first and second areas,

each area having an intaglio printed, raised line structure of spaced apart lines with a background filling the spaces between the lines

wherein the visual colour appearance of the lines is different to that of the background,

wherein the visual colour appearances of the respective backgrounds and/or of the respective line structures of the two areas differ from one another,

and wherein the visual colour appearances of the backgrounds and line structures and the form of the line structures are chosen such that,

a) when viewed by the naked eye of an observer perpendicularly to the plane of the substrate, the resultant visual colour appearances of the two areas results from a combination of the visual colour appearances of the respective background and raised line structure of each area and appear substantially the same, and

b) when viewed by the naked eye of an observer at a first oblique angle to the plane of the substrate, the resultant visual colour appearances of the two areas differ from one another due to part of the backgrounds being obscured by the height of the corresponding intaglio printed raised line structures, the change in the resultant visual colour appearances of the two areas being indicative of the authenticity of the device.

[0013] In accordance with a second aspect of the present invention, we provide a public recognition security device comprising a planar substrate providing first and second areas

each area having an intaglio printed, raised line structure of spaced apart lines with a background filling the spaces between the lines,

wherein the visual colour appearance of the lines is different to that of the background,

wherein the visual colour appearances of the respective backgrounds and/or of the respective line structures of the two areas differ from one another,

and wherein the visual colour appearances of the backgrounds and line structures and the form of the line structures are chosen such that,

a) when viewed by the naked eye of an observer perpendicularly to the plane of the substrate, the first area presents a first resultant visual colour appearance and the second area presents a second visual colour appearance different from the first, each resultant visual colour appearance resulting from a combination of the visual colour appearances of the corresponding background and raised line structure, and,

b) when viewed by the naked eye of an observer at a first oblique angle to the plane of the substrate, the first area presents substantially the second resultant visual colour appearance and the second area presents substantially the first resultant visual colour appearance as a result of part of the backgrounds being obscured by the height of the corresponding intaglio printed raised line structures, the change in resultant visual colour appearances of the two areas being indicative of the authenticity of the device.

[0014] In accordance with a third aspect of the present invention, we provide a public recognition security device comprising a planar substrate providing first and second areas, one area having a printed, raised line structure of spaced apart lines with a background filling the spaces between the lines

[0015] wherein the visual colour appearance of the lines is different to that of the background, the other area having a visual colour appearance which is substantially unchanged at all viewing angles, and wherein the visual colour appearance of the background and raised line structure of the one area and the form of the line structure are chosen such that,

a) when viewed by the naked eye of an observer perpendicularly to the plane of the substrate, the resultant visual colour appearances of the two areas are substantially the same, and

b) when viewed by the naked eye of an observer at a first oblique angle to the plane of the substrate, the resultant visual colour appearances of the two areas differ from one another, the difference being indica-

tive of the authenticity of the device, the difference being caused by a change in the visual colour appearance of the one area due to part of the background being obscured by the height of the intaglio printed raised line structure.

[0016] We have realised that it is possible to utilise a combination of raised line structures and background colours to solve the problem mentioned above of providing a security document which is difficult to copy but is easy for the public to authenticate by considering the way in which the line structures and colours interact in the or each discrete area.

[0017] In contrast to the approach adopted in WO2004/022355, we have considered the relationship between the colours of the discrete areas as defined by the background colour and the raised line structure colour and the way in which these can be related to one another.

[0018] The advantage of the first aspect is that by having two areas appearing substantially similar when viewed normally but different when viewed at an angle, the change in appearance is obvious as the areas now look different to each other. This is much more obvious than if an area changes in appearance without there being anything to compare it against.

[0019] In some cases, the visual colour appearance of an area is defined by a flat or solid colour presented by that area but in other examples the visual colour appearance could be in the form of stripes or other designs.

[0020] The raised line structures are printed onto the substrate by intaglio printing.

[0021] The background visual colour appearance could comprise the natural colour of the substrate or a colour which has been applied e.g. printed, coated, sprayed or transferred onto the substrate. It could be intaglio or non-intaglio printed with a constant tone, cross hatching or the like i.e. optically invariant.

[0022] Typically, the raised line structures are formed by rectilinear lines but the lines could be wavy or curved while the lines are typically continuous but could be broken.

[0023] Security devices according to the invention can be used with a wide variety of articles of value as mentioned in the introduction.

[0024] Some examples of security devices according to the invention will now be described with reference to the accompanying drawings (which are not to scales), in which:

Figure 1a illustrates a first example of a security device viewed in plan;

Figures 1b and 1c are schematic, partial cross-sections taken along respective arrows through areas 1 and 2 of the device respectively in Figure 1a;

Figures 1d and 1e illustrate areas 1 and 2 respectively when viewed at an oblique angle;

Figure 1f illustrates the security device as a whole when viewed at an oblique angle;

Figures 2a - 2f are views similar to Figures 1a - 1f but of a second example;

Figures 3a - 3f are views similar to Figures 1a - 1f but of a third example;

Figure 4a illustrates a modified form of third example of the security device when viewed normally;

Figure 4b illustrates the device of Figure 4a when viewed at an oblique angle;

Figures 5a - 5f are views similar to views Figures 1a - 1f but of a fourth example;

Figure 6 illustrates schematically the structure of a modified form of the fourth example;

Figures 7a, 7b and 7c are views of a fifth example when viewed perpendicularly and at two different acute angles;

Figures 8a and 8b are views similar to Figures 4a and 4b but of a sixth example;

Figures 9a and 9b, 9c and 9d are views similar to Figures 4a and 4b but of a seventh example and modified seventh example respectively;

Figures 10a and 10b illustrate schematically in cross-section line structures of different spacing and line width;

Figures 11a and 11b illustrate schematically in cross-section line structures of different height;

Figures 12a - 12h illustrate different arrangements of the discrete areas on a document;

Figures 13a and 13b illustrate suitable parallel and non-parallel line structures;

Figures 14a and 14b illustrate different arrangements of line structures on background colours;

Figures 15a and 15b are views similar to Figures 4a and 4b and illustrate a modified form of the third example; and

Figures 16a and 16b are views similar to Figures 4a and 4b but of an eighth example.

[0025] Several examples described in this specification assume that when viewed normally or perpendicular to the device two defined areas appear colour matched. Such an effect could be interpreted subjectively and in all examples here where it is stated that two areas are colour matched this should be defined as being an approximate match where the two areas appear substantially the same colour.

[0026] Other examples described here also assume that when viewed at an oblique angle the colour that appears in a particular area will be approximately the same colour as that of the intaglio lines in that area. In practice it should be noted that the background and raised line structure colour and opacity of the raised line structure ink will influence the colour that appears at an angle.

[0027] It is also important to remember throughout this specification that the total height of an intaglio line will be dependent on the amount of emboss as well as the amount of ink transferred.

[0028] Typically, the line structures have line widths and spacings each in the range 30-600 μ m, preferably

50-500 μ m, more preferably 80-400 μ m, most preferably 80-300 μ m. Typical raised print coverage is 30-70%, preferably 35-65%, most preferably 40-60%.

5 **Example 1 - Figure 1**

Black & white switch

[0029] On a first area 1, white intaglio lines 1A are printed on a black background 1B so as to look substantially the same when viewed normally as a second area 2 with black intaglio 2A printed on a white background 2B, as shown in Figures 1a), 1b) and 1c). Depending on the line structures of the areas, they should both appear either as a flat grey colour or as a series of black and white lines. The background colour of Area 1 and/or Area 2 may result from a print or coating on the substrate 3, or may be the colour of the substrate itself. When both areas are viewed at an angle, only the raised print can be seen visually, so a colour change is observed with the first area appearing white and the second area appearing black, as shown in Figures 1 d) 1e) and 1f).

25 **Example 2 - Figure 2**

Colour switch

[0030] On a first area 1, intaglio lines 4 of a certain colour (A) are printed on a background 5 with a different colour (B) so as to look substantially the same as a second area with intaglio lines 6 of colour (B) printed on a background 7 with colour (A), as shown in Figures 2a), 2b) and 2c). The background colour of Area 1 and/or Area 2 may result from a print or coating on the substrate 3, or may be the colour of the substrate itself. When viewed at an angle only the raised print can be seen visually, so the first area appears colour (A), the second area appears colour (B), as shown in Figures 2d), 2e) and 2f).

40 **Example 3 - Figures 3 and 4**

Matched face-on (giving appearance of one colour) → mismatch (2 alternative colours)

[0031] The first area 1 has a background colour (A) and intaglio lines with colour (B). The second area 2 has a background colour (C) which may or may not be the same or similar as colour (B) and intaglio lines with colour (D) which may or may not be the same or similar as colour (A), as shown in Figure 3a). The first and second areas are approximately visually colour matched when viewed normally so they appear substantially as a solid flat tint with one colour (E), described in Figure 3a), b) and c). The background colour of Area 1 and/or Area 2 may result from a print or coating on the substrate, or may be the colour of the substrate itself. When viewed at an angle only the raised print will be visualised, so the first area

switches from colour (E) to colour (B) and the second area switches from colour (E) to colour (D) - the colours of the intaglio lines, as described in Figure 3d), e) and f).

[0032] Relatively fine intaglio lines and spacing may enhance this feature. The range of intaglio printed line widths may be between 50 and 250 μm , preferably 80-250 μm with a raised print coverage of 30-70%. A combination of violet intaglio on yellow background in area 1 and yellow intaglio on a violet background in area 2 could give a colour matched effect when viewed normally when a line width of 80 μm and a line spacing of 100 μm is employed.

[0033] As an alternative example, Area 1 could have a red background with green intaglio, appearing brown under normal viewing. Area 2 could have a blue background with orange intaglio, also appearing brown under normal viewing. The two areas would then appear different at a low angle (Area 1 going green and Area 2 going orange).

[0034] For each area, as the ratio of the intaglio line width to spacing decreases, so the colour when viewed normally becomes less like the intaglio print colour and more like the background colour. For instance, an area with a background colour (A) but with 95% coverage of intaglio lines with colour (B) will take on the appearance approaching colour (B) when viewed normally. In contrast, an area with a background colour (A) with 5% coverage of intaglio ink with colour (B) will take on the appearance approaching colour (A) when viewed normally.

[0035] As an example, an area with blue intaglio lines with line width 200 μm and spacing 135 μm , i.e. approximately 60% coverage, printed over a yellow background will appear blue-green in colour (colour E) when viewed normally (closer to the colour of the intaglio lines than to the background) and blue when viewed at an angle. However an area with blue intaglio lines with line width 135 μm and 200 μm spacing (approximately 40% coverage) printed over a yellow background will appear yellow-green when viewed normally (more like the colour of the background), but will switch to blue when viewed at an angle.

[0036] This effect can be used to improve a colour match between two areas. For example, take area 1 and area 2 which both have an intaglio line width of 140 μm and a spacing of 140 μm . A combination of blue intaglio on yellow background in area 1 could appear a bluer green when viewed normally than a combination of yellow intaglio on a blue background in area 2. However, by utilizing a line width of 120 μm and a line spacing of 160 μm in area 2, it will appear bluer when viewed normally and improve the colour match. Similarly, it would be possible to adjust the line width and spacing of area 1 to improve the colour match further.

Example 4 - Figures 5 and 6

Matched face-on (giving appearance of stripes) $\rightarrow$ mismatch (2 alternative colours)

[0037] The first area has a background colour (A) and intaglio lines with colour (B). The second area has a background colour (C) and intaglio lines with colour (D). Colour C is substantially similar to the appearance of colour B as it appears on background A, and colour A is substantially similar to the appearance of colour D as it appears on background C. The first and second areas are substantially indistinguishable and appear as a series of stripes when viewed normally. This is described in Figure 5a), b) and c). The background colour of Area 1 and/or Area 2 may result from a print or coating on the substrate, or may be the colour of the substrate itself. When viewed at an angle, the two areas switch to solid colours (B) and (D) respectively - the colours of the intaglio lines, shown in Figure 5d), e) and f).

[0038] Coarser intaglio lines and spacing may enhance this feature. The range of intaglio printed line widths may be between 150 and 450 μm .

[0039] For example, violet intaglio with a line width of 300 μm and a spacing of 400 μm on yellow background in area 1 would appear as alternating violet and yellow stripes when viewed normally. Yellow intaglio with a line width of 400 μm and a spacing of 300 μm on a violet background would also appear as a series of alternating violet and yellow stripes when viewed normally. The two areas would appear substantially similar if the colour of the violet intaglio on yellow background in area 1 were similar to the violet background in area 2 and the colour of the yellow intaglio on violet background in area 2 were similar to the colour of the yellow background in area 1. When viewed at an angle, area 1 would appear violet and area 2 would appear yellow.

[0040] When viewed normally, to give an appearance of continuous lines from the first area to the second area, the intaglio lines may be offset slightly so that the position of the intaglio lines in the first area are in the opposite position to the intaglio lines in the second area i.e. the position of the spacings, as shown in Figure 5a).

[0041] Alternatively the position of the intaglio lines in the first and second areas could be the same as described in Figure 6 - especially if viewed face on, the two areas do not need to visually appear as continuous stripes as in the case of Example 3.

Example 5 - Figure 7

Mismatched face-on (giving appearance of 2 different colours) $\rightarrow$ opposite mismatch (2 opposite colours appear)

[0042] The first area has a background colour (A) and intaglio lines with colour (B). The second area has a background colour (C), which may be similar or the same as

colour (B) and intaglio lines with colour (D), which may be similar or the same as colour (A). The first area visually appears as colour (E), which is closer to the background colour (A) than intaglio colour (B) when viewed normally, whereas the second area visually appears as colour (F), which is closer to the background colour (C) than intaglio colour (D) when viewed normally. This is described in Figure 7a). The background colour of Area 1 and/or Area 2 may result from a print or coating on the substrate, or may be the colour of the substrate itself. When viewed at an angle, the two areas switch in colour to their opposite colour as defined by their intaglio print colours. The first area switches to colour (B) when viewed at an angle from a colour that appears closer to the background colour (A) than intaglio colour (B) when viewed normally. The second area switches to colour (D) when viewed at an angle - which may be similar or the same as Colour (A) - from a colour that is closer to the background colour (C) - which may be similar or the same as colour (B) when viewed normally. This is shown by Figure 7c).

[0043] In a version of this example, the range of intaglio printed line widths may be 50-250 μ m and with line width-space to give a raised print coverage of 30-70%, preferably 35-65%, best 40-60%. To control this effect, the line spacing on each area may be made to be greater than the intaglio line width, i.e. the ratio of line width to space may be less than 1. For example, take area 1 and area 2 which both have an intaglio line width and spacing of 140 μ m. A combination of blue intaglio on yellow background in area 1 could appear a bluer green when viewed normally than a combination of yellow intaglio on a blue background in area 2. These areas switch when viewed at a low angle with area 1 appearing blue and area 2 appearing yellow. The switch can be enhanced by making the line spacing greater than the line width. For example, the line widths can be changed to 115 μ m and the line spacing to 165 μ m in both areas 1 and 2. This would make each area appear closer to its background colour than before. Area 1 would appear more yellow than before when viewed normally, and area 2 would appear more blue than before.

[0044] When viewed perpendicularly, Area 1 may then appear yellow-green and Area 2 may appear blue-green. As the document is tilted, the colour of the raised print in each area will begin to play a larger role in the overall visual appearance of each area and at a particular oblique angle, e, the visual colours of the two areas will switch to the colour of the opposite area when viewed perpendicularly i.e. Area 1 will appear blue-green and Area 2 will appear yellow-green. However, at a second oblique angle, θ' , when the document is tilted further each area will then appear the same colour as the raised print. At this point, Area 1 will appear blue and Area 2 will appear yellow. This is shown in Figures 7a), b) and c). At some point, as the device is tilted, the two areas may appear the same colour.

[0045] In another example the two areas could give the appearance of stripes on normal viewing, as opposed

to two flat colours. In this case the entire stripy area in Area 1 and Area 2 would appear closer to its background colour than the intaglio colour. For this stripy effect, raised print line widths of between 150-450 μ m would be preferable. For example area 1 and area 2 could have a line structure with 260 μ m raised print line width and 340 μ m spacing. Area 1 has blue intaglio on a yellow background and Area 2 has yellow intaglio on blue background. The line structure is such that in both areas when viewed normally they appear as stripes, but the overall area is closer to the background colour i.e. Area 1 appears yellow-green but stripy and Area 2 appears blue-green but stripy. When viewed at an oblique angle each area switches to its raised print colour - Area 1 will now appear as a flat blue colour and Area 2 will appear as a flat yellow colour.

Example 6 - Figure 8

Mismatch face-on (giving appearance of 2 different colours) $\rightarrow$ same mismatch (same 2 colours appear).

[0046] The first area has a background colour (A) and intaglio lines with colour (B). The second area has a background colour (C), which may be similar or the same as colour (B) and intaglio lines of colour (D), which may be similar or the same as colour (A). The first area visually appears substantially closer to the intaglio line colour (B) than the background colour (A) when viewed normally, whereas the second area visually appears substantially closer to the intaglio colour (D) than the background colour (C) when viewed normally. This is shown in Figure 8a). The background colour of Area 1 and/or Area 2 may result from a print or coating on the substrate, or may be the colour of the substrate itself. When viewed at an angle, the first area appears as colour (B) and the second area appears as colour (D) - that is, there is only a subtle switch in colours when the colours are viewed at an angle. This is described in Figure 8b).

[0047] The range of intaglio printed line widths may be 50-250 μ m and the raised print to spacing ratio should be such that the raised print coverage is between 30-70%, preferably 35-65%, most preferably 40-60%. A method to achieve this effect could be to make the raised print line width on each area greater than the line spacing, i.e. the ratio of line width to space may be greater than 1. For example, area 1 and area 2 may both have an intaglio line width of 140 μ m and a spacing on 140 μ m. A combination of blue intaglio on a yellow background in area 1 could appear substantially the same (green) when viewed normally as a combination of yellow intaglio on a blue background in area 2. When viewed at an angle, these areas switch with area 1 appearing blue and area 2 appearing yellow (the colour of the raised print). By making the line width greater than the line spacing the switch could be made subtler. For example the line widths could be changed to 165 μ m and the line spacing to 115 μ m in both area 1 and 2. When viewed normally, this would make area 1 appear bluer than before i.e. blue-

green, and area 2 more yellow i.e. yellow-green. Area 1 would appear bluer than area 2 under normal viewing. However, when viewed at an oblique angle area 1 (the bluer area) will switch to blue and area 2 (the yellower area) will switch to yellow. The colour switch is therefore more subtle.

[0048] In another example the two areas could give the appearance of stripes on normal viewing, as opposed to two flat colours. In this case the entire stripy area in Area 1 and Area 2 would appear closer to its intaglio colour than the background colour. For this stripy effect, raised print line widths of between 150-450 μ m would be preferable. For example area 1 and area 2 could have a line structure with 300 μ m raised print line width and 200 μ m spacing. Area 1 has blue intaglio on a yellow background and Area 2 has yellow intaglio on blue intaglio. The line structure is such that in both areas when viewed normally they appear as stripes, but the overall area is closer to the intaglio colour i.e. Area 1 appears blue-green but stripy and Area 2 appears yellow-green but stripy. When viewed at an oblique angle each area switches to its raised print colour - Area 1 will now appear as a flat blue colour and Area 2 will appear as a flat yellow colour.

Example 7 - Figure 9

Matched face-on $\rightarrow$ mismatched (two different colours)

[0049] On a first area intaglio lines of colour (B) are printed on a background with a different colour (A) so that when viewed normally it appears substantially the same as a second area which has just a background. This background could be a non-intaglio printed area or an intaglio area printed with a constant tone, cross hatching or the like i.e. optically invariant. The background of the second area is provided by at least colour (C) with or without an additional colour (D). The background colour of area 1 and one of the background colours of area 2 may be the colour of the substrate itself. When viewed at an angle the first area appears colour (B) - the colour of the intaglio lines. The colour of the second area is unchanged.

[0050] As an example area 1 could have an intaglio line width of 80 μ m with a line spacing of 80 μ m. A combination of blue intaglio on a yellow background would appear green when viewed normally. Area 2 can be printed with a single colour green to substantially match this appearance. When viewed at an angle area 1 will appear blue and area 2 will remain green. This is shown in Figures 9 a) and b).

[0051] As a second example area 1 could have an intaglio line width of 250 μ m and a line spacing of 250 μ m. This will appear as blue and yellow stripes. Area 2 can be printed in alternating yellow and blue stripes each 250 μ m width to provide a substantial match to area 1 when viewed normally. When viewed at an angle area 1 will appear blue and area 2 will remain as yellow and blue

stripes. This is shown in Figures 9c) and d).

Effect of line structure on colour switch angle.

[0052] If each area includes intaglio lines with fixed line width and print height, as the spacing between the intaglio lines increases, so the viewing angle required to see the colour switch becomes closer to the substrate surface. By decreasing the line spacing, the viewing angle required to see the colour switch becomes closer to the normal viewing position. As a result the switching colour may become more apparent. This is shown in Figures 10 a) and b).

[0053] For example an area with blue intaglio lines with line width 160 μ m and spacing 40 μ m printed over a yellow background will show a colour switch at an angle θ' to the normal viewing position. However, an area with blue intaglio lines with line width 160 μ m and spacing 200 μ m printed over a yellow background will show a colour switch at an angle θ which is closer to the substrate surface.

Effect of print height on colour switch and colour switch angle

[0054] The height of the intaglio lines may affect the colour that appears on each area when viewed both normally and at an angle. This is particularly so when the intaglio print colour is much lighter than the background colour, for example yellow intaglio print over a dark blue background. As the ink film thickness increases so more ink is put down over the background, meaning less of the background colour shows through the intaglio ink. When viewed at an angle, the switching colour will be close to the actual colour of the intaglio ink as it is when it is printed over a white background. Alternatively, as the ink film thickness decreases so less ink is put down over the background meaning more of the background colour shows through the intaglio ink. When viewed at an angle, the switching colour will appear as a combination of the intaglio and background colours.

[0055] The height of the intaglio lines, which comprises the ink height and emboss height, on each area may also affect the viewing angle required to see the colour switch. A low height may mean an angle θ' that is closer to the substrate surface is required to view the colour switch. An increased intaglio height may mean an angle θ that is closer to the normal viewing position is required to view the colour switch. This is explained in Figures 11 a) and b).

Effect of intaglio print opacity on colour switch and angle

[0056] By increasing the opacity of the intaglio print on either or each area, the switching colour of each area may be enhanced and more colourful when viewed at an angle i.e. the colour will approach the actual intaglio print colour achieved when printed over a white background.

If a transparent intaglio ink is used on either or each area, the background colour that the intaglio ink is printed over will show through, so the colour that appears when each area is viewed at an angle will be a combination of the intaglio and background colours and will look less like the intaglio colour. This effect is more apparent if a light intaglio colour is chosen e.g. yellow and printed over a dark background e.g. blue.

[0057] If each defined area produces a different colour to the other when viewed at an angle, the intaglio inks used on each area should have sufficient opacity to allow greater contrast between the two colours. For example, take area 1 and area 2 both having an intaglio line width of 80µm and a line spacing of 100µm, with area 1 having red intaglio lines on a blue background and area 2 having blue intaglio lines on a red background. If both the red and the blue intaglio inks are of low opacity then when viewed at a low angle area 1 could appear as a dark red and area 2 appear dark blue, with little contrast in either colour or tone. If both the red and blue inks are of high opacity then the two colours that appear when viewed at a low angle may be bright blue and bright red - appearing closer to the colour of the intaglio inks as they appear when printed over a white background, and also appearing strongly contrasting.

[0058] Alternatively, if an area with opaque red intaglio lines on a blue background is compared to a second area with transparent blue intaglio lines on a red background, the colours that appear when viewed at an angle may still be strongly contrasting but may appear as a red and dark blue-black pair. As a final example, if a transparent blue intaglio ink is used on the first area and an opaque blue intaglio ink is used on the second area printed on a red background, an approximate colour match may be obtained when viewed normally, but when viewed at an angle, the first area may appear dark blue-black whereas the second area may appear a much brighter blue.

[0059] In addition, the angle that the switching colours appear may become closer to the normal viewing position, and therefore more obvious, as the opacity of the intaglio inks used on each area increases. If transparent intaglio inks are used on each area, then the angle required to view the switching colours may become closer to the substrate surface and so less obvious.

Effect of intaglio opacity on colour match when viewed normally.

[0060] As the opacity of the intaglio lines printed over a coloured background increases, the colour of those lines will approach the colour of the same intaglio ink printed over a white background when viewed normally. This will affect the overall colour and appearance of each area when viewed normally and is particularly relevant when considering a colour-matched pair of areas as described in Example 3.

[0061] For example, take area 1 and area 2 both having intaglio line width of 120µm and a line spacing of 120µm,

with blue intaglio on red background in area 1 and red intaglio on a blue background in area 2. These areas may appear quite different when viewed normally depending on the opacity of the intaglio inks. If both intaglio inks are low opacity then the two areas may appear approximately colour matched when viewed normally. If higher opacity inks are used then the colour of the intaglio print appears closer to the appearance of the intaglio colour as when printed over a white background. This will change the appearance of the areas when viewed normally with the result that the two areas may no longer be matched at all.

Effect of background colour on colour switch colour.

[0062] Depending on the opacity of the intaglio inks printed on each or either area, the colour of the background on each or either area will contribute to the switching colours that appear when each or either area is viewed at an angle. If a dark colour is used as the background e.g. blue with a light colour e.g. yellow intaglio printed over the top, then the colour that appears when the area is viewed at an angle will be darker than the actual intaglio print colour achieved when printed over a white background. Similarly, if a light colour e.g. yellow is used as the background with a dark colour e.g. blue intaglio printed over the top, then the colour that appears when the area is viewed at an angle will be similar to the actual intaglio print colour achieved when printed over a white background. In both of the above examples as the opacity of the intaglio ink is raised the colour of that appears when viewed at a low angle approaches the colour of the intaglio ink as when printed over a white background.

Position of the 2 areas

[0063] The two defined areas may be adjacent to each other as in Figure 12a); separated from each other e.g. in separate corners of a document as in Figure 12b); separated from each other by utilising additional print areas with or without background print and/or intaglio print in the overall design as in Figure 12c); overlap slightly as in Figure 12d); rainbow into each other as in Figure 12e); or one area could be located within the second area as in Figure 12f). In addition to these examples, more than two areas can be utilized e.g. each of the areas can be split into multiple sections (see Figure 12g which is comparable to a chequerboard pattern), and/or extra areas which take on a different appearance to the first two areas may be added (see Figure 12h). This Figure consists of four different areas Area 1, Area 2, Area 3 and Area 4. Areas 1 and 2 appear colour matched (as Colour E) when viewed normally, but when viewed at an angle appear as different colours (colours B & D) - this is similar to that described in Example 3. Areas 3 and 4 appear as a mismatch when viewed normally and when viewed at an angle appear as a similar mismatch - this is similar to that described in Example 6. Area 2 and Area 4 appear

as another mismatch when viewed normally, and then appear colour matched when viewed at an angle. Area 1 and Area 3 also behave in this manner. Of course, any combination of areas may be utilised in this manner.

Shape of lines

[0064] In the examples the intaglio printed areas are a series of repeated straight lines. These lines do not necessarily have to be straight but could take the form of any shape/design e.g. concentric designs, wavy or curved, circles, triangles, zigzag etc.

[0065] Figure 13 a) illustrates some suitable line structures made up of parallel lines, including lines in the form of triangles, lines with a variation of width along their length, wavy lines and concentric circles. However, the intaglio lines do not necessarily need to be parallel but can be converging or diverging. Some similar nonparallel structures are shown in Figure 13b). These include diverging lines, lines with their centre-points varying along their length, non-parallel wavy lines and concentric ellipses.

Shape of intaglio print

[0066] In the examples the intaglio printed areas are made up of a series of repeated lines. However, the lines need not be continuous lines but could take the form of broken lines. The lines could be broken into dashes; dots; repeated shapes and non-repeated shapes which are arranged in a linear fashion. Shapes include circular dots; square dots; triangular dots; star-shaped dots etc.

Position of intaglio printed area in relation to background colour.

[0067] The intaglio printed lines of either area may extend beyond the background colour of the corresponding area, as shown in Figure 14a). Alternatively the background colour of either area may extend beyond the intaglio printed lines of either area, as described in Figure 14b).

Line structure variation

[0068] Shading effects may be possible at the normal viewing position if the intaglio line structure across each area is varied e.g. by increasing or decreasing the spacing or staggering the lines. This may not necessarily cause a similar shading effect when each area is viewed at an angle. Simple shading is highlighted in Figures 15a) and 15b). It is possible to use this effect in more complicated designs such as a portrait as illustrated in Figures 16a) and 16b). Darker images are produced by increasing the % coverage of intaglio lines printed in a dark colour over a light coloured background, or by reducing the % coverage of intaglio lines printed in a light colour over a dark background. Alternatively when viewed normally

shading effects may be created by varying the colour strength of the background colour in each area.

Choice of colours to enhance colour switch effect.

[0069] Any colours may be used for the background and intaglio print of each or either area, but to maximise the impact of the colours that appear when viewed at an angle, colours pairs that strongly contrast each other could be used e.g. blue-yellow; blue-red; red-yellow; violet-orange; violet-yellow; red-green; black-white etc.

[0070] For example an area with a blue-yellow colour pair may have a background with PANTONE 2955M colour (blue) and a raised print with visual colour of PANTONE YELLOW M (yellow). Alternatively an area with a red-yellow colour pair may have a background colour of PANTONE 130M (yellow) and a raised print with visual colour of PANTONE 1788M (red). Another example may show an area with a violet-orange colour pair that may have a background colour of PANTONE 153M (orange) with a raised print line structure with visual colour of PANTONE 2957M (violet).

25 Claims

1. A public recognition security device comprising a planar substrate providing first and second areas, each area having an intaglio printed, raised line structure of spaced apart lines with a background filling the spaces between the lines wherein the visual colour appearance of the lines is different to that of the background, wherein the visual colour appearances of the respective backgrounds and/or of the respective line structures of the two areas differ from one another, and wherein the visual colour appearances of the backgrounds and line structures and the form of the line structures are chosen such that,

a) when viewed by the naked eye of an observer perpendicularly to the plane of the substrate, the resultant visual colour appearances of the two areas results from a combination of the visual colour appearances of the respective background and raised line structure of each area and appear substantially the same, and
b) when viewed by the naked eye of an observer at a first oblique angle to the plane of the substrate, the resultant visual colour appearances of the two areas differ from one another due to part of the backgrounds being obscured by the height of the corresponding intaglio printed raised line structures, the change in the resultant visual colour appearances of the two areas being indicative of the authenticity of the device.

2. A public recognition security device comprising a pla-

nar substrate providing first and second areas each area having an intaglio printed, raised line structure of spaced apart lines with a background filling the spaces between the lines, wherein the visual colour appearance of the lines is different to that of the background, wherein the visual colour appearances of the respective backgrounds and/or of the respective line structures of the two areas differ from one another, and wherein the visual colour appearances of the backgrounds and line structures and the form of the line structures are chosen such that,

a) when viewed by the naked eye of an observer perpendicularly to the plane of the substrate, the first area presents a first resultant visual colour appearance and the second area presents a second visual colour appearance different from the first, each resultant visual colour appearance resulting from a combination of the visual colour appearances of the corresponding background and raised line structure, and,

b) when viewed by the naked eye of an observer at a first oblique angle to the plane of the substrate, the first area presents substantially the second resultant visual colour appearance and the second area presents substantially the first resultant visual colour appearance as a result of part of the backgrounds being obscured by the height of the corresponding intaglio printed raised line structures, the change in resultant visual colour appearances of the two areas being indicative of the authenticity of the device.

3. A device according to claim 1 or claim 2, wherein the visual colour appearance of each background and each raised line structure is defined by one or both of its colour and intensity.
4. A device according to claim 3, wherein the change in the resultant visual colour appearance of an area is defined by one or both of a change in colour and intensity.
5. A device according to any of the preceding claims, wherein the resultant visual colour appearance of an area when viewed perpendicularly to the plane of the substrate comprises a pattern, for example of parallel or non-parallel lines.
6. A device according to any of claims 1 to 4, wherein the resultant visual appearance of an area when viewed perpendicularly comprises a substantially solid colour.
7. A device according to any of the preceding claims, wherein the resultant visual colour appearance of an area when viewed at the first oblique angle to the

plane of the substrate comprises a pattern.

8. A device according to any of claims 1 to 6, wherein the resultant visual colour appearance of an area when viewed at the first oblique angle to the plane of the substrate comprises a substantially solid colour.
9. A device according to claim 6 or claim 8, wherein the lines of the raised line structures are not readily apparent to the naked eye against the background.
10. A device according to claim 5 or claim 7, wherein the pattern comprises a set of parallel stripes.
11. A device according to claim 10, wherein both areas present stripes when viewed in one of the perpendicular and oblique angles, the stripes being laterally offset from one another.
12. A device according to any of the preceding claims, wherein the visual colour appearance of the background of the first area is substantially the same as the visual colour appearance of the raised line structure of the second area; and the visual colour appearance of the background of the second area is substantially the same as the visual colour appearance of the raised line structure of the first area.
13. A device according to claim 1, or any of claims 3 to 11 when dependent on claim 1, wherein the visual colour appearance of each background and each raised line structure is defined by its colour, the colour of the backgrounds and line structures all being different from each other, and wherein the colours are chosen such that the resultant colour of the areas when viewed perpendicularly is different from the individual colours of the backgrounds and line structures.
14. A device according to at least claim 1, wherein the visual colour appearance of the background and the visual colour appearance of the raised line structure of one area are different from both the visual colour appearances of the background and the raised line structure of the other area, and wherein the raised line structure of each area is such that when viewed perpendicularly; the areas present resultant visual colour appearances closer in hue to the raised line structure visual colour appearance than to the corresponding background visual colour appearance while at a first, oblique angle, the areas present resultant visual colour appearances substantially the same as the raised line structures.
15. A device according to at least claim 2, wherein the visual colour appearance of the background and the visual colour appearance of the raised line structure

- of one area are different from both the visual colour appearances of the background and the raised line structure of the other area, and wherein the raised line structure of each area is such that when viewed perpendicularly, the areas present resultant visual colour appearances closer in hue to the background colour than to the corresponding raised line structure colour while at a second, oblique angle, the areas present resultant visual colour appearances substantially the same as the raised line structures.
16. A device according to claim 15, wherein the first and second oblique angles are different.
17. A device according to any of the preceding claims, wherein the first and second areas are separated from each other by utilising additional print areas with or without background print and/or intaglio print in the overall design.
18. A device according to any of the preceding claims, wherein the visual colour appearance of one of the backgrounds and/or raised line structures is black.
19. A device according to any of the preceding claims, wherein the visual colour appearance of one of the backgrounds and/or raised line structures is white.
20. A device according to any of the preceding claims, wherein at least one of the resultant visual colour appearances presented by the two areas when viewed at the first oblique angle is substantially the same as the visual colour appearance of one of the raised line structures.
21. A device according to any of the preceding claims, wherein the visual colour appearances of at least one of the backgrounds are defined by one or more coloured materials provided on the substrate and having a colour different to the natural colour of the substrate.
22. A device according to claim 21, wherein the or each coloured material extends throughout the respective area including underneath the raised, printed line structure.
23. A device according to any of claims 1 to 22, wherein the visual colour appearance of at least one background comprises the natural colour of the substrate.
24. A device according to any of the preceding claims, wherein the colours for the background and the raised line structure respectively of one area are chosen from the following colour pairs: blue-yellow, blue-red, red-yellow, violet-orange, violet-yellow, red-green, black-white.
25. A device according to any of the preceding claims, wherein the first and second areas abut one another.
26. A device according to any of the preceding claims, wherein the raised line structures of the two areas differ from one another in one or both of their width and spacing.
27. A device according to claim 26, when dependent on claim 25, wherein the line widths and spacing defined by the raised line structures of the two areas are complementary.
28. A device according to any of the preceding claims, wherein the lines of at least one raised line structure each have a width greater than the spacing between adjacent lines.
29. A device according to any of the preceding claims, wherein the lines of at least one raised line structure each have a width less than the spacing between adjacent lines.
30. A device according to any of the preceding claims, wherein the lines of at least one raised line structure are substantially equally spaced apart.
31. A device according to any of the preceding claims, wherein the line structures have line widths and spacings each in the range 30-600 μ m, preferably 50-500 μ m, more preferably 80-400 μ m, most preferably 80-300 μ m.
32. A device according to any of the preceding claims, wherein the raised print coverage is 30-70%, preferably 35-65%, most preferably 40-60%.
33. A device according to any of the preceding claims, wherein the lines of the raised line structure are continuous or broken.
34. A device according to any of the preceding claims, wherein the lines of the raised line structures are one of rectilinear, wavy or curved.
35. A device according to any of the preceding claims, wherein the lines of the two raised line structures are substantially parallel.
36. A public recognition security device comprising a planar substrate providing first and second areas, the first area having an intaglio printed, raised line structure of spaced apart lines with a background filling the spaces between the lines wherein the visual colour appearance of the lines is different to that of the background, the second area having a visual colour appearance which is substantially unchanged at all viewing angles, and wherein

the visual colour appearance of the background and raised line structure of the first area and the form of the line structure are chosen such that,

- a) when viewed by the naked eye of an observer perpendicularly to the plane of the substrate, the resultant visual colour appearances of the two areas are substantially the same, and
 - b) when viewed by the naked eye of an observer at a first oblique angle to the plane of the substrate, the resultant visual colour appearances of the two areas differ from one another, the difference being indicative of the authenticity of the device, the difference being caused by a change in the visual colour appearance of the first area due to part of the background being obscured by the height of the intaglio printed raised line structure.
37. A device according to claim 36, wherein the first area is defined in the same way as an area of a device according to any of claims 1 to 35.
38. A document of value carrying a security device according to any of the preceding claims.
39. A document of value according to claim 38, the document comprising a banknote.

Patentansprüche

1. Öffentlichkeitserkennungs-Sicherheitsvorrichtung, ein ebenes Substrat umfassend, das einen ersten und einen zweiten Bereich bereitstellt, wobei jeder Bereich eine tiefgedruckte erhabene Linienstruktur aus voneinander beabstandeten Linien aufweist, wobei die Räume zwischen den Linien mit einem Hintergrund gefüllt sind, wobei das optische Farberscheinungsbild der Linien anders ist als das des Hintergrundes, wobei sich die optischen Farberscheinungsbilder der entsprechenden Hintergründe und/oder der entsprechenden Linienstrukturen der zwei Bereiche voneinander unterscheiden und wobei die optischen Farberscheinungsbilder der Hintergründe und Linienstrukturen und die Form der Linienstrukturen derart gewählt sind, dass
- a) bei Betrachtung mit dem bloßen Auge eines Betrachters senkrecht zur Ebene des Substrats die entstehenden optischen Farberscheinungsbilder der zwei Bereiche aus einer Kombination der optischen Farberscheinungsbilder des entsprechenden Hintergrundes und der erhabenen Linienstruktur jedes Bereiches entstehen und im Wesentlichen gleich erscheinen und
 - b) bei Betrachtung mit dem bloßen Auge eines

Betrachters in einem ersten schiefen Winkel zur Ebene des Substrats sich die entstehenden optischen Farberscheinungsbilder der zwei Bereiche voneinander unterscheiden, aufgrund dessen, dass ein Teil der Hintergründe durch die Höhe der entsprechenden tiefgedruckten erhabenen Linienstrukturen verdeckt wird, wobei die Veränderung der entstehenden optischen Farberscheinungsbilder der zwei Bereiche die Echtheit der Vorrichtung anzeigt.

2. Öffentlichkeitserkennungs-Sicherheitsvorrichtung, ein ebenes Substrat umfassend, das einen ersten und einen zweiten Bereich bereitstellt, wobei jeder Bereich eine tiefgedruckte erhabene Linienstruktur aus voneinander beabstandeten Linien aufweist, wobei die Räume zwischen den Linien mit einem Hintergrund gefüllt sind, wobei das optische Farberscheinungsbild der Linien anders ist als das des Hintergrundes, wobei sich die optischen Farberscheinungsbilder der entsprechenden Hintergründe und/oder der entsprechenden Linienstrukturen der zwei Bereiche voneinander unterscheiden und wobei die optischen Farberscheinungsbilder der Hintergründe und Linienstrukturen und die Form der Linienstrukturen derart gewählt sind, dass

- a) bei Betrachtung mit dem bloßen Auge eines Betrachters senkrecht zur Ebene des Substrats der erste Bereich ein erstes entstehendes optisches Farberscheinungsbild zeigt und der zweite Bereich ein zweites optisches Farberscheinungsbild zeigt, das sich vom ersten unterscheidet, wobei jedes entstehende optische Farberscheinungsbild aus einer Kombination der optischen Farberscheinungsbilder des entsprechenden Hintergrundes und der entsprechenden Linienstruktur entsteht, und
- b) bei Betrachtung mit dem bloßen Auge eines Betrachters in einem ersten schiefen Winkel zur Ebene des Substrats der erste Bereich im Wesentlichen das zweite entstehende optische Farberscheinungsbild zeigt und der zweite Bereich im Wesentlichen das erste entstehende optische Farberscheinungsbild zeigt, im Ergebnis dessen, dass ein Teil der Hintergründe durch die Höhe der entsprechenden tiefgedruckten erhabenen Linienstrukturen verdeckt wird, wobei die Veränderung der entstehenden optischen Farberscheinungsbilder der zwei Bereiche die Echtheit der Vorrichtung anzeigt.

3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei das optische Farberscheinungsbild jedes Hintergrundes und jeder erhabenen Linienstruktur durch seine Farbe und/oder seine Intensität definiert ist.

4. Vorrichtung nach Anspruch 3, wobei die Veränderung des entstehenden optischen Farberscheinungsbildes eines Bereiches durch eine Veränderung der Farbe und/oder eine Veränderung der Intensität definiert ist. 5
5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das beim Betrachten senkrecht zur Ebene des Substrats entstehende optische Farberscheinungsbild eines Bereiches ein Muster umfasst, zum Beispiel aus parallelen oder nicht parallelen Linien. 10
6. Vorrichtung nach einem der Ansprüche 1 bis 4, wobei das beim senkrechten Betrachten entstehende optische Farberscheinungsbild eines Bereiches im Wesentlichen einfarbig ist. 15
7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das beim Betrachten in dem ersten schiefen Winkel zur Ebene des Substrats entstehende optische Farberscheinungsbild eines Bereiches ein Muster umfasst. 20
8. Vorrichtung nach einem der Ansprüche 1 bis 6, wobei das beim Betrachten in dem ersten schiefen Winkel zur Ebene des Substrats entstehende optische Farberscheinungsbild eines Bereiches im Wesentlichen einfarbig ist. 25
9. Vorrichtung nach Anspruch 6 oder Anspruch 8, wobei die Linien der erhabenen Linienstrukturen mit dem bloßen Auge nicht leicht vom Hintergrund unterschieden werden können. 30
10. Vorrichtung nach Anspruch 5 oder Anspruch 7, wobei das Muster eine Gruppe paralleler Streifen umfasst. 35
11. Vorrichtung nach Anspruch 10, wobei beide Bereiche beim senkrechten Betrachten oder beim Betrachten in schiefen Winkeln Streifen zeigen, wobei die Streifen zueinander seitlich versetzt sind. 40
12. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das optische Farberscheinungsbild des Hintergrundes des ersten Bereiches im Wesentlichen gleich dem optischen Farberscheinungsbild der erhabenen Linienstruktur des zweiten Bereiches ist und das optische Farberscheinungsbild des Hintergrundes des zweiten Bereiches im Wesentlichen gleich dem optischen Farberscheinungsbild der erhabenen Linienstruktur des ersten Bereiches ist. 45
13. Vorrichtung nach Anspruch 1 oder einem der Ansprüche 3 bis 11, wenn abhängig von Anspruch 1, wobei das optische Farberscheinungsbild jedes Hintergrundes und jeder erhabenen Linienstruktur durch seine bzw. ihre Farbe definiert ist, wobei sich alle Farben der Hintergründe und der Linienstrukturen voneinander unterscheiden und wobei die Farben derart gewählt sind, dass die beim senkrechten Betrachten entstehende Farbe der Bereiche anders als die jeweiligen Farben der Hintergründe und Linienstrukturen ist. 50
14. Vorrichtung nach mindestens Anspruch 1, wobei sich das optische Farberscheinungsbild des Hintergrundes und das optische Farberscheinungsbild der erhabenen Linienstruktur eines Bereiches sowohl vom optischen Farberscheinungsbild des Hintergrundes als auch dem der erhabenen Linienstruktur des anderen Bereiches unterscheiden und wobei die erhabene Linienstruktur jedes Bereiches derart ist, dass die Bereiche beim senkrechten Betrachten ein entstehendes optisches Farberscheinungsbild zeigen, das dem optischen Farberscheinungsbild der erhabenen Linienstruktur im Farbton näher liegt als dem optischen Farberscheinungsbild des entsprechenden Hintergrundes, wohingegen die Bereiche in einem ersten schiefen Winkel ein entstehendes optisches Farberscheinungsbild zeigen, das im Wesentlichen dem der erhabenen Linienstrukturen gleich ist. 55
15. Vorrichtung nach mindestens Anspruch 2, wobei sich das optische Farberscheinungsbild des Hintergrundes und das optische Farberscheinungsbild der erhabenen Linienstruktur eines Bereiches sowohl vom optischen Farberscheinungsbild des Hintergrundes als auch dem der erhabenen Linienstruktur des anderen Bereiches unterscheiden und wobei die erhabene Linienstruktur jedes Bereiches derart ist, dass die Bereiche beim senkrechten Betrachten ein entstehendes optisches Farberscheinungsbild zeigen, das der Farbe des Hintergrundes im Farbton näher liegt als der Farbe der entsprechenden erhabenen Linienstruktur, wohingegen die Bereiche in einem zweiten schiefen Winkel ein entstehendes optisches Farberscheinungsbild zeigen, das im Wesentlichen dem der erhabenen Linienstrukturen gleich ist.
16. Vorrichtung nach Anspruch 15, wobei sich der erste und der zweite schiefe Winkel unterscheiden.
17. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der erste und der zweite Bereich durch Verwendung zusätzlicher Druckbereiche mit oder ohne Hintergrunddruck und/oder Tiefdruck in der Gesamtgestaltung voneinander getrennt sind.
18. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das optische Farberscheinungsbild eines der Hintergründe und/oder einer der erhabenen Linienstrukturen schwarz ist.

19. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das optische Farberscheinungsbild eines der Hintergründe und/oder einer der erhabenen Linienstrukturen weiß ist. 5
20. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei mindestens eines der entstehenden optischen Farberscheinungsbilder, die durch die zwei Bereiche gezeigt werden, beim Betrachten im ersten schiefen Winkel im Wesentlichen gleich dem optischen Farberscheinungsbild einer der erhabenen Linienstrukturen ist. 10
21. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das optische Farberscheinungsbild mindestens eines der Hintergründe durch ein oder mehrere farbige Materialien definiert ist, die auf dem Substrat bereitgestellt sind und eine Farbe aufweisen, die sich von der natürlichen Farbe des Substrats unterscheidet. 15
22. Vorrichtung nach Anspruch 21, wobei sich das oder jedes farbige Material über den gesamten entsprechenden Bereich erstreckt, auch unter der erhabenen, gedruckten Linienstruktur. 20
23. Vorrichtung nach einem der Ansprüche 1 bis 22, wobei das optische Farberscheinungsbild mindestens eines Hintergrundes die natürliche Farbe des Substrats umfasst. 25
24. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Farben für den Hintergrund beziehungsweise die erhabene Linienstruktur eines Bereiches aus den folgenden Farbpaaren ausgewählt sind: Blau-Gelb, Blau-Rot, Rot-Gelb, Violett-Orange, Violett-Gelb, Rot-Grün, Schwarz-Weiß. 30
25. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der erste und der zweite Bereich aneinander anliegen. 35
26. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei sich die erhabenen Linienstrukturen der zwei Bereiche in ihrer Breite und/oder ihrem Abstand voneinander unterscheiden. 40
27. Vorrichtung nach Anspruch 26, wenn abhängig von Anspruch 25, wobei sich die Linienbreiten und -abstände, die durch die erhabenen Linienstrukturen der zwei Bereiche definiert sind, gegenseitig ergänzen. 45
28. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linien mindestens einer erhabenen Linienstruktur jeweils eine Breite aufweisen, die größer als der Abstand zwischen benachbarten Linien ist. 50
29. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linien mindestens einer erhabenen Linienstruktur jeweils eine Breite aufweisen, die geringer als die Abstände zwischen benachbarten Linien ist. 5
30. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linien mindestens einer erhabenen Linienstruktur im Wesentlichen gleichmäßig beabstandet sind. 10
31. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linienstrukturen Linienbreiten und -abstände aufweisen, die jeweils im Bereich von 30 bis 600 μm , bevorzugt 50 bis 500 μm , bevorzugter 80 bis 400 μm und am stärksten bevorzugt 80 bis 300 μm liegen. 15
32. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Abdeckung der erhabenen Bedruckung 30 bis 70 %, bevorzugt 35 bis 65 % und am stärksten bevorzugt 40 bis 60 % beträgt. 20
33. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linien der erhabenen Linienstruktur durchgehend oder durchbrochen sind. 25
34. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linien der erhabenen Linienstrukturen geradlinig, wellenförmig oder gekrümmt sind. 30
35. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Linien der zwei erhabenen Linienstrukturen im Wesentlichen parallel liegen. 35
36. Öffentlichkeitserkennungs-Sicherheitsvorrichtung, ein ebenes Substrat umfassend, das einen ersten und einen zweiten Bereich bereitstellt, wobei der erste Bereich eine tiefgedruckte erhabene Linienstruktur aus voneinander beabstandeten Linien aufweist, wobei die Räume zwischen den Linien mit einem Hintergrund gefüllt sind, wobei das optische Farberscheinungsbild der Linien anders ist als das des Hintergrundes, wobei der zweite Bereich ein optisches Farberscheinungsbild aufweist, das in allen Betrachtungswinkeln im Wesentlichen unverändert bleibt, und wobei das optische Farberscheinungsbild des Hintergrundes und der erhabenen Linienstruktur des ersten Bereiches und die Form der Linienstruktur derart gewählt sind, dass 40
- a) bei Betrachtung mit dem bloßen Auge eines Betrachters senkrecht zur Ebene des Substrats die entstehenden optischen Farberscheinungsbilder der zwei Bereiche im Wesentlichen gleich sind und 45

b) bei Betrachtung mit dem bloßen Auge eines Betrachters in einem ersten schiefen Winkel zur Ebene des Substrats sich die entstehenden optischen Farberscheinungsbilder der zwei Bereiche voneinander unterscheiden, wobei der Unterschied die Echtheit der Vorrichtung anzeigt, wobei der Unterschied durch eine Änderung des optischen Farberscheinungsbildes des ersten Bereiches aufgrund dessen verursacht wird, dass ein Teil des Hintergrundes durch die Höhe der tiefgedruckten erhabenen Linienstruktur verdeckt wird.

37. Vorrichtung nach Anspruch 36, wobei der erste Bereich auf gleiche Weise definiert ist wie ein Bereich einer Vorrichtung nach einem der Ansprüche 1 bis 35.

38. Wertdokument, das eine Sicherheitsvorrichtung nach einem der vorhergehenden Ansprüche trägt.

39. Wertdokument nach Anspruch 38, wobei das Dokument eine Banknote umfasst.

Revendications

1. Dispositif de sécurité de reconnaissance publique comprenant un substrat plan fournissant des première et seconde zones, chaque zone ayant une structure de lignes surélevées imprimées en creux de lignes espacées les unes des autres avec un arrière-plan remplissant les espaces entre les lignes dans lequel l'aspect de couleur visuel des lignes est différent de celui de l'arrière-plan, dans lequel les aspects de couleur visuels des arrière-plans respectifs et/ou des structures de lignes respectives des deux zones diffèrent les uns des autres, et dans lequel les aspects de couleur visuels des arrière-plans et des structures de lignes et la forme des structures de lignes sont choisis de telle sorte que,

a) lorsqu'ils sont vus par un observateur à l'oeil nu perpendiculairement au plan du substrat, les aspects de couleur visuels résultants des deux zones résultent d'une combinaison des aspects de couleur visuels de l'arrière-plan respectif et de la structure de lignes surélevées de chaque zone et apparaissent sensiblement identiques, et

b) lorsqu'ils sont vus par un observateur à l'oeil nu à un premier angle oblique par rapport au plan du substrat, les aspects de couleur visuels résultants des deux zones diffèrent les uns des autres car une partie des arrière-plans est obs-

curcie par la hauteur des structures de lignes surélevées imprimées en creux correspondantes, le changement des aspects de couleur visuels résultants des deux zones étant indicatif de l'authenticité du dispositif.

2. Dispositif de sécurité de reconnaissance publique comprenant un substrat plan fournissant des première et seconde zones, chaque zone ayant une structure de lignes surélevées imprimées en creux de lignes espacées les unes des autres avec un arrière-plan remplissant les espaces entre les lignes dans lequel l'aspect de couleur visuel des lignes est différent de celui de l'arrière-plan, dans lequel les aspects de couleur visuels des arrière-plans respectifs et/ou des structures de lignes respectives des deux zones diffèrent les uns des autres, et dans lequel les aspects de couleur visuels des arrière-plans et des structures de lignes et la forme des structures de lignes sont choisis de telle sorte que,

a) lorsqu'elle est vue par un observateur à l'oeil nu perpendiculairement au plan du substrat, la première zone présente un premier aspect de couleur visuel résultant et la seconde zone présente le second aspect de couleur visuel différent du premier, chaque aspect de couleur visuel résultant provenant d'une combinaison des aspects de couleur visuels de l'arrière-plan correspondant et de la structure de lignes surélevées, et,

b) lorsqu'elle est vue par un observateur à l'oeil nu à un premier angle oblique par rapport au plan du substrat, la première zone présente sensiblement le second aspect de couleur visuel résultant et la seconde zone présente sensiblement le premier aspect de couleur visuel résultant car une partie des arrière-plans est obscurcie par la hauteur des structures de lignes surélevées imprimées en creux correspondantes, le changement des aspects de couleur visuels résultants des deux zones étant indicatif de l'authenticité du dispositif.

3. Dispositif selon la revendication 1 ou la revendication 2, dans lequel l'aspect de couleur visuel de chaque arrière-plan et chaque structure de lignes surélevées est défini par sa couleur et/ou son intensité.

4. Dispositif selon la revendication 3, dans lequel le changement de l'aspect de couleur visuel résultant d'une zone est défini par un changement de couleur et/ou un changement d'intensité.

5. Dispositif selon l'une quelconque des revendications

- précédentes, dans lequel l'aspect de couleur visuel résultant d'une zone lorsqu'elle est vue perpendiculairement au plan du substrat comprend un motif, par exemple, de lignes parallèles ou non parallèles.
6. Dispositif selon l'une quelconque des revendications 1 à 4, dans lequel l'aspect visuel résultant d'une zone lorsqu'elle est vue perpendiculairement comprend une couleur sensiblement pleine. 5
 7. Dispositif selon l'une quelconque des revendications précédentes, dans lequel l'aspect de couleur visuel résultant d'une zone lorsqu'elle est vue au premier angle oblique par rapport au plan du substrat comprend un motif. 10
 8. Dispositif selon l'une quelconque des revendications 1 à 6, dans lequel l'aspect de couleur visuel résultant d'une zone lorsqu'elle est vue au premier angle oblique par rapport au plan du substrat comprend une couleur sensiblement pleine. 15
 9. Dispositif selon la revendication 6 ou la revendication 8, dans lequel les lignes des structures de lignes surélevées ne sont pas aisément apparentes à l'oeil nu contre l'arrière-plan. 20
 10. Dispositif selon la revendication 5 ou la revendication 7, dans lequel le motif comprend un jeu de rayures parallèles. 25
 11. Dispositif selon la revendication 10, dans lequel les deux zones présentent des rayures lorsqu'elles sont vues dans l'un des angles perpendiculaire et oblique, les rayures étant latéralement décalées les unes des autres. 30
 12. Dispositif selon l'une quelconque des revendications précédentes, dans lequel l'aspect de couleur visuel de l'arrière-plan de la première zone est sensiblement identique à l'aspect de couleur visuel de la structure de lignes surélevées de la seconde zone ; et l'aspect de couleur visuel de l'arrière-plan de la seconde zone est sensiblement le même que l'aspect de couleur visuel de la structure de lignes surélevées de la première zone. 35
 13. Dispositif selon la revendication 1, ou l'une quelconque des revendications 3 à 11, lorsqu'elle dépend de la revendication 1, dans lequel l'aspect de couleur visuel de chaque arrière-plan et chaque structure de lignes surélevées est défini par sa couleur, la couleur des arrière-plans et les structures de lignes étant tous différents les uns des autres, et dans lequel les couleurs sont choisies de telle sorte que la couleur résultante des zones lorsqu'elles sont vues perpendiculairement est différente des couleurs individuelles des arrière-plans et des structures de lignes. 40
 14. Dispositif selon au moins la revendication 1, dans lequel l'aspect de couleur visuel de l'arrière-plan et l'aspect de couleur visuel de la structure de lignes surélevées d'une zone sont différents à la fois des aspects de couleur visuels de l'arrière-plan et de la structure de lignes surélevées de l'autre zone, et dans lequel la structure de lignes surélevées de chaque zone est telle que lorsqu'elles sont vues perpendiculairement, les zones présentent des aspects de couleur visuels résultants plus proches en nuance à l'aspect de couleur visuel de la structure de lignes surélevées qu'à l'aspect de couleur visuel d'arrière-plan correspondant alors qu'à un premier angle oblique, les zones présentent des aspects de couleur visuels résultants sensiblement identiques aux structures de lignes surélevées. 45
 15. Dispositif selon au moins la revendication 2, dans lequel l'aspect de couleur visuel de l'arrière-plan et l'aspect de couleur visuel de la structure de lignes surélevées d'une zone sont différents à la fois des aspects de couleur visuels de l'arrière-plan et de la structure de lignes surélevées de l'autre zone, et dans lequel la structure de lignes surélevées de chaque zone est telle que lorsqu'elles sont vues perpendiculairement, les zones présentent des aspects de couleur visuels résultants plus proches en nuance de la couleur d'arrière-plan que de la couleur de la structure de lignes surélevées correspondante alors qu'à un second angle oblique, les zones présentent des aspects de couleur visuels résultants sensiblement identiques aux structures de lignes surélevées. 50
 16. Dispositif selon la revendication 15, dans lequel les premier et second angles obliques sont différents. 55
 17. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les première et seconde zones sont séparées les unes des autres en utilisant des zones d'impression additionnelles avec ou sans impression d'arrière-plan et/ou impression en creux dans la conception globale.
 18. Dispositif selon l'une quelconque des revendications précédentes, dans lequel l'aspect de couleur visuel de l'un des arrière-plans et/ou de l'une des structures de lignes surélevées est noir.
 19. Dispositif selon l'une quelconque des revendications précédentes, dans lequel l'aspect de couleur visuel de l'un des arrière-plans et/ou des structures de lignes surélevées est blanc.
 20. Dispositif selon l'une quelconque des revendications précédentes, dans lequel au moins l'un des aspects de couleur visuels résultants présentés par les deux zones lorsqu'elles sont vues au premier angle oblique est sensiblement identique à l'aspect de couleur

visuel de l'une des structures de lignes surélevées.

21. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les aspects de couleur visuels d'au moins l'un des arrière-plans sont définis par une ou plusieurs matières colorées fournies sur le substrat et ayant une couleur différente de la couleur naturelle du substrat. 5
22. Dispositif selon la revendication 21, dans lequel la ou chaque matière colorée s'étend partout sur la zone respective y compris en dessous de la structure de lignes surélevées imprimées. 10
23. Dispositif selon l'une quelconque des revendications 1 à 22, dans lequel l'aspect de couleur visuel d'au moins un arrière-plan comprend la couleur naturelle du substrat. 15
24. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les couleurs pour l'arrière-plan et la structure de lignes surélevées respectivement d'une zone sont choisies parmi les paires de couleurs suivantes : bleu-jaune, bleu-rouge, rouge-jaune, violet-orange, violet-jaune, rouge-vert, noir-blanc. 20 25
25. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les première et seconde zones sont contiguës l'une à l'autre. 30
26. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les structures de lignes surélevées des deux zones diffèrent les unes des autres dans leur largeur et/ou espacement. 35
27. Dispositif selon la revendication 26, lorsqu'elle dépend de la revendication 25, dans lequel les largeurs et espacement de ligne définis par les structures de lignes surélevées des deux zones sont complémentaires. 40
28. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les lignes d'au moins une structure de lignes surélevées ont chacune une largeur plus grande que l'espacement entre lignes adjacentes. 45
29. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les lignes d'au moins une structure de lignes surélevées ont chacune une largeur inférieure à l'espacement entre des lignes adjacentes. 50
30. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les lignes d'au moins une structure de lignes surélevées sont espacées les unes des autres de manière sensiblement égale. 55

31. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les structures de lignes ont des largeurs et espacements de ligne chacun dans la plage de 30 à 600 μm , de préférence 50 à 500 μm , de manière davantage préférée 80 à 400 μm , de manière préférée entre toutes 80 à 300 μm . 5
32. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la couverture d'impression surélevée est de 30 à 70 %, de préférence 35 à 65 %, de manière préférée entre toutes 40 à 60 %. 10
33. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les lignes de la structure de lignes surélevées sont continues ou interrompues. 15
34. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les lignes des structures de lignes surélevées sont l'une parmi rectilignes, ondulées ou incurvées. 20
35. Dispositif selon l'une quelconque des revendications précédentes, dans lequel les lignes des deux structures de lignes surélevées sont sensiblement parallèles. 25
36. Dispositif de sécurité de reconnaissance publique comprenant un substrat plan fournissant des première et seconde zones, la première zone ayant une structure de lignes surélevées imprimées en creux de lignes espacées les unes des autres avec un arrière-plan remplissant les espaces entre les lignes, dans lequel l'aspect de couleur visuel des lignes est différent de celui de l'arrière-plan, la seconde zone ayant un aspect de couleur visuel qui est sensiblement inchangé à tous les angles de vision, et dans lequel l'aspect de couleur visuel de l'arrière-plan et la structure de lignes surélevées de la première zone et la forme de la structure de lignes sont choisis de telle sorte que, 30
 - a) lorsqu'ils sont vus par un observateur à l'oeil nu perpendiculairement au plan du substrat, les aspects de couleur visuels résultants des deux zones sont sensiblement les mêmes, et
 - b) lorsqu'ils sont vus par un observateur à l'oeil nu à un premier angle oblique par rapport au plan du substrat, les aspects de couleur visuels résultants des deux zones diffèrent les uns des autres, la différence étant indicative de l'authenticité du dispositif, la différence étant causée par un changement de l'aspect de couleur visuel de la première zone car une partie de l'arrière-plan est obscurcie par la hauteur de la structure de lignes surélevées imprimées en creux. 35
37. Dispositif selon la revendication 36, dans lequel la 40

première zone est définie de la même manière qu'une zone d'un dispositif selon l'une quelconque des revendications 1 à 35.

38. Document de valeur portant un dispositif de sécurité selon l'une quelconque des revendications précédentes. 5

39. Document de valeur selon la revendication 38, le document comprenant un billet de banque. 10

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Figure 1a

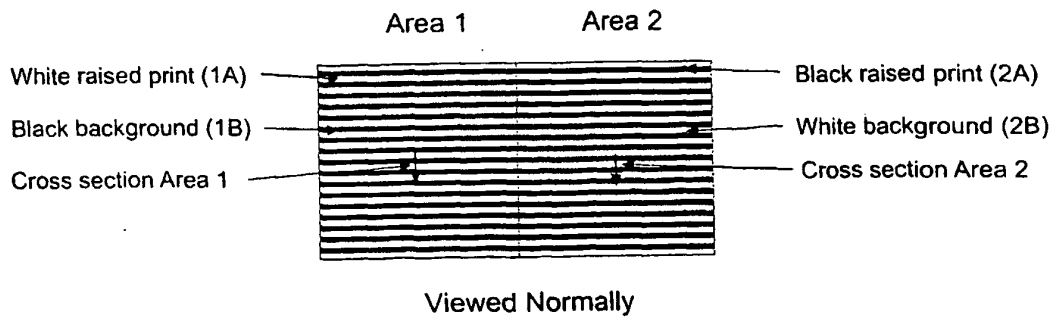


Figure 1b

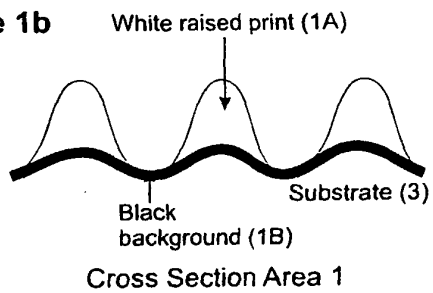


Figure 1c

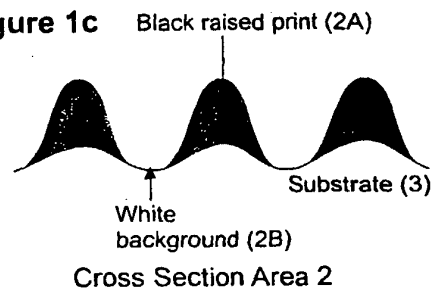


Figure 1d

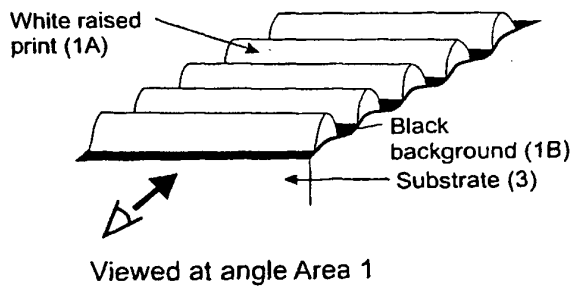


Figure 1e

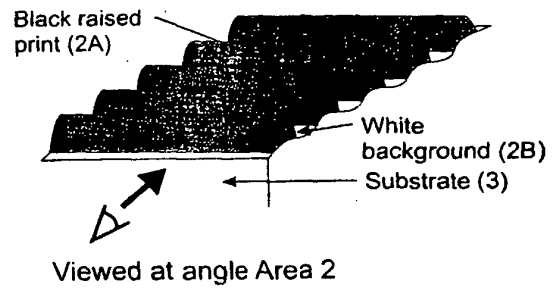


Figure 1f

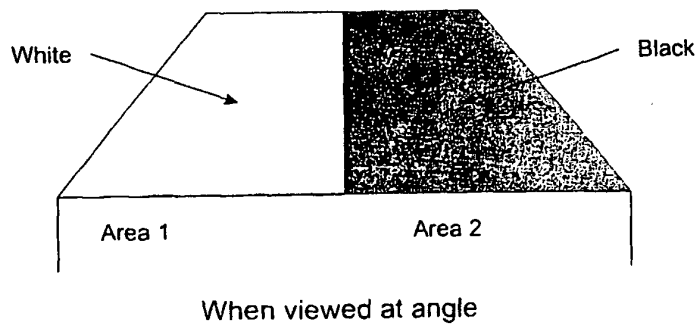


Figure 2a

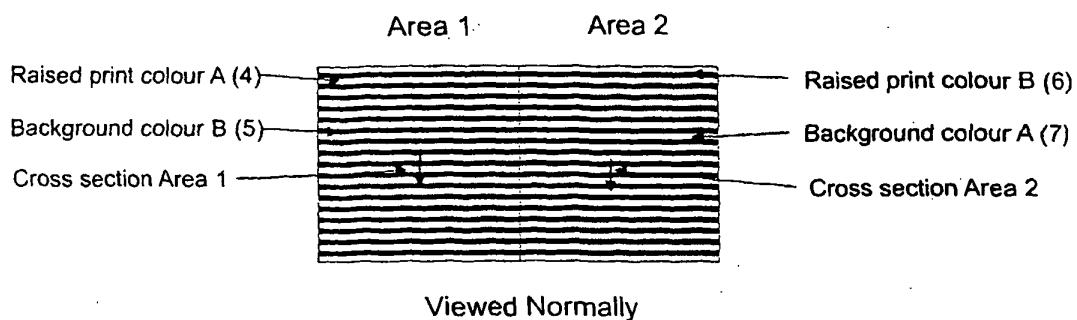


Figure 2b

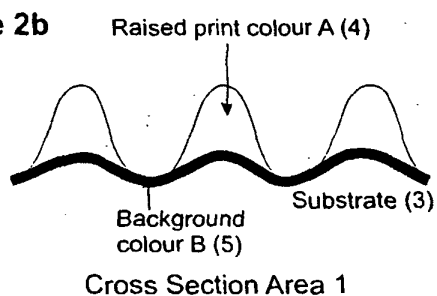


Figure 2c

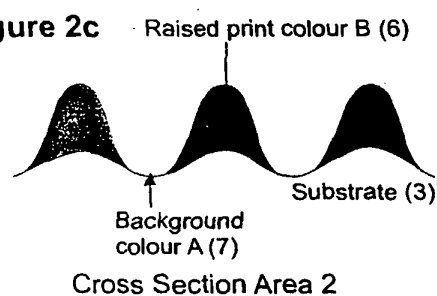


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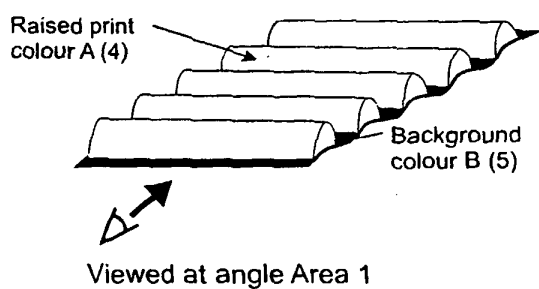


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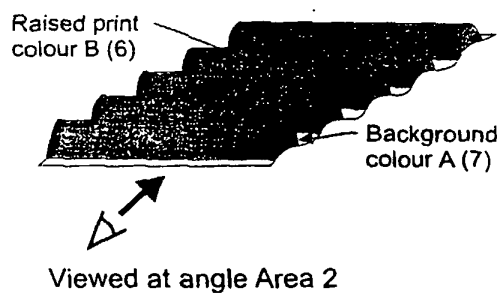


Figure 2f

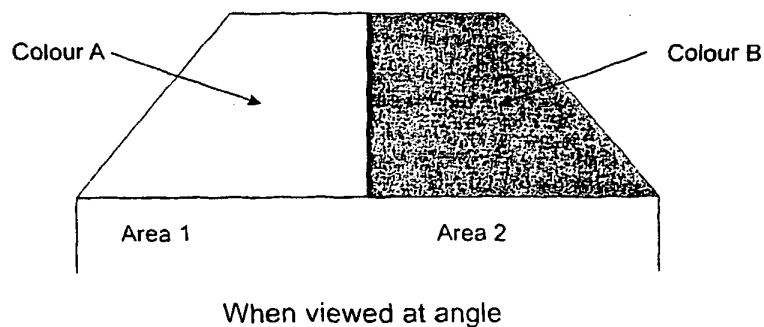


Figure 3a

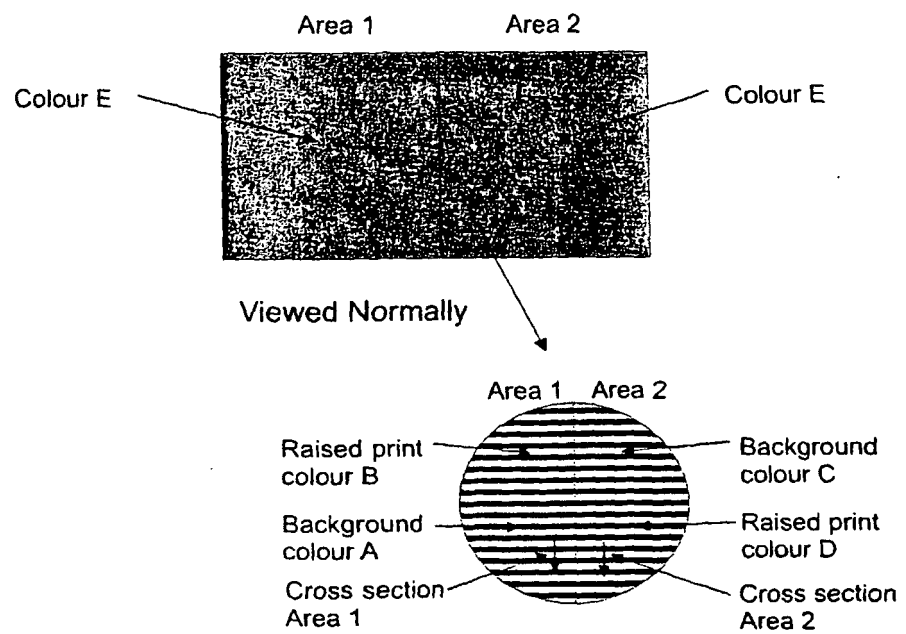


Figure 3b

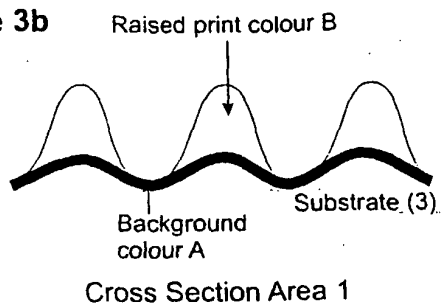


Figure 3c

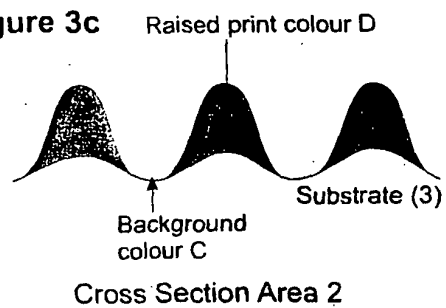


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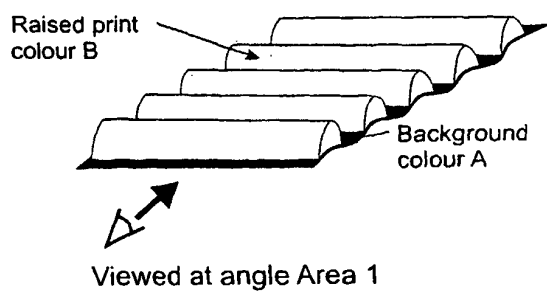


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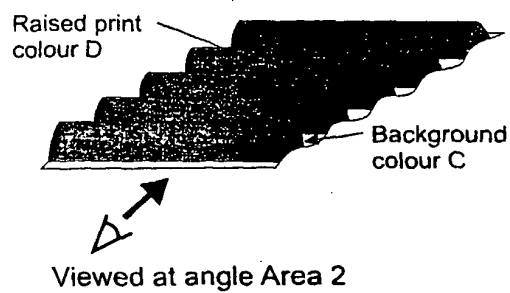


Figure 3f

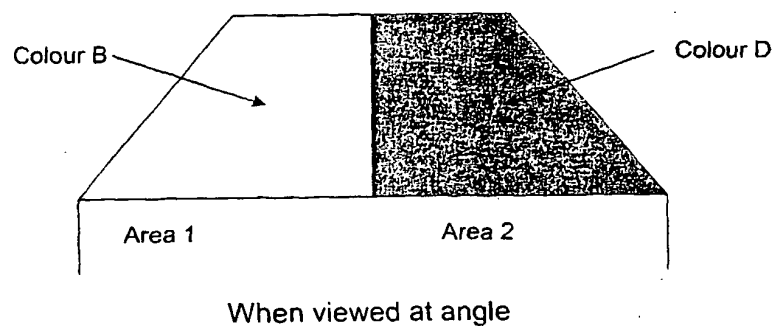


Figure 4a

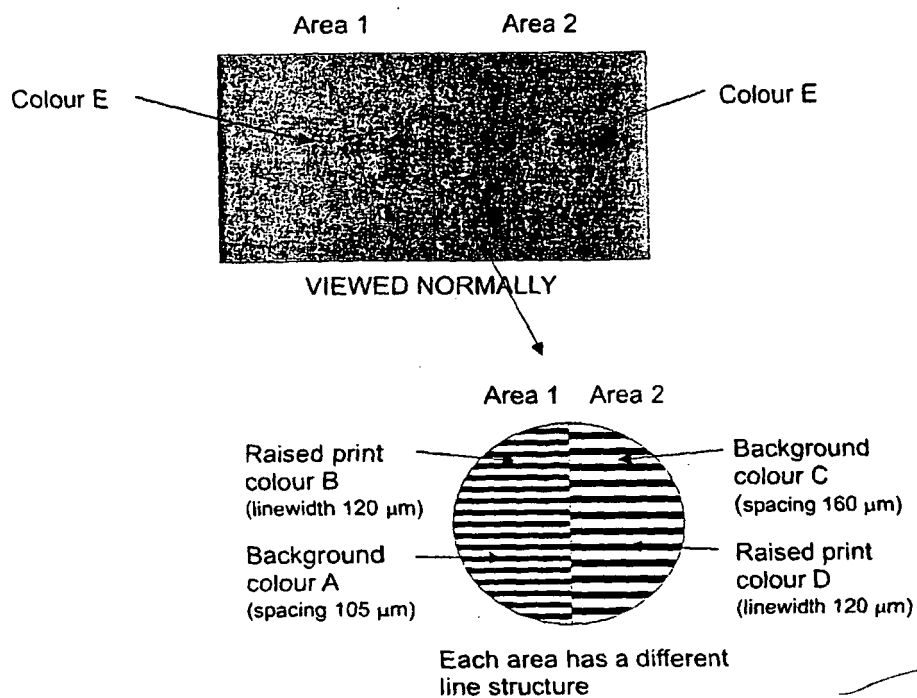


Figure 4b

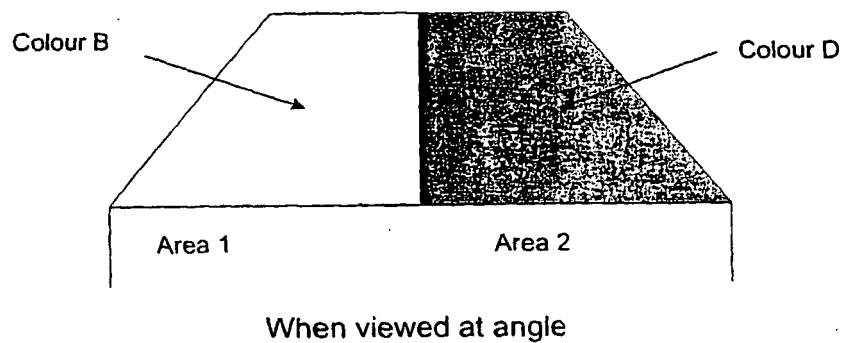


Figure 5a

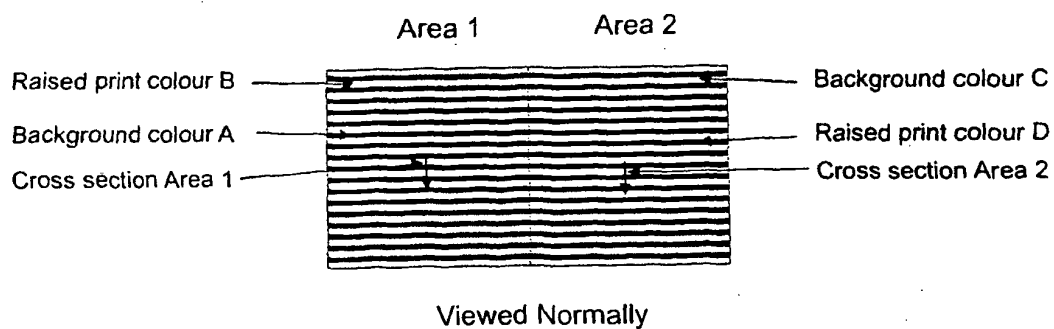


Figure 5b

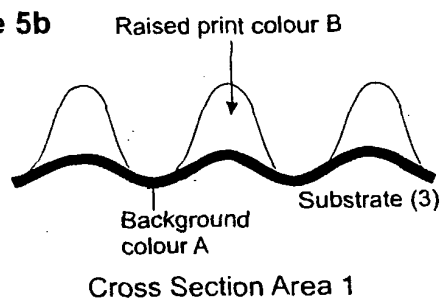


Figure 5c

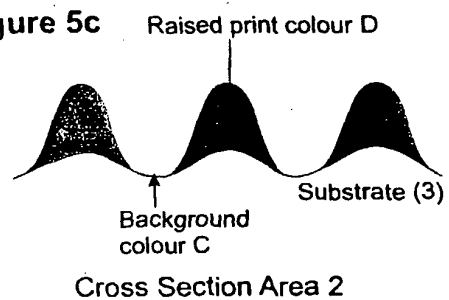


Figure 5d

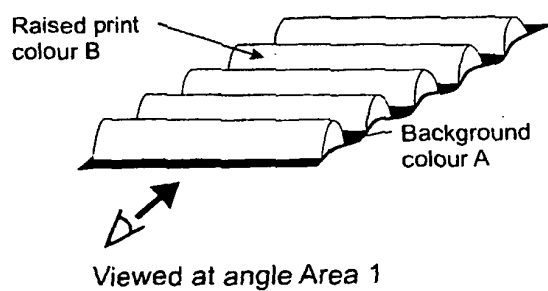


Figure 5e

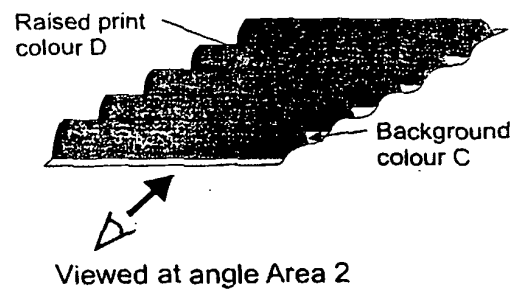


Figure 5f

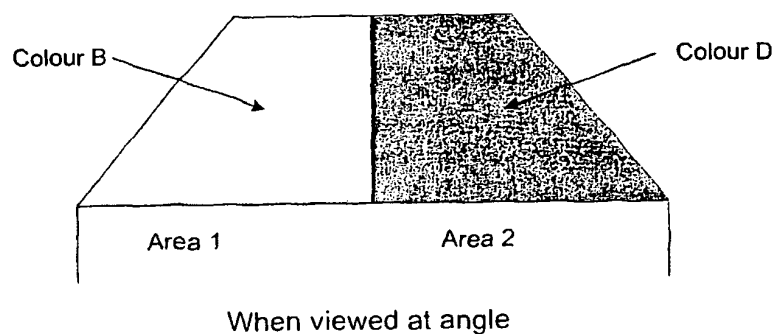
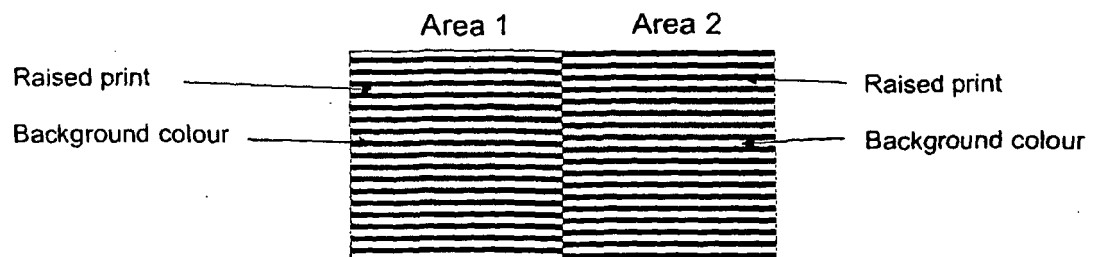


Figure 6



Viewed Normally

Intaglio lines are continuous from Area 1 to Area2.

Figure 7a

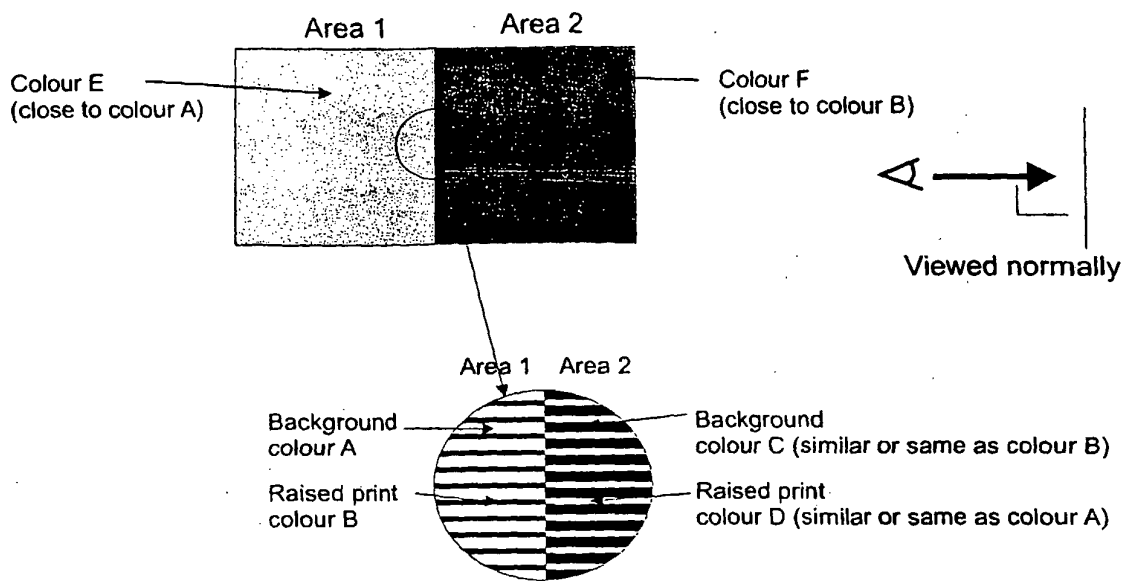


Figure 7b

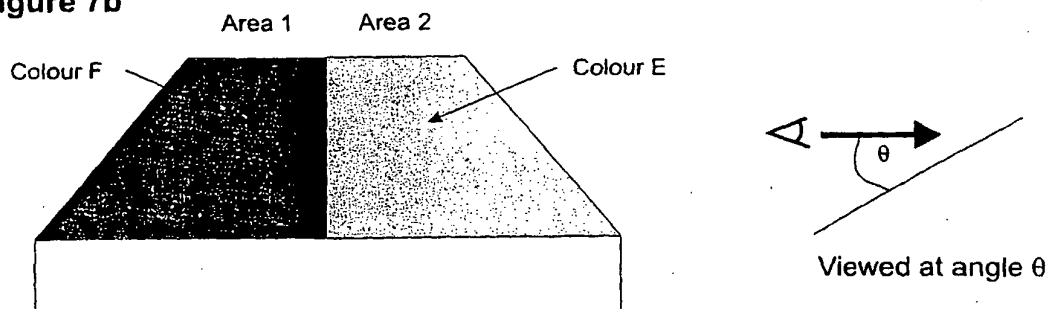


Figure 7c

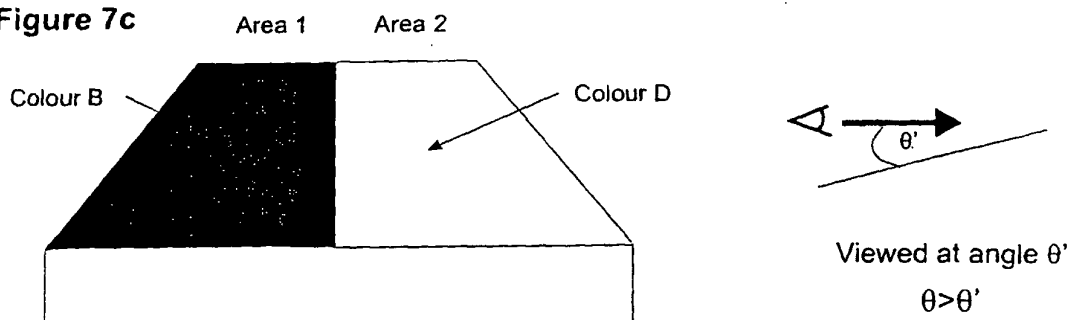


Figure 8a

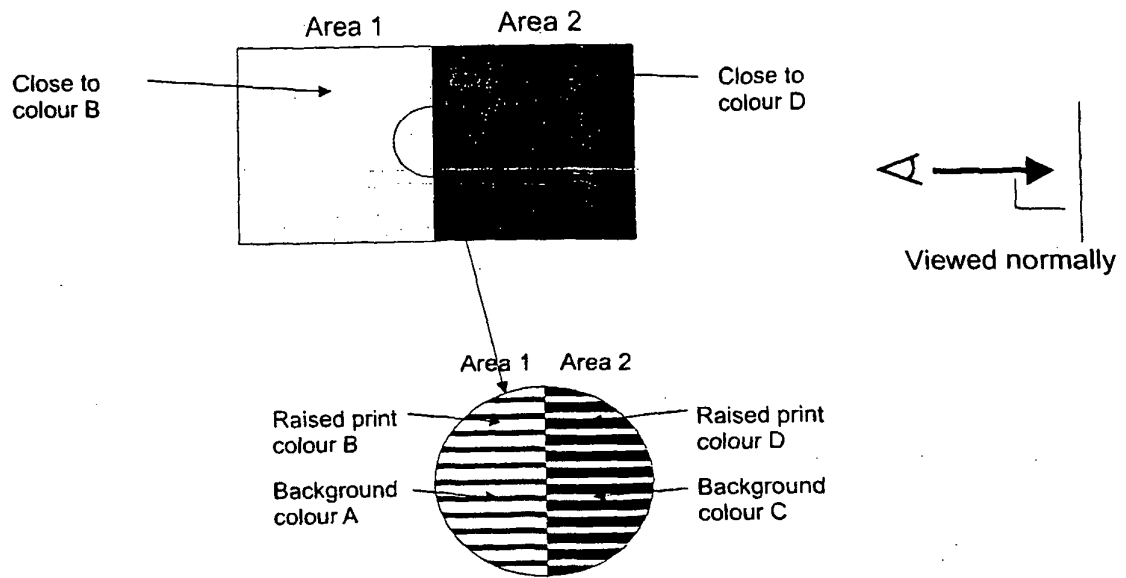


Figure 8b

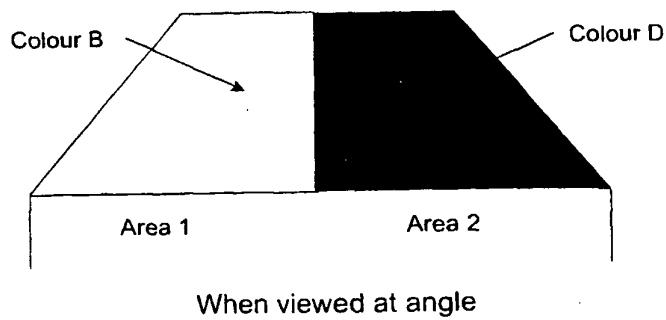


Figure 9a

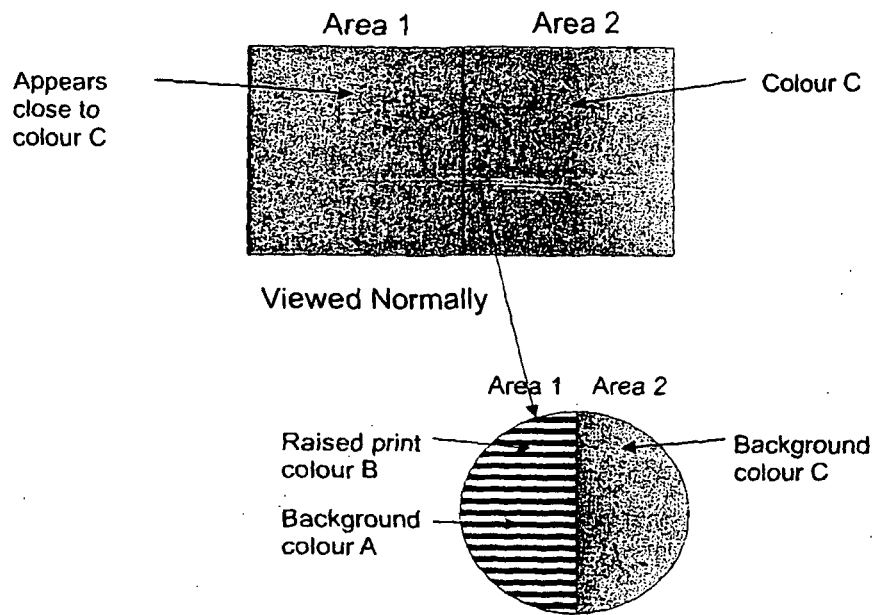


Figure 9b

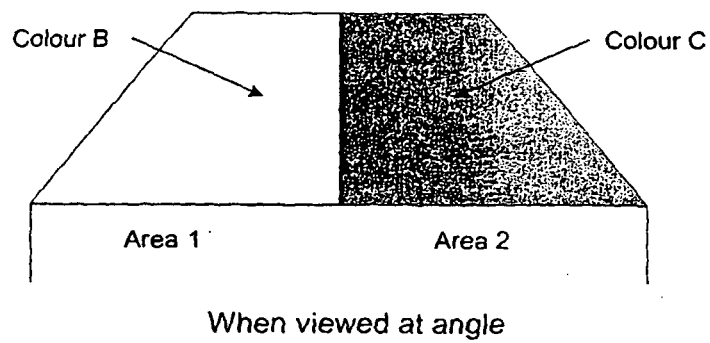


Figure 9c

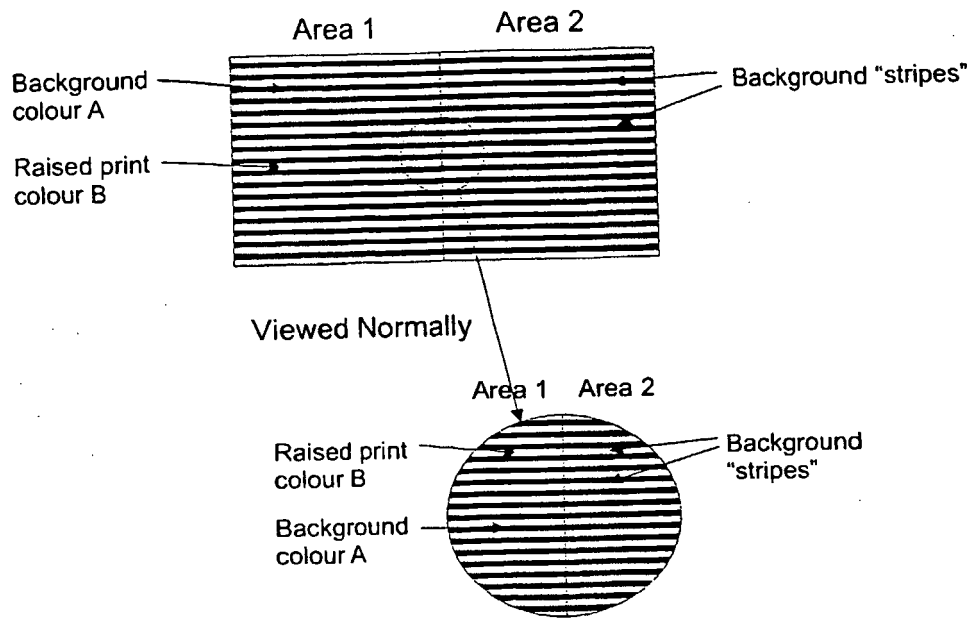


Figure 9d

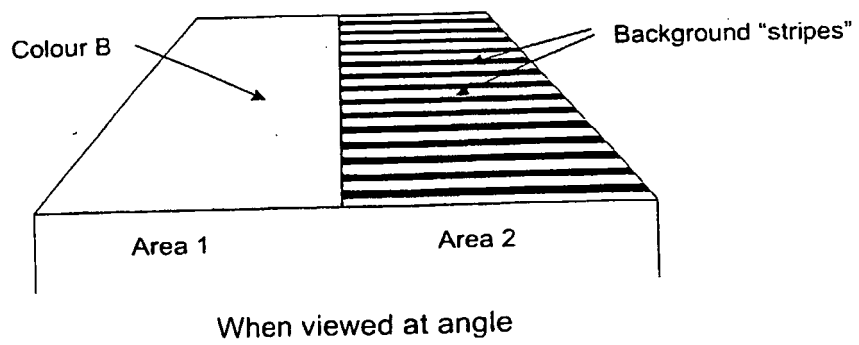


Figure 10a

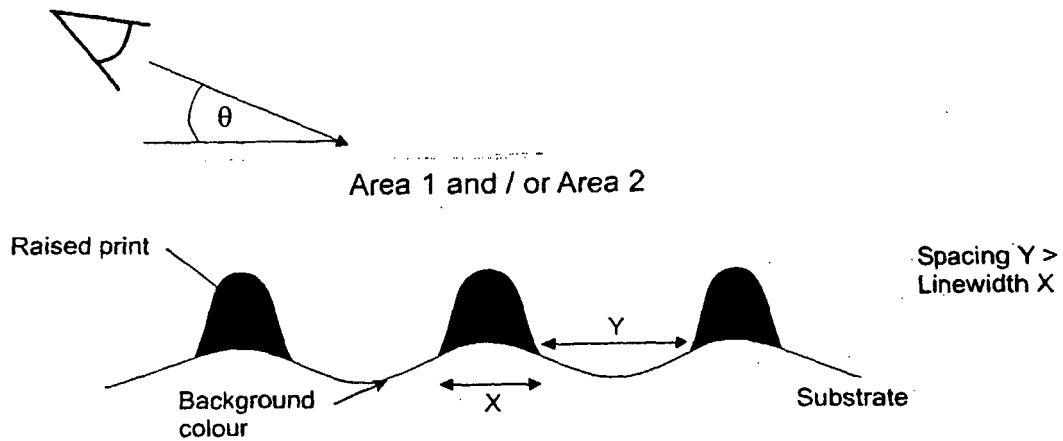


Figure 10b

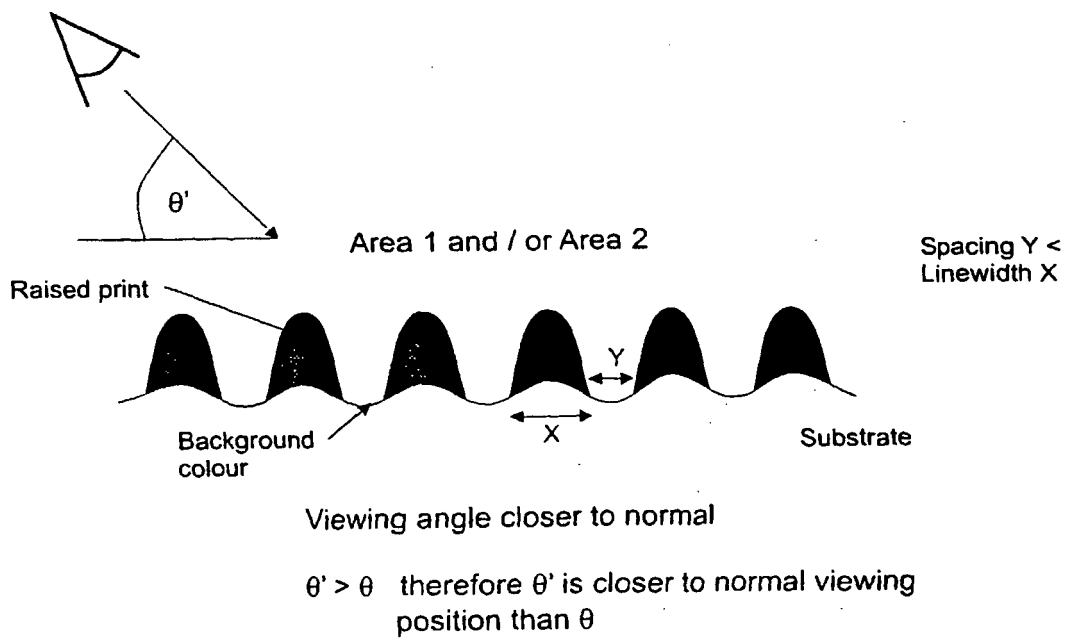


Figure 11a

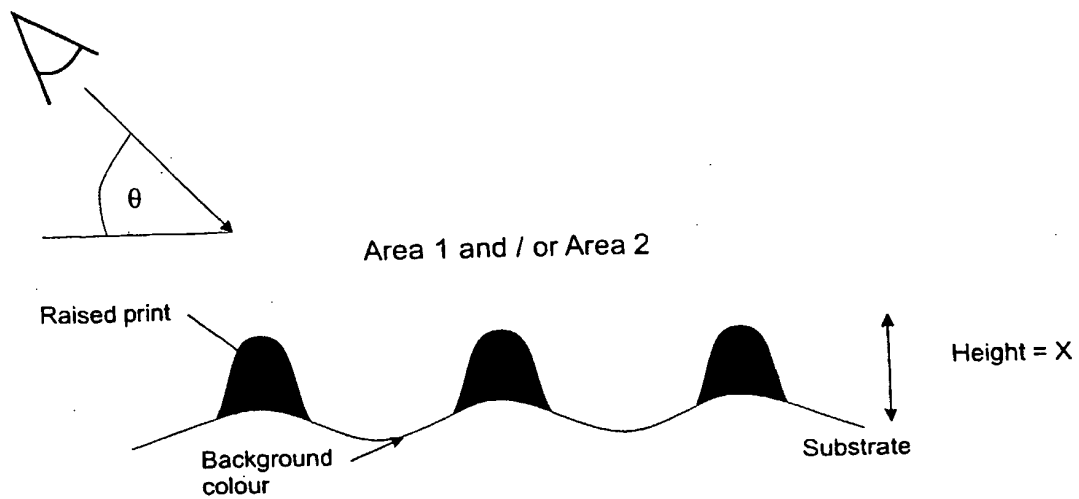
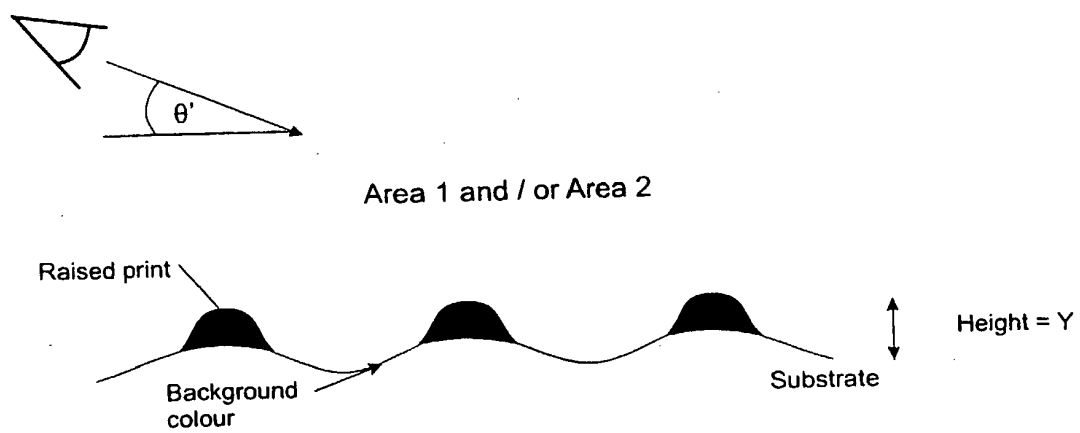


Figure 11b



$$X > Y$$

$$\theta > \theta'$$

Figure 12

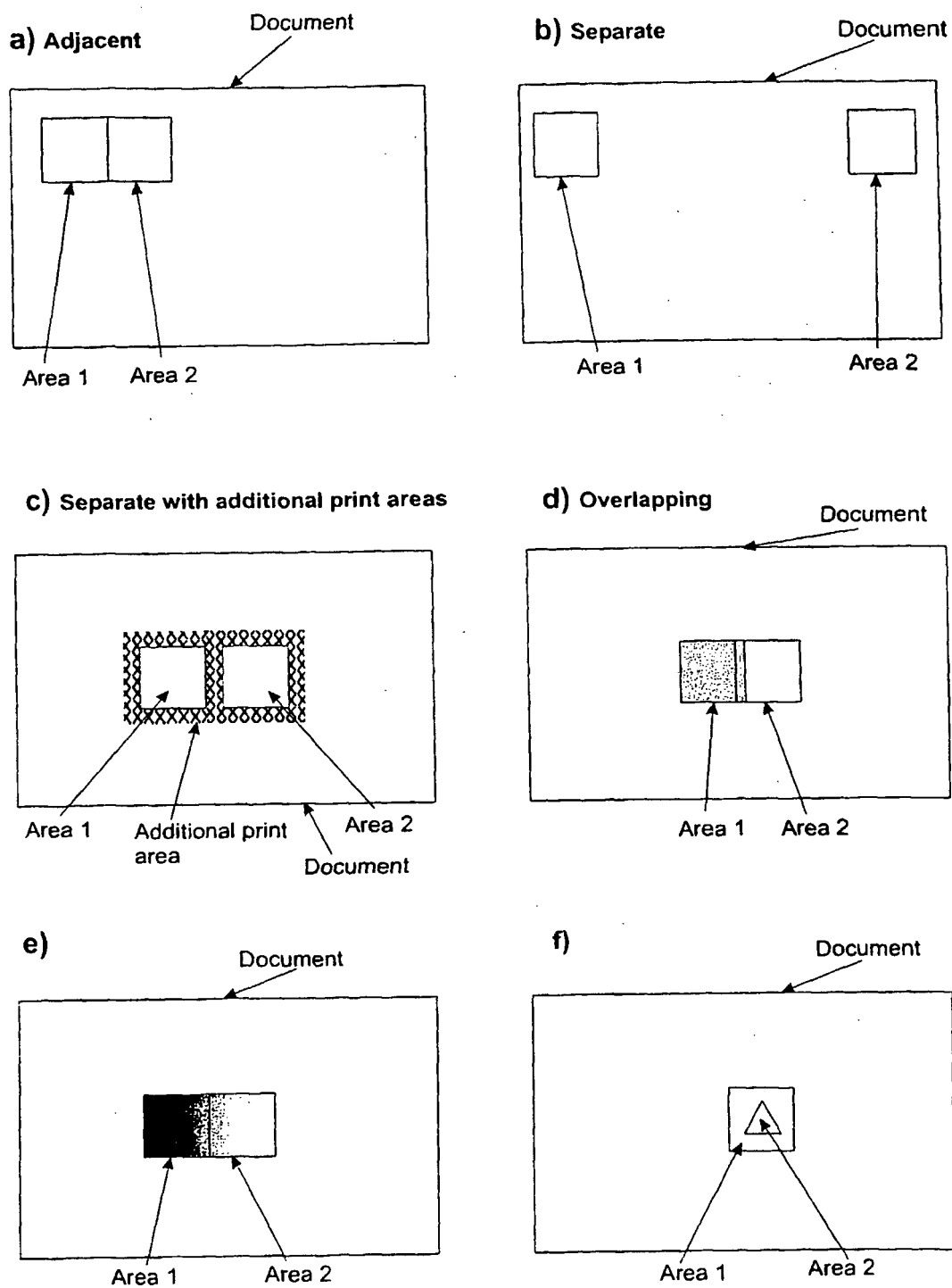
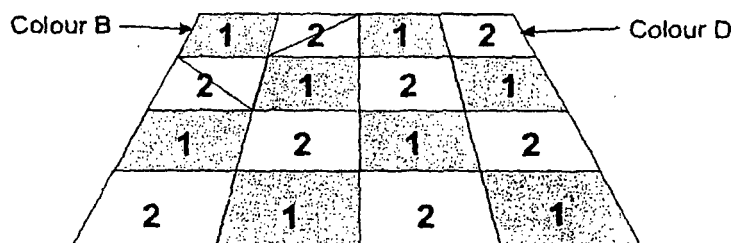
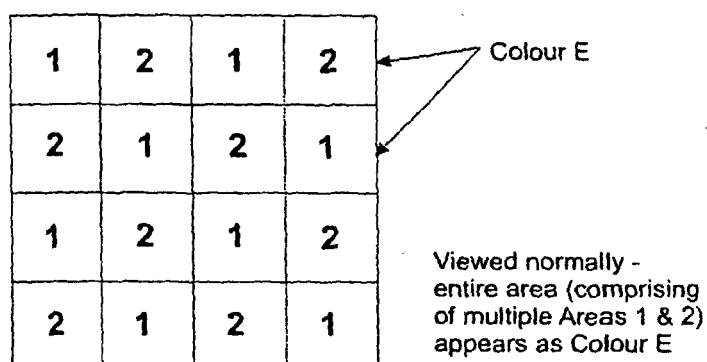


Figure 12 g)



Viewed at angle -
each Area 1 appears as Colour B
& each Area 2 appears as Colour D

Figure 12 h)

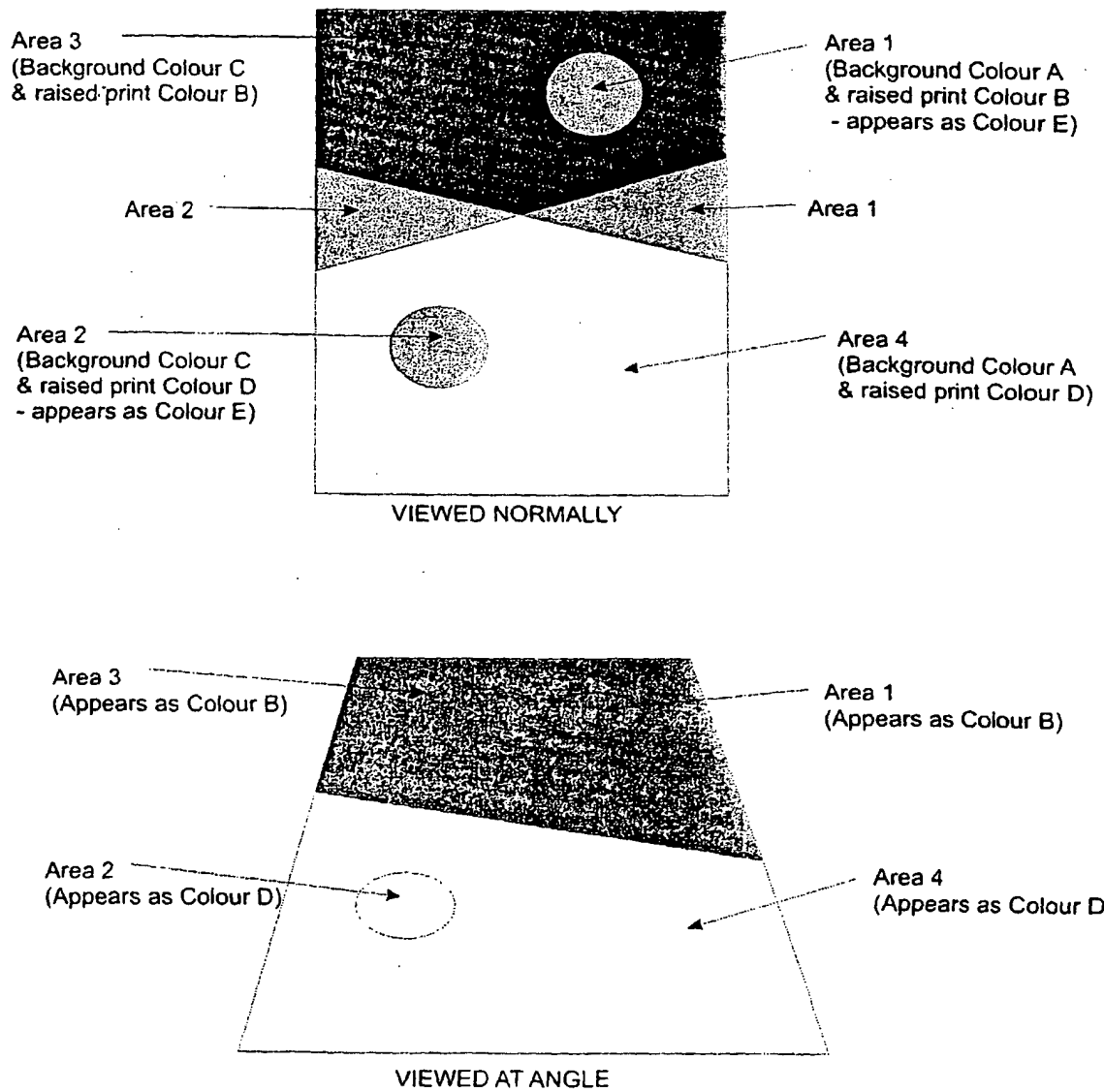
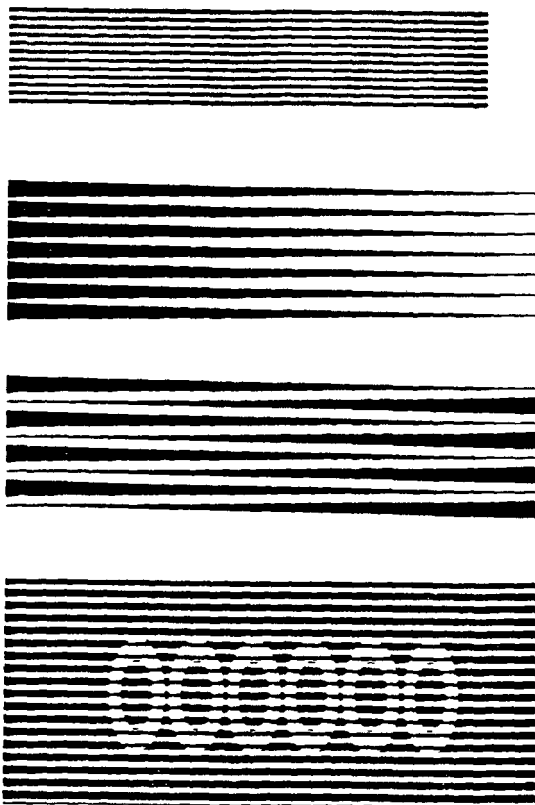


Figure 13

a) Parallel Lines



b) Non-Parallel Lines



Diverging 0.5°

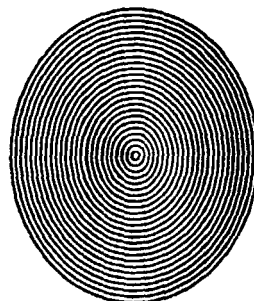
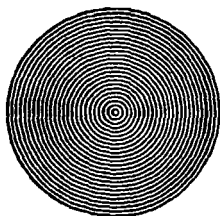
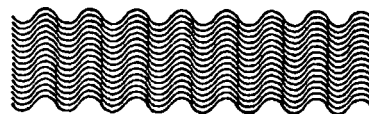
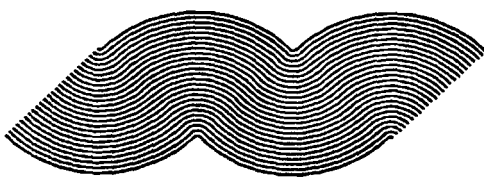
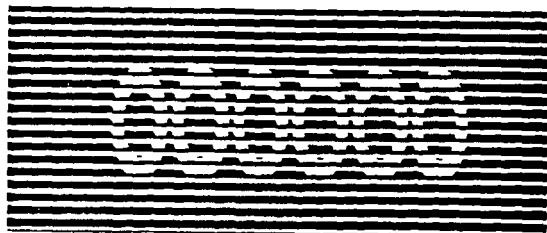


Figure 14 a)

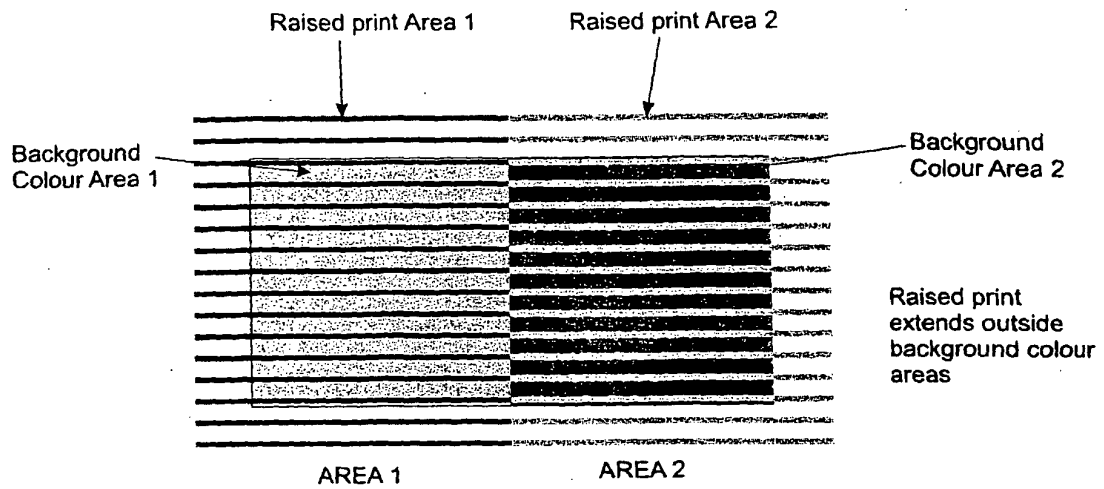


Figure 14 b)

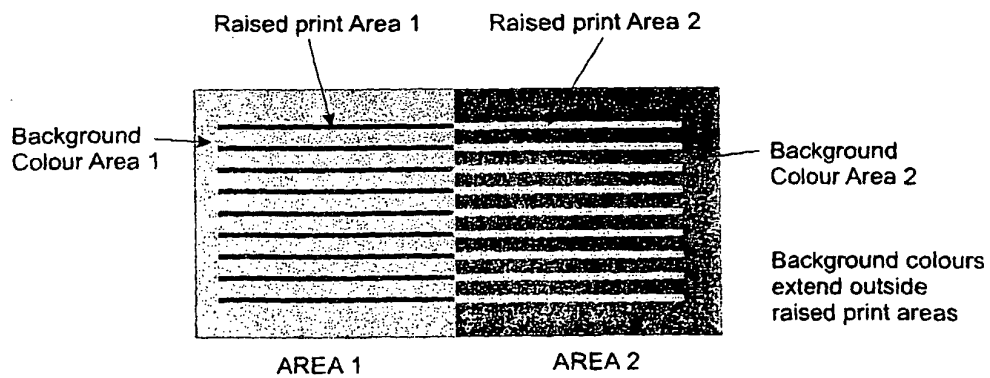


Figure 15a

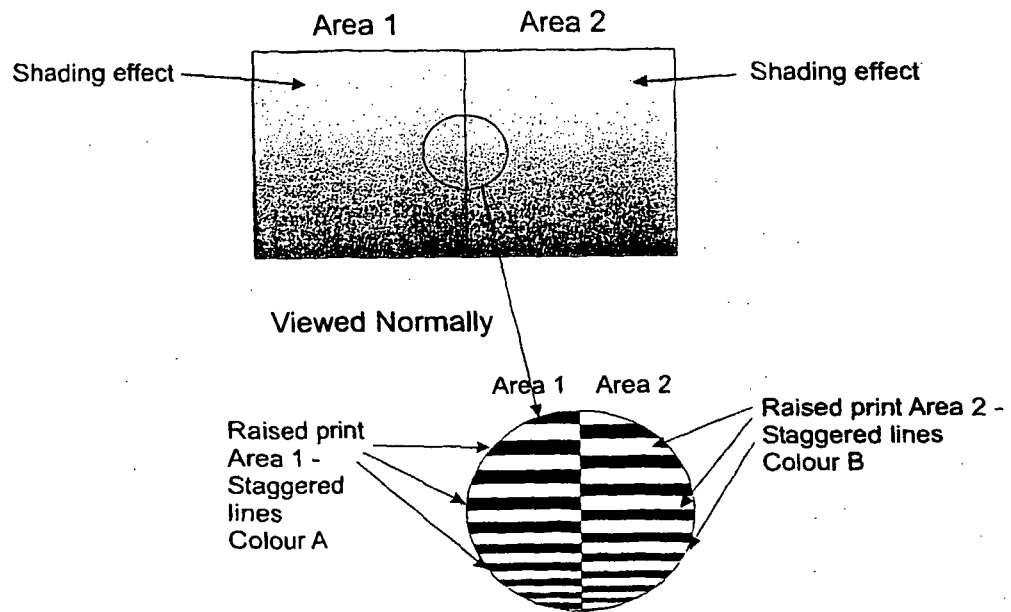


Figure 15b

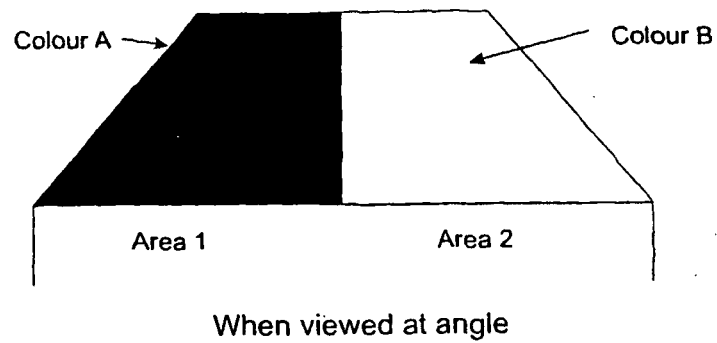


Figure 16 a)

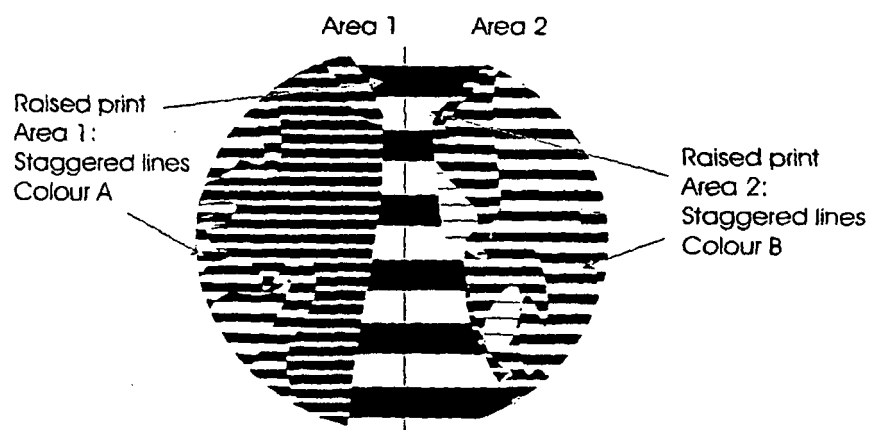
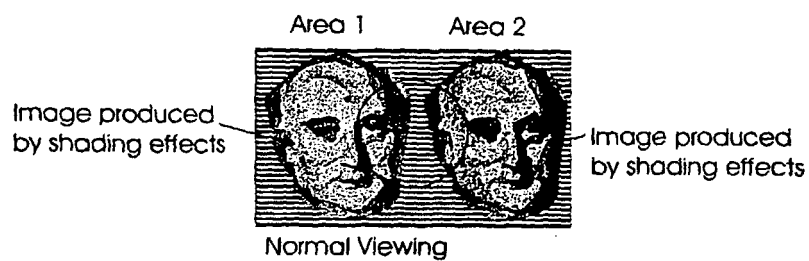
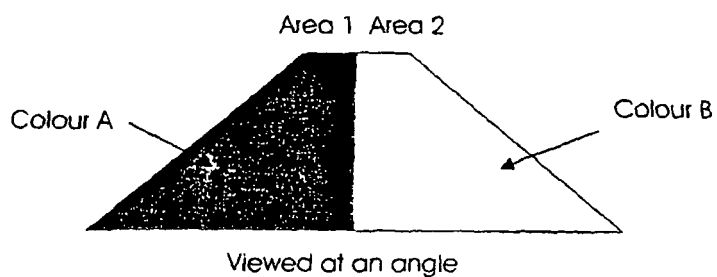


Figure 16 b)



REFERENCES CITED IN THE DESCRIPTION

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