layer. After curing of the photo resist layer by impinging light onto it through the transparent stamp, the stamp can be progressively released from the substrate leaving well-defined structures with dimensions of smaller than 100 nm.

In Mingato Li, et al., Fabrication of circular optical structures with a 20 nm minimum size using nano-imprint lithography, Applied physics letters, volume 76, number 6 page 673-675, it is described that a parallel plate imprint machine can be used to manufacture Fresnel Zone plates.

WO 2009/078881 describes an imprint lithography stamp having a regular pattern of sub-features, the stamp being made of silicon or polymeric materials.

In an embodiment of a security device according to the invention, the array of lenses is an array of elongated cylindrical lenses, the image pattern being comprised of groups of parallel image lines. In this manner, the elongated lenses may interfere with the underlying image pattern when the lenses are placed at an angle with the underlying image lines to generate a Moiré pattern of shifting dark and light bands that shift across the image are when the security device is tilted relative to the viewer. This technology is described in EP 1 894 169 in the name of the applicant.

In view of the above, according to an aspect of the present invention, there is provided a security document comprising a portrait image of a holder and an image area, an image pattern in the image area of mutually spaced image elements at a mutual distance D, a layer of a plastics material overlying the image area and an array of lenses in the layer, wherein the lenses are spaced at a mutual distance L which differs from D, wherein the array of lenses overlies only a part of the image pattern and is formed in the layer of plastics material within an image contour in such a way that a part of the image pattern below the layer is situated outside the image contour, is not covered by any lenses and has a uniform appearance when viewed by a user, which image contour forms holder-specific indicia displaying information pertaining to the holder and/or an issuing authority of the document.

According to another aspect of the present invention, there is provided a security document comprising a portrait image of a holder and an image area, an image pattern in the image area of mutually spaced image elements at a mutual distance D, a layer of a plastics material overlying the image area and an array of lenses in the layer. The array of lenses overlies only a part of the image pattern and is formed in the layer of plastics material within an image contour by laser ablation of the plastics material in such a way that a part of the image pattern below the layer is situated outside the image contour, is not covered by any lenses and has a uniform appearance when viewed by a user, which image contour forms holder-specific indicia displaying information pertaining to the holder and/or an issuing authority of the document

According to yet another aspect of the present invention, there is provided a method of forming a security document comprising the steps of: providing a layer comprising an image area, an image pattern in the image area and a layer of a plastics material overlying the image area, providing a portrait image of a holder in or on said layer, forming an array of lenses in the layer of plastics material within an image contour, which lenses overlie only a part of the image pattern and leaving the part of the image pattern below the layer outside the contour not covered by any lenses such that it has a uniform appearance when viewed by a user, which contour forms holder-specific indicia displaying information pertaining to the holder and/or an issuing authority of the document.

Brief description of the drawings

Embodiments of a security device and method of manufacturing will by way of non-limiting example, be explained in detail with reference to the accompanying drawings. In the drawings:

Fig. 1a and fig. 1b respectively show a top plan view and a cross-sectional view of a security card having an image pattern prior to forming of the lenses,

Fig 2a and fig. 2b respectively show a top plan view and a cross-sectional view of the security card of figs. 1a and 1b after forming of the lenses within a contour,

Claims

1. Security document (1) comprising a portrait image (2) of a holder and an image area (3), an image pattern (4) in the image area of mutually spaced image elements (5,6) at a mutual distance D, a layer (8) of a plastics material overlying the image area and an array of lenses (11,12;17,18) in the layer (8), wherein the lenses (11,12) are spaced at a mutual distance L which differs from D, wherein the array of lenses overlies only a part of the image pattern (4) and is formed in the layer (8) of plastics material within an image contour (10,19) in such a way that a part of the image pattern below the layer (8) is situated outside the image contour, is not covered by any lenses and has a uniform appearance when viewed by a user, which image contour forms holder-specific indicia displaying information pertaining to the holder and/or an issuing authority of the document (1).

2. Security document (1) according to claim 1 wherein the lenses (11,12;17,18) are formed by laser ablation of the layer (8) of plastics material.

3. Security document (1) according to claim 1, wherein the lenses (11,12;17,18) are formed by imprinting.

4. Security document (1) according to claim 1, 2 or 3, wherein the image elements (4,6) are formed by an array of microstructures.

5. Security document (1) according to any of the preceding claims, wherein the array of lenses is an array of elongated cylindrical lenses (17, 18), the image elements comprising parallel image lines (15,16) having a length direction (l) extending at an angle (α) to the elongated lenses (17,18).

6. Security document (1) according to any of the preceding claims, wherein the image elements (5,6) are written into the plastics material or a layer below the plastics material, by means of a laser.

7. Security document (1) according to any of claims 1-6 in which the image elements (5,6) are printed.

8. Security document (1) comprising a portrait image (2) of a holder and an image area (3), an image pattern (4) in the image area of mutually spaced image elements (5,6) at a mutual distance D, a layer (8) of a plastics material overlying the image area and an array of lenses (11,12;17,18) in the layer (8), characterized in that the array of lenses overlies only a part of the image pattern (4) and is formed in the layer (8) of plastics material within an image contour (10,19) by laser ablation of the plastics material in such a way that a part of the image pattern below the layer (8) is situated outside the image contour, is not covered by any lenses and has a uniform appearance when viewed by a user, which image contour forms holder-specific indicia displaying information pertaining to the holder and/or an issuing authority of the document.

9. Method of forming a security document (1) comprising the steps of:

- providing a layer (9) comprising an image area (3), an image pattern (5,6) in the image area and a layer (8) of a plastics material overlying the image area (3),

- providing a portrait image of a holder in or on said layer (9),

- forming an array of lenses (11,12;17,18) in the layer of plastics material within an image contour, which lenses overlie only a part of the image pattern (5,6) and leaving the part of the image pattern below the layer (8) outside the contour not covered by any lenses such that it has a uniform appearance when viewed by a user, which contour forms holder-specific indicia displaying information pertaining to the holder and/or an issuing authority of the document.

10. Method according to claim 9, wherein the array of lenses (11,12;17,18) is formed by laser ablation of the layer (8) of plastics material.

11. Method according to claim 9 wherein the array of lenses(11,12;17,18) is formed by imprinting of the layer (8) of plastics material.

12. Method according to any of claims 9-11, wherein the image pattern (5,6) comprises a matrix of images spaced at a mutual distance D, the array of lenses (11,12;17,18) comprising lens elements that are spaced apart at a mutual distance L which differs from D.

13. Method according to any of claims 9-11, wherein the image pattern (5,6) is comprised of groups of image lines (15,16), the array of lenses comprising elongate cylindrical lenses (17,18) that are formed at an angle (α) to the image lines (15,16).