Claims

1. A method for verifying an authenticity of a security document (100), wherein said security document (100) comprises a substrate (200) and at least one perforation pattern (210, 220, 230, 240) in said substrate (200), the method comprising a step of

- acquiring a transmission mode image of at least a part of said perforation pattern (210, 220, 230, 240) of said security document (100) by means of a verification device (500), and a step of

- verifying by means of said verification device (500) said authenticity of said security document (100) using said transmission mode image,

wherein said perforation pattern (210, 220, 230, 240) comprises a plurality of perforations (211, 212, 213) of at least a part of said substrate (200), and

wherein to the naked eye of a human observer at least one of said perforations (211, 212, 213) is not visible in a reflection mode.

2. The method of claim 1 wherein said verification device (500) is selected from a group consisting of a camera-equipped cellular phone, a camera-equipped tablet computer, a digital camera, a camera-equipped laptop computer, a bank note sorter, and a bank note acceptor.

3. The method of any of the preceding claims wherein at least one of said perforations (211, 212, 213) of said substrate (200) has a lateral dimension less than 200 microns, in particular less than 150 microns, particularly less than 100 microns, in at least one direction parallel to a surface of said substrate (200).

4. The method of any of the preceding claims wherein said perforations (211, 212, 213) have different shapes and/or different lateral dimensions parallel to a surface of said substrate (200) and/or different axial dimensions perpendicular to a surface of said substrate (200).

5. The method of any of the claims 1 to 3 wherein all perforations (211, 212, 213) have substantially the same shapes and the same lateral dimensions parallel to a surface of said substrate (200) and the same axial dimensions perpendicular to a surface of said substrate (200).

6. The method of any of the preceding claims wherein the security document (100) comprises at least a first perforation pattern (210) and a second perforation pattern (220), each perforation pattern (210,220) comprising a plurality of perforations (211, 212, 213) of said substrate (200),

wherein said second perforation pattern (220) is translated and/or rotated and/or mirrored and/or scaled with respect to said first perforation pattern (210).

7. The method of any of the preceding claims wherein a first lateral dimension along a first axis (x) parallel to a surface of said substrate (200) of at least one of said perforations (211, 212, 213) is different from a second lateral dimension along a second axis (y) parallel to said surface of said substrate (200) of said at least one of said perforations (211, 212, 213), and

wherein said step of acquiring said transmission mode image is carried out at a non-zero tilt angle (phi) between an optical axis (z') of said verification device (500) and a third axis (z) perpendicular to said surface of said substrate (200).

8. The method of claim 7 wherein said tilt angle (phi) is greater than 10 degrees, in particular greater than 30 degrees, particularly greater than 45 degrees.

9. The method of any of the claims 7 or 8 wherein said optical axis (z') of said verification device (500) substantially lies in a plane defined by said first axis (x) and said third axis (z) or in a plane defined by said second axis (y) and said third axis (z).

10. The method of any of the claims 7 to 9 wherein said step of acquiring said transmission mode image is carried out at a first tilt angle (phi_1) and wherein a further step of acquiring an additional transmission mode image is carried out at a second tilt angle (phi_2) different from said first tilt angle (phi_1), and

wherein said transmission mode image and said additional transmission mode image are used in said step of verifying said authenticity of said security document (100).

11. The method of any of the preceding claims wherein said perforation pattern (210, 220, 230, 240) is self-similar.

12. The method of any of the preceding claims comprising a further step of

- acquiring a reflection mode image of at least a part of said perforation pattern (210, 220, 230, 240) of said security document (100) by means of said verification device (500),

wherein said transmission mode image and said reflection mode image are used in said step of verifying said authenticity of said security document (100).

13. The method of claim 12 wherein said step of acquiring said reflection mode image comprises a change of an illumination of said security document (100), in particular by means of a firing of a flash (503) of said verification device (500).

14. The method of any of the preceding claims wherein

- a shape of at least one of said perforations, and/or

- a lateral dimension parallel to a surface of said substrate (200) of at least one of said perforations, and/or

- a transmitted light intensity and/or wavelength through at least one of said perforations, and/or

- a number of perforations (211, 212, 213), and/or

- an absolute and/or a relative positioning of at least one of said perforations (211, 212, 213), and/or

- at least one angle (α, β, γ) between two connecting lines (a, b, c) between three perforations (211, 212, 213)

is or are used in said step of verifying said authenticity of said security document (100).

15. The method of any of the preceding claims wherein said security document (100) additionally comprises at least one perforation (214) which is not used in said step of verifying said authenticity of said security document (100).

16. The method of any of the preceding claims wherein said security document (100) further comprises an additional security feature (101), in particular a printed security feature (101) on said substrate (200),

the method comprising a step of

- acquiring a reflection mode image and/or a transmission mode image of said additional security feature (101) of said security document (100) by means of said verification device (500),

wherein said transmission mode image of at least said part of said perforation pattern (210, 220, 230, 240) and said reflection mode image and/or said transmission mode image of said additional security feature (101) are used in said step of verifying said authenticity of said security document (100).

17. The method of claim 16 comprising a further step of

- determining a relative positioning of at least one of said perforations (211, 212, 213) with respect to said additional security feature (101),

wherein said determined positioning is used in said step of verifying said authenticity of said security document (100).

18. The method of any of the preceding claims comprising a further step of determining a relative alignment of said security document (100) with respect to said verification device (500), in particular by means of using an acquired image of said security document (100) and by comparing an alignment dependent parameter of said security document (100) in said acquired image to an expected alignment dependent parameter.

19. A verification device (500) for verifying an authenticity of a security document (100) comprising

- a camera (502) for acquiring a transmission mode image of at least a part of a perforation pattern (210, 220, 230, 240) of said security document (100) and
- an analysis and control unit (501) adapted and structured to carry out the step of a method of any of the preceding claims.

20. A computer program element comprising computer program code means for, when executed by an analysis and control unit, implementing a method according to any of the claims 1 to 18.

Claims

1. A method for verifying an authenticity of a security document (100), wherein said security document (100) comprises a substrate (200) and at least one perforation pattern (210, 220, 230, 240) in said substrate (200), the method comprising steps of

- acquiring a transmission mode image of at least a part of said perforation pattern (210, 220, 230, 240) of said security document (100) by means of a verification device (500),

- acquiring a reflection mode image of at least a part of said perforation pattern (210, 220, 230, 240) of said security document (100) by means of said verification device (500),

- verifying by means of said verification device (500) said authenticity of said security document (100) using said transmission mode image and said reflection mode image,

wherein said perforation pattern (210, 220, 230, 240) comprises a plurality of perforations (211, 212, 213) of at least a part of said substrate (200), and

wherein to the naked eye of a human observer at least one of said perforations (211, 212, 213) is not visible in a reflection mode.

2. The method of claim 1 wherein said verification device (500) is selected from a group consisting of a camera-equipped cellular phone, a camera-equipped tablet computer, a digital camera, a camera-equipped laptop computer, a bank note sorter, and a bank note acceptor.

3. The method of any of the preceding claims wherein at least one of said perforations (211, 212, 213) of said substrate (200) has a lateral dimension less than 200 microns, in particular less than 150 microns, partic-

ularly less than 100 microns, in at least one direction parallel to a surface of said substrate (200).

4. The method of any of the preceding claims wherein said perforations (211, 212, 213) have different shapes and/or different lateral dimensions parallel to a surface of said substrate (200) and/or different axial dimensions perpendicular to a surface of said substrate (200).

5. The method of any of the claims 1 to 3 wherein all perforations (211, 212, 213) have substantially the same shapes and the same lateral dimensions parallel to a surface of said substrate (200) and the same axial dimensions perpendicular to a surface of said substrate (200).

6. The method of any of the preceding claims wherein the security document (100) comprises at least a first perforation pattern (210) and a second perforation pattern (220), each perforation pattern (210,220) comprising a plurality of perforations (211, 212, 213) of said substrate (200),

wherein said second perforation pattern (220) is translated and/or rotated and/or mirrored and/or scaled with respect to said first perforation pattern (210).

7. The method of any of the preceding claims wherein a first lateral dimension along a first axis (x) parallel to a surface of said substrate (200) of at least one of said perforations (211, 212, 213) is different from a second lateral dimension along a second axis (y) parallel to said surface of said substrate (200) of said at least one of said perforations (211, 212, 213), and

wherein said step of acquiring said transmission mode image is carried out at a non-zero tilt angle

(phi) between an optical axis (z') of said verification device (500) and a third axis (z) perpendicular to said surface of said substrate (200).

8. The method of claim 7 wherein said tilt angle (phi) is greater than 10 degrees, in particular greater than 30 degrees, particularly greater than 45 degrees.

9. The method of any of the claims 7 or 8 wherein said optical axis (z') of said verification device (500) substantially lies in a plane defined by said first axis (x) and said third axis (z) or in a plane defined by said second axis (y) and said third axis (z).

10. The method of any of the claims 7 to 9 wherein said step of acquiring said transmission mode image is carried out at a first tilt angle (phi_1) and wherein a further step of acquiring an additional transmission mode image is carried out at a second tilt angle (phi_2) different from said first tilt angle (phi_1), and

wherein said transmission mode image and said additional transmission mode image are used in said step of verifying said authenticity of said security document (100).

11. The method of any of the preceding claims wherein said perforation pattern (210, 220, 230, 240) is self-similar.

12. The method of any of the preceding claims wherein said step of acquiring said reflection mode image comprises a change of an illumination of said security document (100), in particular by means of a firing of a flash (503) of said verification device (500).

13. The method of any of the preceding claims wherein

- a shape of at least one of said perforations, and/or
- a lateral dimension parallel to a surface of said substrate (200) of at least one of said perforations, and/or
- a transmitted light intensity and/or wavelength through at least one of said perforations, and/or
- a number of perforations (211, 212, 213), and/or
- an absolute and/or a relative positioning of at least one of said perforations (211, 212, 213), and/or
- at least one angle (α, β, γ) between two connecting lines (a, b, c) between three perforations (211, 212, 213)

is or are used in said step of verifying said authenticity of said security document (100).

14. The method of any of the preceding claims wherein said security document (100) additionally comprises at least one perforation (214) which is not used in said step of verifying said authenticity of said security document (100).

15. The method of any of the preceding claims wherein said security document (100) further comprises an additional security feature (101), in particular a printed security feature (101) on said substrate (200),

the method comprising a step of

- acquiring a reflection mode image and/or a transmission mode image of said additional security feature (101) of said security document (100) by means of said verification device (500),

wherein said transmission mode image of at least said part of said perforation pattern (210, 220,

230, 240) and said reflection mode image and/or said transmission mode image of said additional security feature (101) are used in said step of verifying said authenticity of said security document (100).

16. The method of claim 15 comprising a further step of

- determining a relative positioning of at least one of said perforations (211, 212, 213) with respect to said additional security feature (101),

wherein said determined positioning is used in said step of verifying said authenticity of said security document (100).

17. The method of any of the preceding claims comprising a further step of determining a relative alignment of said security document (100) with respect to said verification device (500), in particular by means of using an acquired image of said security document (100) and by comparing an alignment dependent parameter of said security document (100) in said acquired image to an expected alignment dependent parameter.

18. A verification device (500) for verifying an authenticity of a security document (100) comprising

- a camera (502) for acquiring a transmission mode image of at least a part of a perforation pattern (210, 220, 230, 240) of said security document (100) and

- an analysis and control unit (501) adapted and structured to carry out the steps of a method of any of the preceding claims.

19. A computer program element comprising computer program code means for, when executed by an analysis and control unit, implementing a method according to any of the claims 1 to 17.