Claims

1. A security document comprising a substrate (1),

an optical waveguide (7) arranged on and/or in said substrate (1), and

at least a coupler (10a, 10b) for coupling light into said waveguide (7) or out from said waveguide (7),

characterized in that said coupler (10b) comprises at least one perforation (14) extending through said waveguide (7).

2. The security document of claim 1 comprising a first and a second coupler (10a, 10b), wherein light coupled into said waveguide (7) by means of said first coupler (10a) is at least partially transmitted to and coupled out by said second coupler (10b).

3. The security document of any of the preceding claims wherein said coupler (10b) comprises a plurality of perforations (14) extending through said waveguide (7) and said substrate (1).

4. The security document of any of the preceding claims wherein said substrate (1) is non-transparent and comprises at least one transparent window or half-window (8a, 8b), wherein at least one coupler (10a, 10b) is arranged in said window or half-window (8a, 8b).

5. The security document of claim 4 wherein said substrate (1) comprises at least a first and a second transparent window or half-window (8a, 8b,), wherein a first coupler (10b) is arranged in said first window or half-widow (8a) and a second coupler (10b) is arranged in said second window or half-window (8b), and wherein said waveguide (7) extends between said first and said second window or half- window (8a, 8b).

6. The security document of any of the preceding claims wherein said coupler (10a, 10b) comprises a grating (11).

7. The security document of any of the preceding claims wherein said coupler (10a, 10b) comprises light scattering objects embedded in or arranged on said waveguide (7).

8. The security document of any of the preceding claims comprising a fluorescent or luminescent dye arranged in or on said waveguide (7) for coupling light into our out from said waveguide (7).

9. The security document of claim 8 comprising luminescent dyes of at least two different luminescent colors.

10. The security document of any of the preceding claims comprising a periodic microlens-array (15), and wherein said coupler (10a, 10b) has a periodic structure with the microlens-array having a period substantially equal to said periodic structure.

11. The security document of any of the preceding claims wherein said waveguide (7) is embedded at least partially in the substrate (1).

12. The security document of any of the preceding claims wherein said waveguide (7) comprises at least a first layer (7a) and a second layer (7b), with said first layer (7a) having a refractive index higher than said second layer (7b), wherein said second layer (7b) is arranged between said first layer (7a) and an absorbing part of said substrate (1).

13. The security document claim 12 wherein said waveguide (7) further comprises a third layer (7c), with said first layer (7a) having a refractive index higher than said third layer (7c), and wherein said first layer (7a) is arranged between said second and third layers (7b, 7c).

14. The security document of any of the preceding claims further comprising a light source coupled to said waveguide (7).

15. The security document of any of the preceding claims wherein said waveguide (7) is a security thread embedded at least partially in said substrate (1).

16. The security document of any of the claims 1 to 14 wherein said waveguide (7) is a plastic foil having substantially the same size as said substrate (1).

Claims

1. A security document comprising a substrate (1),

an optical waveguide (7) arranged on and/or in said substrate (1), and

at least a coupler (10a, 10b) for coupling light into said waveguide (7) or out from said waveguide (7),

characterized in that said coupler (10b) comprises at least one perforation (14) extending through said waveguide (7).

2. The security document of claim 1 comprising a first and a second coupler (10a, 10b), wherein light coupled into said waveguide (7) by means of said first coupler (10a) is at least partially transmitted to and coupled out by said second coupler (10b).

3. The security document of any of the preceding claims wherein said coupler (10b) comprises a plurality of perforations (14) extending through said waveguide (7) and all the way through said non-transparent substrate (1).

4. The security document of any of the preceding claims wherein said substrate (1) is non-transparent and comprises at least one transparent window or half-window (8a, 8b), wherein at least one coupler (10a, 10b) is arranged in said window or half-window (8a, 8b).

5. The security document of claim 4 wherein said substrate (1) comprises at least a first and a second transparent window or half-window (8a, 8b,), wherein a first coupler (10b) is arranged in said first window or half-widow (8a) and a second coupler (10b) is arranged in said second window or half-window (8b), and wherein said waveguide (7) extends between said first and said second window or half- window (8a, 8b).

6. The security document of any of the preceding claims wherein said coupler (10a, 10b) comprises a grating (11).

7. The security document of any of the preceding claims wherein said coupler (10a, 10b) comprises light scattering objects embedded in or arranged on said waveguide (7).

8. The security document of any of the preceding claims comprising a fluorescent or luminescent dye arranged in or on said waveguide (7) for coupling light into our out from said waveguide (7).

9. The security document of claim 8 comprising luminescent dyes of at least two different luminescent colors.

10. The security document of any of the preceding claims comprising a periodic microlens-array (15), and wherein said coupler (10a, 10b) has a periodic structure with the microlens-array having a period substantially equal to said periodic structure.

11. The security document of any of the preceding claims wherein said waveguide (7) is embedded at least partially in the substrate (1).

12. The security document of any of the preceding claims wherein said waveguide (7) comprises at least a first layer (7a) and a second layer (7b), with said first layer (7a) having a refractive index higher than said second layer (7b), wherein said second layer (7b) is arranged between said first layer (7a) and an absorbing part of said substrate (1).

13. The security document claim 12 wherein said waveguide (7) further comprises a third layer (7c), with said first layer (7a) having a refractive index higher than said third layer (7c), and wherein said first layer (7a) is arranged between said second and third layers (7b, 7c).

14. The security document of any of the preceding claims further comprising a light source coupled to said waveguide (7).

15. The security document of any of the preceding claims wherein said waveguide (7) is a security thread embedded at least partially in said substrate (1).

16. The security document of any of the claims 1 to 14 wherein said waveguide (7) is a plastic foil having substantially the same size as said substrate (1).