CLAIMS

What is claimed is:

1. An automated method for constructing a composite image having an authentication image formed therein, the authentication image being viewable by placement of a decoder lens having a plurality of lens elements defining one or more decoder lens frequencies over an object to which the composite image has been applied, the method comprising:

generating a first plurality of component images in which corresponding tonal areas are tonally balanced around at least one tonal value, at least one of the component images being configured to include a representation of the authentication image;

determining a pattern of component image elements for each of the component images, the pattern including an element configuration and at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, the component image elements for a given component image collectively carrying all the content of that component image;

extracting at least a portion of the content of each component image element of each component image; and

constructing a composite image having a pattern of composite image elements having the at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, each composite image element including the extracted content from a component image element from each component image in a location in the component image that corresponds to the location in the composite image.

2. An automated method according to claim 1 wherein the component image elements are overlapping elements and the method further comprises:

applying a predetermined element reduction factor to reduce the size of each component element to form a subelement,

wherein the subelement defines the content extracted from each component image element in the extracting action.

3. An automated method according to claim 2 wherein the action of constructing a composite image includes placing each subelement in the composite image so that the subelement is

centered on a point corresponding to a center point of the composite image element from which the subelement was formed.

4. An automated method according to claim 1 further comprising:

subdividing each component element into a number of subelements to form a subelement pattern,

6. An automated method according to claim 4 wherein the number of subelements is equal to or a multiple of the number of component images.

6. An automated method according to claim 4 wherein at least a portion of the subelements have a geometric shape selected from the group consisting of a polygon, an ellipse, a partial ellipse, a circle, and a partial circle.

7. An automated method according to claim 4 wherein the at least a portion of the content of each component image element of each component image includes one or more of the subelements of the component image element.

8. An automated method according to claim 4 wherein the action of constructing a composite image includes placing at least one subelement from each component image element of each component image into a composite image element subdivided into the subelement pattern and positioned at a location corresponding to the location of the component image element from which the subelement was extracted.

9. An automated method according to claim 1 wherein some or all of the at least a portion of the content of each component image element of a selected one of the component images is flipped about an axis of the component image element.

10. An automated method according to claim 1 wherein the decoder lens is a lenticular lens having a single lenticular lens frequency and the component image elements are configured as elongate segments having a predetermined width and spaced apart so as to define an element frequency that is equal to or a multiple of the lenticular lens frequency.

11. An automated method according to claim 10 wherein the lens elements and the elongate segments are curvilinear.

12. An automated method according to claim 1 wherein the decoder lens is a fly's eye lens having a two dimensional array of lens elements having a predetermined lens element shape and a plurality of lens frequencies and wherein the pattern of component image elements corresponds to the pattern of the fly's eye lens.

13. An automated method according to claim 12 wherein the component image elements have a shape corresponding to the predetermined lens element shape.

14. An automated method according to claim 1 further comprising:

screening a visible artwork image using the composite image to produce a half-tone image of the visible artwork image having the authentication image incorporated therein, the authentication image being non-viewable to the naked eye, but viewable through the decoder lens when the decoder lens is placed over the half-tone image.

15. An automated method according to claim 1 wherein each component image is formed from the same visible artwork image, the visible artwork image having varying tonal densities and the component images being formed so that they are balanced around the varying tonal densities of the visible artwork image at each corresponding location within the component images.

16. An automated method according to claim 15 wherein the action of generating a first plurality of component images includes:

forming a first replication of the visible artwork image in which the tone density of all content is darker than in the visible artwork image;

forming a second replication of the visible artwork image in which the tone density of all content is lighter than in the visible artwork image;

masking a portion of the first replication using the authentication image;

masking a portion of the second replication using the authentication image;

replacing the masked portion of the first replication with the masked portion of the second replication to form a first component image; and

replacing the masked portion of the second replication with the masked portion of the first replication to form a second component image.

17. An automated method according to claim 16 wherein the first replication is darker than the visible artwork image by a first percentage that is equal to a second percentage by which the second replication is lighter that the visible artwork image.

18. An automated method according to claim 1 further comprising:

generating a second plurality of component images, each of the second plurality of component images being a replication of a visible artwork image,

wherein the second plurality of component images is greater in number than the first plurality of component images.

19. An automated method according to claim 1 further comprising:

applying the composite image to an object to be authenticated.

20. An automated method according to claim 19 wherein the action of applying the composite image includes at least one of the set consisting of printing the composite image on a surface of the object and embossing, debossing, molding or otherwise altering a surface geometry of the object according to the composite image.

21. A non-transitory computer-readable medium having software code stored thereon, the software code being configured to cause a computer to execute a method for constructing a composite image having an authentication image formed therein, the authentication image being viewable by placement over of a decoder lens having a plurality of lens elements defining one or more decoder lens frequencies over an object to which the composite image has been applied, the method comprising:

generating a first plurality of component images in which corresponding tonal areas are tonally balanced around at least one tonal value, at least one of the component images being configured to include a representation of the authentication image;

determining a pattern of component image elements for each of the component images, the pattern including an element configuration and at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, the component image elements for a given component image collectively carrying all the content of that component image;

extracting at least a portion of the content of each component image element of each component image; and

constructing a composite image having a pattern of composite image elements having the at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, each composite image element including the extracted content from a component image element from each component image in a location in the component image that corresponds to the location in the composite image.

22. A non-transitory computer-readable medium according to claim 21 wherein the component image elements are overlapping elements and the method further comprises:

applying a predetermined element reduction factor to reduce the size of each component element to form a subelement,

wherein the subelement defines the content extracted from each component image element in the extracting action.

23. A non-transitory computer-readable medium according to claim 21 wherein the method further comprises:

subdividing each component element into a number of subelements to form a subelement pattern, the number of subelements being equal to or a multiple of the number of component images, and

wherein the at least a portion of the content of each component image element of each component image includes one or more of the subelements of the component image element.

24. A non-transitory computer-readable medium according to claim 21 wherein the method further comprises:

screening a visible artwork image using the composite image to produce a half-tone image of the visible artwork image having the authentication image incorporated therein, the authentication image being non-viewable to the naked eye, but viewable through the decoder lens when the decoder lens is placed over the half-tone image.

25. A non-transitory computer-readable medium according to claim 21 wherein each component image is formed from the same visible artwork image, the visible artwork image having varying

tonal densities and the component images being formed so that they are balanced around the varying tonal densities of the visible artwork image at each corresponding location within the component images.

26. An authenticatable object comprising:

a receiving surface configured for receiving a composite security image; and

a composite security image applied to the receiving surface, the composite security image comprising a plurality of composite elements each comprising a subelement extracted from a component element of each of a plurality of component images in which corresponding tonal areas are tonally balanced around at least one tonal value, at least one of the component images being configured to include a representation of an authentication image,

wherein the composite elements and the component elements of each of the component images are formed in a pattern having a frequency corresponding to a lens frequency of a multi-element decoder lens, so that if the decoder lens is placed over the composite security image, the authentication image is viewable through the decoder lens.

CLAIMS

What is claimed is:

1. An automated method for constructing a composite image having an authentication image formed therein, the authentication image being viewable through a decoder lens having a plurality of lens elements defining one or more decoder lens frequencies, the method comprising:

generating a first plurality of component images in which corresponding tonal areas are tonally balanced around at least one tonal value, at least one of the component images being configured to include a representation of the authentication image;

determining a pattern of component image elements for each of the component images, the pattern including an element configuration and at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, the component image elements for a given component image collectively carrying all the content of that component image;

extracting at least a portion of the content of each component image element of each component image; and

constructing a composite image having a pattern of composite image elements having the at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, each composite image element including the extracted content from a component image element from each component image in a location in the component image that corresponds to the location in the composite image.

2. An automated method according to claim 1 wherein the component image elements are overlapping elements and the method further comprises:

applying a predetermined element reduction factor to reduce the size of each component element to form a subelement,

wherein the subelement defines the content extracted from each component image element in the extracting action.

3. An automated method according to claim 2 wherein the action of constructing a composite image includes placing each subelement in the composite image so that the subelement is centered on a point corresponding to a center point of the composite image element from which the subelement was formed.

4. An automated method according to claim 1 further comprising:

subdividing each component element into a number of subelements to form a subelement pattern.

5. An automated method according to claim 4 wherein the number of subelements is equal to or a multiple of the number of component images.

6. An automated method according to claim 4 wherein at least a portion of the subelements have a geometric shape selected from the group consisting of a polygon, an ellipse, a partial ellipse, a circle, and a partial circle.

7. An automated method according to claim 4 wherein the at least a portion of the content of each component image element of each component image includes one or more of the subelements of the component image element.

8. An automated method according to claim 4 wherein the action of constructing a composite image includes placing at least one subelement from each component image element of each component image into a composite image element subdivided into the subelement pattern and positioned at a location corresponding to the location of the component image element from which the subelement was extracted.

9. An automated method according to claim 1 wherein some or all of the at least a portion of the content of each component image element of a selected one of the component images is flipped about an axis of the component image element.

10. An automated method according to claim 1 wherein the decoder lens is a lenticular lens having a single lenticular lens frequency and the component image elements are configured as elongate segments having a predetermined width and spaced apart so as to define an element frequency that is equal to or a multiple of the lenticular lens frequency.

11. An automated method according to claim 10 wherein the lens elements and the elongate segments are curvilinear.

12. An automated method according to claim 1 wherein the decoder lens is a fly's eye lens having a two dimensional array of lens elements having a predetermined lens element shape and a plurality of lens frequencies and wherein the pattern of component image elements corresponds to the pattern of the fly's eye lens.

13. An automated method according to claim 12 wherein the component image elements have a shape corresponding to the predetermined lens element shape.

14. An automated method according to claim 1 further comprising:

screening a visible artwork image using the composite image to produce a half-tone image of the visible artwork image having the authentication image incorporated therein, the authentication image being non-viewable to the naked eye, but viewable through the decoder lens provided over the half-tone image.

15. An automated method according to claim 1 wherein each component image is formed from the same visible artwork image, the visible artwork image having varying tonal densities and the component images being formed so that they are balanced around the varying tonal densities of the visible artwork image at each corresponding location within the component images.

16. An automated method according to claim 15 wherein the action of generating a first plurality of component images includes:

forming a first replication of the visible artwork image in which the tone density of all content is darker than in the visible artwork image;

forming a second replication of the visible artwork image in which the tone density of all content is lighter than in the visible artwork image;

masking a portion of the first replication using the authentication image;

masking a portion of the second replication using the authentication image;

replacing the masked portion of the first replication with the masked portion of the second replication to form a first component image; and

replacing the masked portion of the second replication with the masked portion of the first replication to form a second component image.

17. An automated method according to claim 16 wherein the first replication is darker than the visible artwork image by a first percentage that is equal to a second percentage by which the second replication is lighter that the visible artwork image.

18. An automated method according to claim 1 further comprising:

generating a second plurality of component images, each of the second plurality of component images being a replication of a visible artwork image,

wherein the second plurality of component images is greater in number than the first plurality of component images.

19. An automated method according to claim 1 further comprising:

applying the composite image to a surface to be authenticated.

20. An automated method according to claim 19 wherein the action of applying the composite image includes at least one of the set consisting of printing the composite image on the surface and embossing, debossing, molding or otherwise altering a surface geometry of the surface according to the composite image.

21. A non-transitory computer-readable medium having software code stored thereon, the software code being configured to cause a computer to execute a method for constructing a composite image having an authentication image formed therein, the authentication image being viewable through a decoder lens having a plurality of lens elements defining one or more decoder lens frequencies, the method comprising:

generating a first plurality of component images in which corresponding tonal areas are tonally balanced around at least one tonal value, at least one of the component images being configured to include a representation of the authentication image;

determining a pattern of component image elements for each of the component images, the pattern including an element configuration and at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, the component image elements for a given component image collectively carrying all the content of that component image;

extracting at least a portion of the content of each component image element of each component image; and

constructing a composite image having a pattern of composite image elements having the at least one element frequency that is equal to or a multiple of one of the decoder lens frequencies, each composite image element including the extracted content from a component image element from each component image in a location in the component image that corresponds to the location in the composite image.

22. A non-transitory computer-readable medium according to claim 21 wherein the component image elements are overlapping elements and the method further comprises:

applying a predetermined element reduction factor to reduce the size of each component element to form a subelement,

wherein the subelement defines the content extracted from each component image element in the extracting action.

23. A non-transitory computer-readable medium according to claim 21 wherein the method further comprises:

subdividing each component element into a number of subelements to form a subelement pattern, the number of subelements being equal to or a multiple of the number of component images, and

wherein the at least a portion of the content of each component image element of each component image includes one or more of the subelements of the component image element.

24. A non-transitory computer-readable medium according to claim 21 wherein the method further comprises:

screening a visible artwork image using the composite image to produce a half-tone image of the visible artwork image having the authentication image incorporated therein, the authentication image being non-viewable to the naked eye, but viewable through the decoder lens provided over the half-tone image.

25. A non-transitory computer-readable medium according to claim 21 wherein each component image is formed from the same visible artwork image, the visible artwork image having varying tonal densities and the component images being formed so that they are balanced around the varying tonal densities of the visible artwork image at each corresponding location within the component images.

26. An authenticatable object comprising:

a receiving surface configured for receiving a composite security image; and

a composite security image applied to the receiving surface, the composite security image comprising:

a plurality of composite elements each comprising a subelement extracted from a component element of each of a plurality of component images in which corresponding tonal areas are tonally balanced around at least one tonal value, at least one of the component images being configured to include a representation of an authentication image;

a pattern of component image elements for each of the component images, the pattern including an element configuration and at least one element frequency that is equal to or a multiple of one or more decoder lens frequencies, the component image elements for a given component image collectively carrying all the content of that component image; and

a composite image having a pattern of composite image elements having the at least one element frequency that is equal to or a multiple of the one or more decoder lens frequencies, each composite image element including content extracted from a component image element from each component image in a location in the component image that corresponds to the location in the composite image, the authentication image being viewable through a decoder lens provided over the composite security image.