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(54) LAYERED ARTICLE ON A PAPER OR POLYMER BASE (VARIANTS) AND METHOD FOR MANUFACTURING SAME

(57) The claimed group of inventions discloses a layered product on a paper or polymer substrate with an optically variable structure, and also a method for manufacturing same. The layered product comprises a coating in the form of a printed screen, and a three-dimensional screen. The three-dimensional screen is made in the form of elements with a symmetrical and/or asymmetrical profile to form a relief on both sides of the substrate, and is so arranged in respect to the printed screen that the three-dimensional screen is at least partially located above the printed screen. The width of lines, the distance between lines of the printed and three-dimensional screens and the mutual orientation of the screens are selected such that they form a moire image which is hidden, when the data carrier is viewed at a right angle, and becomes visible when the data carrier is viewed at an acute angle. The present invention provides an increase in the security of products, and also an increase in the technological effectiveness and a reduction in the cost of the security element owing to the reduction of passes in a printing machine.

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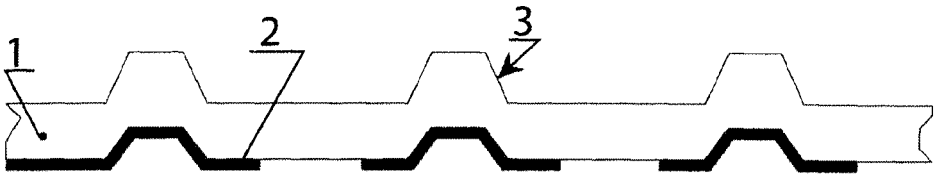


Fig. 1

Description

Technical Field

[0001] The invention relates to the manufacture of a security paper with hidden layered elements, in particular, such as hidden security elements, i.e., those detectable or becoming apparent only with the use of special verification or methods or devices for intervention, that is, to a security paper. The invention can be used in the manufacture of banknotes, securities, passports, tax stamps, identification documents.

Background of the Invention

[0002] A technical solution is known from RU 2440248 C1 of 03.08.2010, in which a data carrier comprises a coating made in the form of a printed screen (which is sometimes referred to as printed raster or grid) and a three-dimensional screen (which is also sometimes referred to as three-dimensional raster or grid). An optically variable structure is used as a feature that can be checked by a person without the use of auxiliary means, if necessary, along with other features for determining the authenticity of the data carrier. A preferred field of application of the invention is the production of security papers. Cards that are employed for person identification or for performing transactions or for providing services can also be used as the data carrier.

[0003] Known in the prior art is a data carrier with an optically variable structure (CA 1019012 A, B32B 29/02, 11.10.1997) formed by a printed screen with equally spaced straight elements and a three-dimensional screen with equally spaced straight elements, the three-dimensional screen being arranged relative to the printed screen such that all printed information is visible when the data carrier is viewed perpendicular to the surface, but only a part that is not covered by the three-dimensional screen is visible when the data carrier is viewed at an acute angle.

[0004] A data carrier is known from RU 2235021 C2, 27.08.2004, in which the mutual arrangement of a printed screen and a three-dimensional screen provides the formation of a moire in the form of color stripes smoothly transiting into each other. This technical solution is the closest to the present invention. The present invention is aimed at enhancing the security properties of the feature with a moire effect.

Disclosure of the Invention

[0005] An objective of the invention is to enhance the security of products by obtaining an optically variable effect on the reverse side of the product, and also to improve the technological effectiveness and to reduce the cost of the security element owing to the reduction of passes in a printing machine.

[0006] The objective is attained by a method and features set forth in independent claims.

[0007] According to a first embodiment the objective is attained by a layered product on a paper or polymer substrate with an optically variable structure verifying the authenticity of the product, comprising a coating in the form of a printed screen, and a three-dimensional screen, characterized in that the coating is formed on one side of the substrate, and the three-dimensional screen is applied onto the other side of the substrate, the field of the printed or three-dimensional screen is divided into two or more sectors shifted relative to each other, each sector being coloured in its own color such that, when changing a viewing angle, the color of the sectors in an image changes, wherein the three-dimensional screen is made in the form of elements with a symmetrical and/or asymmetrical profile to form a relief on the both sides of the substrate, and is so arranged in respect to the printed screen that the three-dimensional screen is at least partially located above the printed screen, wherein the width of lines of the printed screen is from 50 to 200 μm, the width of lines of the three-dimensional screen is from 100 to 600 μm, the angle between the elements of the printed and three-dimensional screens is from 0° to 10°, and the screens form a moire image which is hidden, when the data carrier is viewed at a right angle, and becomes visible when the data carrier is viewed at an acute angle.

[0008] Furthermore, the printed and three-dimensional screens are formed by polygonal or curved lines, and/or dots, and/or dashes, and/or graphic primitives, and/or a combination thereof; an additional information is introduced into the printed screen, said information being visible when viewed at any angle,
or a hidden information is introduced into the printed screen, said information being visible when viewed at an acute angle,
or a hidden information formed by inks with special properties is introduced into the printed screen, said information being visible with the aid of special instruments,
or a hidden information is introduced into the three-dimensional screen, said information being visible when viewed at an acute angle.

[0009] According to a second embodiment, the objective is attained by a layered product on a paper or polymer substrate with an optically variable structure verifying the authenticity of the product, comprising a coating in the form of a printed screen, and a three-dimensional screen, characterized in that the printed screen is applied onto both sides of the substrate, and the three-dimensional screen is applied onto one side of the substrate, wherein the three-dimensional screen is made in the form of elements with a symmetrical and/or asymmetrical profile to form a relief on the both sides of the substrate, and is so arranged in respect to the printed screen that the three-dimensional screen is at least partially located above the printed screen; wherein the width of lines, the distance between lines of the printed and three-dimensional screens and the mutual orientation of the screens are selected such that they form a moire image which is

hidden, when the data carrier is viewed at a right angle, and becomes visible, when the data carrier is viewed at an acute angle, wherein the elements of the printed screen applied to the different sides of the substrate match up in transmitted light, thereby forming an additional security element verifiable in transmitted light, and the moire images visible on the front and reverse sides of the data carrier, when the data carrier is viewed at an acute angle, are identical;
or the moire images visible on the front and reverse sides of the data carrier, when the data carrier is viewed at an acute angle, are different;
or the moire images visible on the front and reverse sides of the data carrier, when the data carrier is viewed at an acute angle, form a moire pattern on one side and a color changing effect on the other side;
or the image obtained on the front side of the carrier has an effect of motion, while the image obtained on the reverse side forms a moire pattern and/or a colour changing effect.

[0010] The objective is also attained by a method for manufacturing a layered product on a paper or polymer substrate as described before, said method including applying onto at least one portion of the substrate graphic elements in the form of a printed screen, followed by applying a three-dimensional screen, wherein according to the invention the printed screen is applied by a printing method onto one side of the substrate, and the three-dimensional screen is applied onto the other side of the substrate, wherein a pressure on the substrate when applying the three-dimensional screen being such that it results in formation of a back relief, and the mutual arrangement of the screens is selected in such manner that they form an image exhibiting an optically variable effect;
the printed screen is applied onto the both sides of the substrate;
or the three-dimensional screen is applied by colorless scratch-off embossing, or multicolor scratch-off printing, or relief stamping;
or the printed screen is applied by a method of stencil screen printing, or scratch-off printing, or offset printing, or intaglio printing, or offset-like printing, or jet printing, or flexographic printing, or electrophotographic printing, or a combination of the methods.

Brief Description of the Drawings

[0011]

Fig. 1 shows a structure of a data carrier when manufactured by using a three-dimensional screen with a symmetric profile.
Fig. 2 shows an arrangement of graphical elements of the three-dimensional screen.
Figs. 3 and 4 show a scheme of obtaining an image when the data carrier is viewed at different angles of inclination.
Fig. 5 shows a structure of a data carrier when manufactured by using a three-dimensional screen with an asymmetric profile.
Fig. 6 shows an arrangement of graphical elements of the three-dimensional screen.
Fig. 7 and 8 show a scheme of obtaining an image when the data carrier is viewed at different angles of inclination.
Fig. 9 shows a structure of a data carrier manufactured according to the second embodiment by using a three-dimensional screen of a symmetrical profile.
Fig. 10 shows a structure of a data carrier manufactured according to the second embodiment by using a three-dimensional screen of an asymmetric profile.
Figs. 11, 12 show a scheme of obtaining an image when the data carrier manufactured according to the second embodiment is viewed at different angles of inclination, and also a principal location of an additional pattern.
Figs. 13 and 14 show a scheme of obtaining an image when the data carrier manufactured according to the second embodiment is viewed at different angles of inclination, and a principal location of an additional pattern.
Fig. 15 shows a scheme of obtaining an image when the data carrier manufactured according to the second embodiment is viewed in transmitted light.
Figs. 16 and 17 show an arrangement of printed screens of a front and a reverse sides.
Fig. 18 shows a scheme of obtaining an image when the data carrier is viewed in transmitted light.

[0012] Designations of reference numerals in the drawings:

1 - a portion of a substrate of a data carrier
2 - graphical elements of a printed screen
3 - elements of a three-dimensional screen
4 - an additional pattern.

Best Mode of Embodying the Invention

[0013] The present technical solution is implemented as follows. A printed screen is applied onto a paper or polymer substrate of a carrier on one or both sides to at least one portion. In a particular case, special inks luminescent when exposed to a UV radiation, creating a similar visual effect when the data carrier is viewed at an angle under the UV radiation, are used for making the printed screen.

[0014] Then a three-dimensional screen is applied onto one of the sides of the substrate of the data carrier, wherein, if the printed screen is applied onto only one side of the substrate, the three-dimensional screen is applied onto the other side. In the process of applying the three-dimensional screen, a pressure on the substrate is selected such that a back relief is formed. As a result, the following options of the data carrier have been produced.

[0015] The invention can be used for protection against counterfeit of printing products (also called as graphic products or printed products), such as securities (value documents), banknotes, identity certificates (identification documents), both on a paper and polymer substrate.

Example 1. (Figs. 1, 2, 3, 4)

[0016] A counterfeit-proof data carrier (Fig. 1) comprises at least one portion 1 onto one side of which graphic elements of a printed screen 2 are applied and onto the other side of which a three-dimensional screen 3 is applied at an angle relative to lines of the printed screen (Fig. 2) by a method of relief stamping or scratch-off printing with a symmetrical profile of the stroke.

[0017] When the data carrier is viewed in reflected light at a right angle, a uniformly colored field is observed (Fig. 3), but when the data carrier is viewed at an acute angle, the appearance of a moire pattern is observed (Fig. 4).

Example 2. (Figs. 5, 6, 3, 7, 8)

[0018] A data carrier (Fig. 5) comprises at least one portion 4 onto one side of which graphic elements of a printed screen 5 are applied and onto the other side a three-dimensional screen 6 is applied at a very small or zero angle relative to lines of the printed screen (Fig. 6) by a method of relief stamping or scratch-off printing with a symmetrical profile of the stroke.

[0019] When the data carrier is viewed in reflected light at a right angle, a uniformly colored field is observed (Fig. 3), but when the data carrier is viewed at an acute angle, coloring of sectors of the element to different colors is observed (Fig. 7), and colors of the sectors change when changing the viewing angle (Fig. 8).

Example 3. (Figs. 9, 10, 11, 13, 14, 15)

[0020] A data carrier manufactured according to the second embodiment (Figs. 9, 10) comprises at least one portion 7, 10 onto both sides of which graphical elements of a printed screen 8, 11 are applied and onto one side of which a three-dimensional screen 9, 12 is applied by a method of relief stamping or scratch-off printing with a symmetrical profile of the stroke.

[0021] As can be seen (Figs. 11 to 14), when the data carrier is viewed in reflected light from the front/reverse side at different angles, regions of the data carrier are colored in a different color, wherein a pattern which forms an image when the data carrier is viewed in transmitted light (Fig. 15), is applied near lines of the printed screen.

Example 4. (Figs. 9, 10, 16, 17, 18)

[0022] A data carrier manufactured according to the second embodiment, having printed screens and three-dimensional screens (Figs. 9, 10) applied thereto on the front and reverse side of the product (Figs. 16, 17), being arranged such that, when the data carrier is viewed in transmitted light, they form an interrelated image (Fig. 18).

[0023] Therefore, the data carrier proposed in the invention allows an optically variable effect to be obtained. An information displayed on the surface of the portion is hidden when viewed at a right angle and is visualized when changing the viewing angle. This allows performing both a machine-readable authenticity verification and visual inspection of the carrier.

[0024] An advantage of the proposed method for manufacturing a counterfeit-proof data carrier consists in improving technological effectiveness of the process owing to the omission of additional operations, in particular reverse scratch-off printing, which leads to a decrease in the cost of the counterfeit-proof data carrier. The application of graphic elements by using conventional printing methods does not require extra processing operations and additional pieces of equipment.

Industrial Applicability

[0025] The invention is applicable in the field of production of banknotes, securities, passports, tax stamps, identification documents on a security paper with hidden layered elements detectable or becoming apparent only when using special verification or methods or devices for intervention.

Claims

1. A layered product on a paper or polymer substrate with an optically variable structure verifying the authenticity of the product, comprising a coating in the form of a printed screen, and a three-dimensional screen, **characterized in that** the coating is formed on one side of the substrate, and the three-dimensional screen is applied onto the other side of the substrate, the field of the printed or three-dimensional screen is divided into two or more sectors shifted relative to each other, each sector being coloured in its own color such that, when changing a viewing angle, the color of the sectors in an image changes, wherein the three-dimensional screen is made in the form of elements with a symmetrical and/or asymmetrical profile to form a relief on the both sides of the substrate, and is so arranged in respect to the printed screen that the three-dimensional screen is at least partially located above the printed screen, wherein the width of lines of the printed screen is from 50 to 200 μm, the width of lines of the three-dimensional screen is from 100 to 600 μm, the angle between the elements of the printed and three-dimensional screens is from 0° to 10°, wherein the screens form a moire image which is hidden, when the data carrier is viewed at a right angle, and becomes visible when the data carrier is viewed at an

acute angle.

2. A product according to claim 1, **characterized in that** the printed and three-dimensional screens are formed by polygonal or curved lines, and/or dots, and/or dashes, and/or graphic primitives, and/or a combination thereof.

3. A product according to claim 1 or claim 2, **characterized in that** an additional information is introduced into the printed screen, said information being visible when viewed at any angle.

4. A product according to claim 1 or claim 2, **characterized in that** a hidden information is introduced into the printed screen, said information being visible when viewed at an acute angle.

5. A product according to claim 3, **characterized in that** a hidden information formed by inks with special properties is introduced into the printed screen, said information being visible with the aid of special instruments.

6. A product according to claim 1 or claim 2, **characterized in that** a hidden information is introduced into the three-dimensional screen, said information being visible when viewed at an acute angle.

7. A layered product on a paper or polymer substrate with an optically variable structure verifying the authenticity of the product, comprising a coating in the form of a printed screen, and a three-dimensional screen, **characterized in that** the printed screen is applied onto both sides of the substrate, and the three-dimensional screen is applied onto one side of the substrate, wherein the three-dimensional screen is made in the form of elements with a symmetrical and/or asymmetrical profile to form a relief on the both sides of the substrate, and is so arranged in respect to the printed screen that the three-dimensional screen is at least partially located above the printed screen, wherein the width of lines, the distance between lines of the printed and three-dimensional screens and the mutual orientation of the screens are selected such that they form a moire image which is hidden, when the data carrier is viewed at a right angle, and becomes visible, when the data carrier is viewed at an acute angle, wherein the elements of the printed screen applied onto the different sides of the substrate match up in transmitted light, thereby forming an additional security element verifiable in transmitted light.

8. A product according to claim 7, **characterized in that** the moire images visible on the front and reverse sides of the data carrier, when the data carrier is viewed at an acute angle, are identical.

9. A product according to claim 7, **characterized in that** the moire images visible on the front and reverse sides of the data carrier, when the data carrier is viewed at an acute angle, are different.

10. A product according to claim 9, **characterized in that** the moire images visible on the front and reverse sides of the data carrier, when the data carrier is viewed at an acute angle, form a moire pattern on one side and a colour changing effect on the other side.

11. A product according to claim 10, **characterized in that** the image obtained on the front side of the carrier has an effect of motion, while the image obtained on the reverse side forms a moire pattern and/or a colour changing effect.

12. A method for manufacturing a layered product on a paper or polymer substrate according to claims 1 to 11, said method including applying onto at least one portion of the substrate graphic elements in the form of a printed screen, followed by applying a three-dimensional screen, **characterized in that** the printed screen is applied by a printing method onto one side of the substrate, and the three-dimensional screen is applied onto the other side of the substrate, wherein a pressure on the substrate when applying the three-dimensional screen is such that it results in formation of a back relief, and the mutual arrangement of the screens is selected in such manner that they form an image exhibiting an optically variable effect.

13. A method according to claim 12, **characterized in that** the printed screen is applied onto the both sides of the substrate.

14. A method according to claim 12 or claim 13, **characterized in that** the three-dimensional screen is applied by colorless scratch-off embossing, or multicolor scratch-off printing, or relief stamping.

15. A method according to claim 14, **characterized in that** the printed screen is applied by a method of stencil screen printing, or scratch-off printing, or offset printing, or intaglio printing, or offset-like printing, or jet printing, or flexographic printing, or electrophotographic printing, or a combination of the methods.

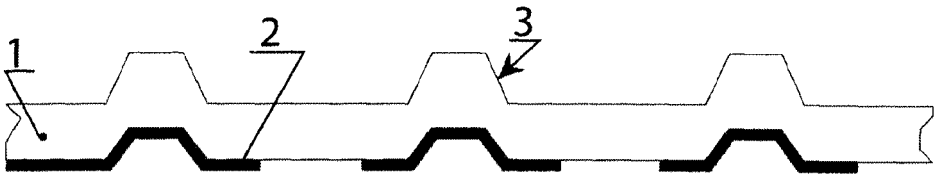


Fig. 1

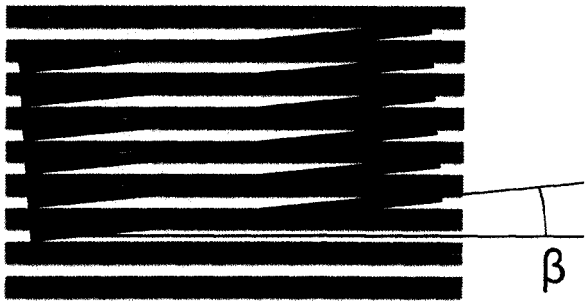
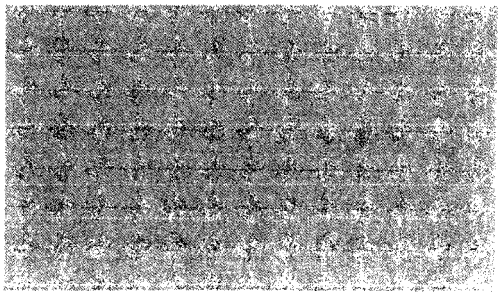


Fig. 2



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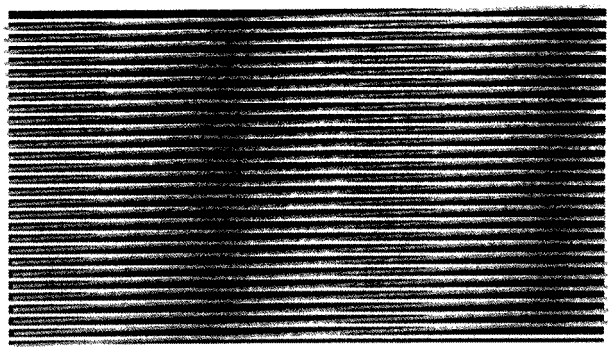
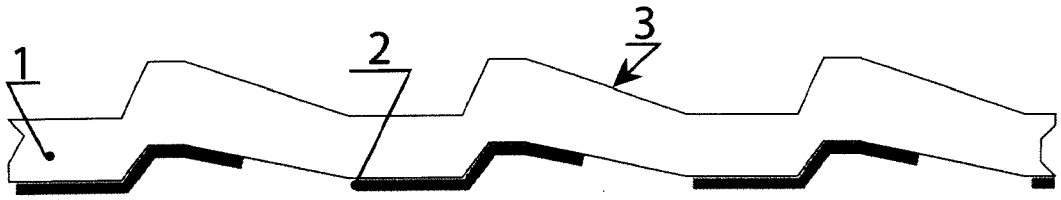


Fig. 4



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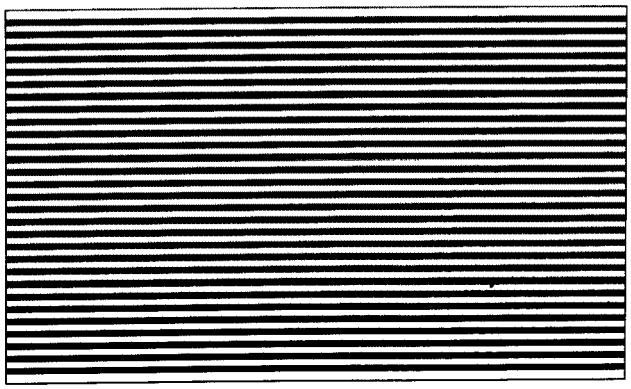


Fig. 6

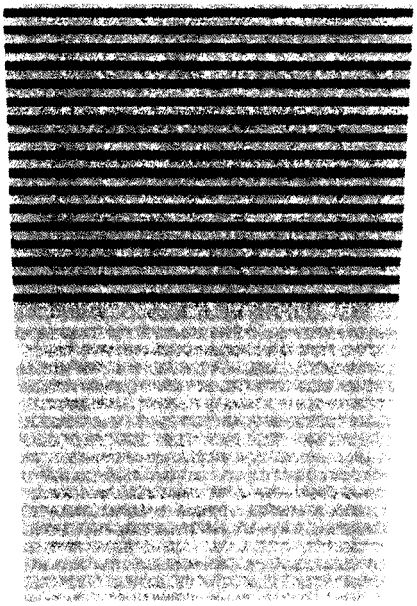


Fig. 7

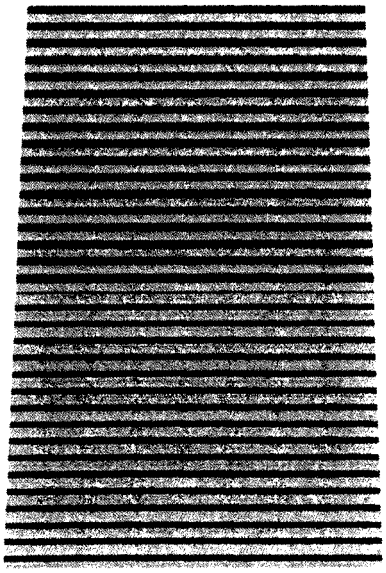


Fig. 8

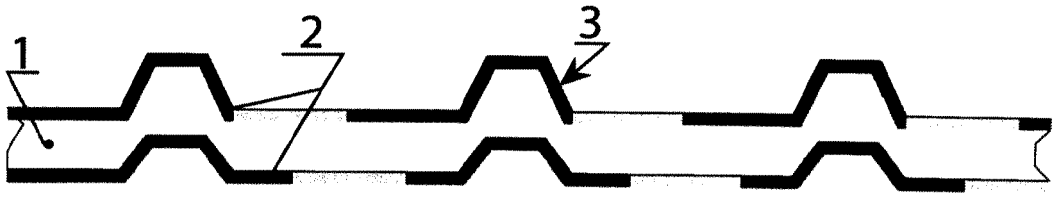


Fig. 9

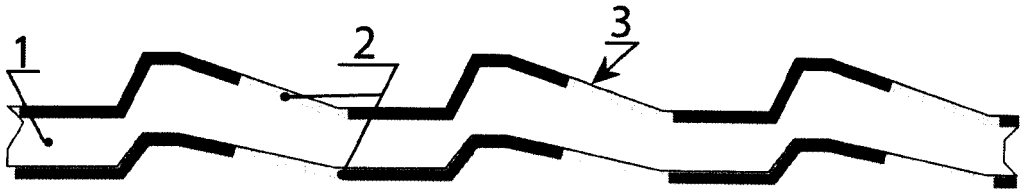
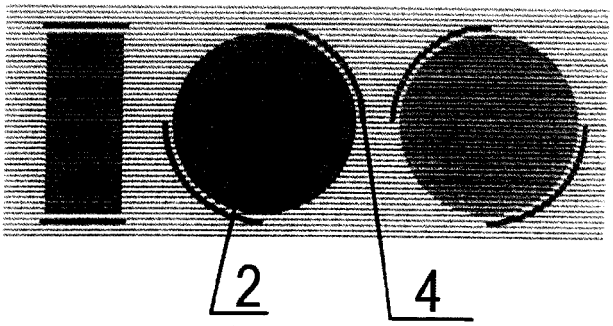


Fig. 10



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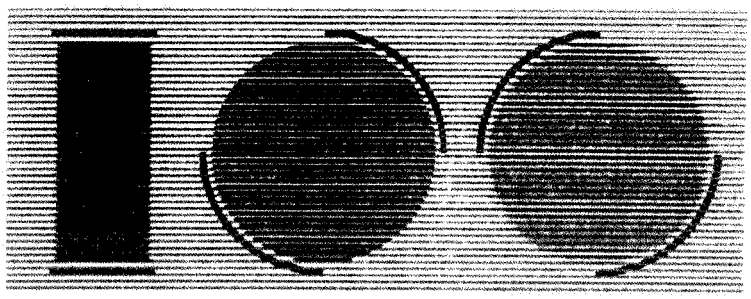
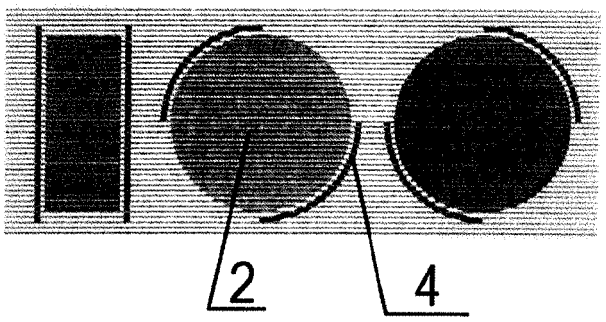


Fig. 12



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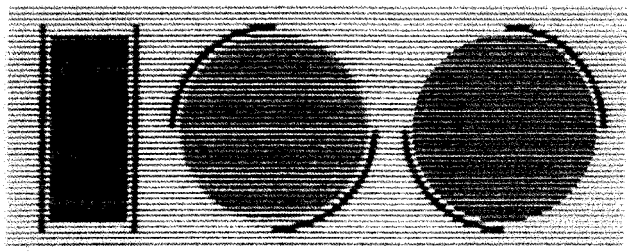

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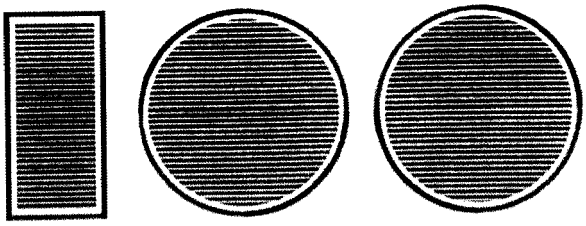

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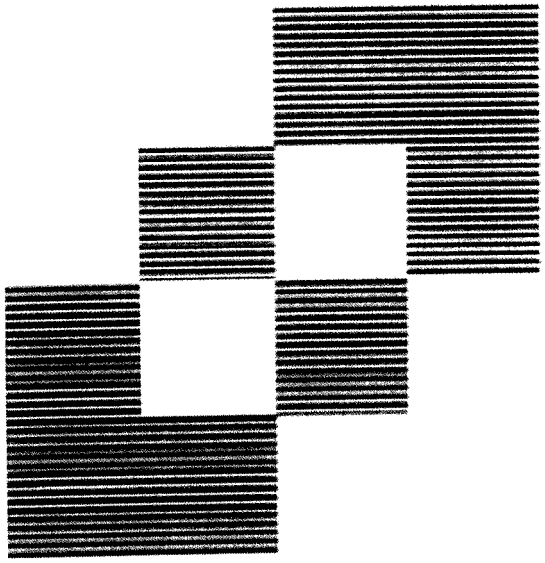

Fig. 16

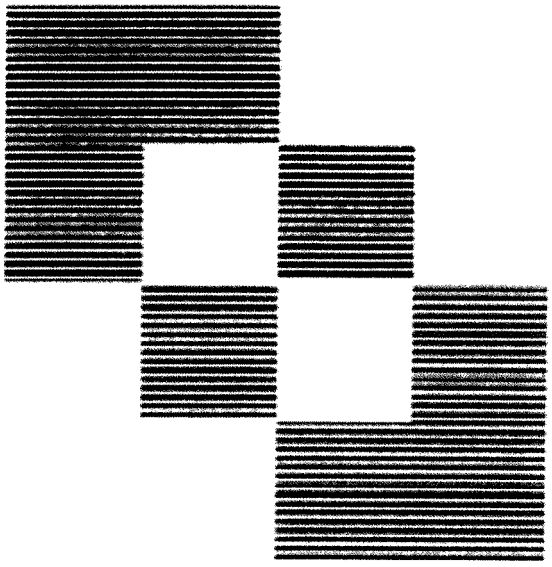

Fig. 17

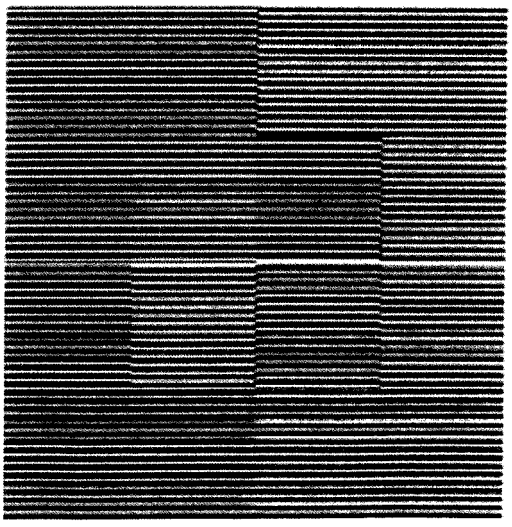

Fig. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2014/000244

A. CLASSIFICATION OF SUBJECT MATTER

B42D 25/342 *(2014.01)*
B32B 33/00 *(2006.01)*
B42D 25/40 *(2014.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B42D 25/00-25/342, B32B 33/00, B42D 25/40

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

FIPS, Espacenet, PAJ, USPTO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
D, A	RU 2235021 C2 (NAUCHNO-ISSLEDOVATELSKY INSTITUT GOZNAKA) 27.08.2004	1-15
A	CA 1019012 A (CANADIAN BANK NOTE COMPANY, LIMITED) 11.10.1977	1-15
A	EP 0440045 A2 (GAO GESELLSCHAFT FUR AUTOMATION UND ORGANIZATION MBH) 07.08.1991	1-15
A	RU 2440248 C1 (FEDERALNOE GOSUDARSTVENNOE UNITARNOE PREDPRIYATIE "GOZNAK") 20.01.2012	1-15

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 July 2014 (21.07.2014)	07 August 2014 (07.08.2014)
Name and mailing address of the ISA/ RU	Authorized officer
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RU 2440248 C1 **[0002]**
- CA 1019012 A **[0003]**
- RU 2235021 C2 **[0004]**