



- (51) International Patent Classification:
G07D 7/12 (2006.01) G07D 7/00 (2006.01)
- (21) International Application Number:
PCT/BY2010/000008
- (22) International Filing Date:
13 October 2010 (13.10.2010)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
201000350 24 November 2009 (24.11.2009) EA
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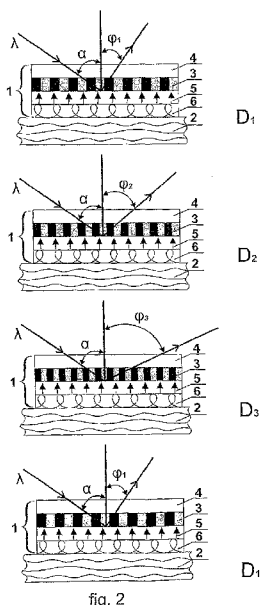
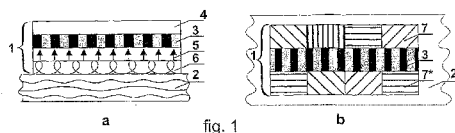
Nikolaevich [BY/BY]; ul. Nekrasova, 20/2-23, Minsk, 220040 (BY). MOISEENKO, Petr Vasil'evich [BY/BY]; ul. Slobodskaya, 21-214, Minsk, 220098 (BY). TANIN, Leonid Viktorovich [BY/BY]; ul. Gorodetskaya, 32-65, Minsk, 220125 (BY). SHEVTSOV, Viktor Arkad'evich [BY/BY]; per. Agatovyj, 6, Minsk, 220020 (BY).

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) Title: ANTI-COUNTERFEIT SECURITY IDENTIFICATION MARK AND METHOD OF MAKING IT



(57) Abstract: Objects, related to an anti-counterfeit identification mark, a paper, defended from counterfeit with identification marks, placed on its surface (two variants), method of making a check or control tape from such a material, are claimed. The present invention relates to identification tools of documents made from paper, polymeric materials or their combination, being rolled at least at the stage of personalized information application to cash register check or control tapes or similar systems. The gist of the invention related to the identification mark comprises that the layer possessing diffraction relief structures has a region, angular dispersion of which for given light wavelength, direction of light source and given order of diffraction maximum has corresponding value; wherein the multilayer protective element is fully placed on a paper along element transverse axis, and region, done along element transverse axis, is placed along the full length and properly oriented. The gist of the invention related to the defended from counterfeit paper with said identification marks, placed on its surface is the following. According to the first variant of the paper implementation, when placing of n identification marks on a paper in longitudinal and transverse directions with; specified spacing and origin, region angular dispersion of every subsequent mark in longitudinal direction differ from region angular dispersion of every previous mark of the same direction on given value, wherein distinctiveness repetition is periodical. According to the second variant of the paper implementation when placing of n identification marks, made according to Claims 1-2, on a paper in longitudinal and transverse directions with specified spacing and origin, region angular dispersion of every mark in longitudinal direction has constant value. The gist of the check or control tape obtainment method from the paper, imolemented according to any said variants comprises that the identification marks on the paper are made in accordance with Claims 1-2, wherein after marks placing the paper is cut into rolls in accordance with check: or control tapes characteristics in such a way that identification marks are located along at least] one edge 'of check or control tape in lon-

gitudinal direction, meanwhile the size of edge mark along l longitudinal check or control tape axis is 1/2 part of identification mark.





- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
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 - of inventorship (Rule 4.17(iv))
- Published:**
- with international search report (Art. 21(3))
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

Declarations under Rule 4.17:

ANTI-COUNTERFEIT SECURITY IDENTIFICATION MARK AND METHOD OF MAKING IT

Field of the Invention

The present invention relates to identification tools of documents made from paper, polymeric materials or their combination, being rolled at least at the stage of personalized information application to cash register check or control tapes or similar systems.

Description of the Related Art

There is known an invention related to identification tool or important document, concerning also the method of making such an identification tool or important document and method of its authentication.

The concept of the invention comprises the following: an identification tool or important document includes a carrier that has translucent or transparent section made from paper or *polymeric material with a liquid-crystal material*, placed on it and intended for obtaining the effects that are different in transmitted and reflected light. In addition, the above section is provided with a watermark, and the liquid-crystal material is placed on at least a part of the watermark [1].

There is known also a protective element, intended for authenticity control of protected printed production, and protected printing production.

According to the above known invention the protective element is implemented in form of a tape, including a polymeric film layer with at least one opaque layer of optical density more than 1.5 deposited on it. The opaque layer has also cutouts in the form of pictures, and/or symbols, and/or signs, and at least one semitransparent layer of optical density less than 1.5 is deposited on it. The semitransparent layer optical density changes by given law along and/or across the tape in order to provide a variable optical density for the cutouts in the opaque layer [2].

Moreover, there is also known a paper, defended from counterfeit (variants) and methods of making of such a paper.

The paper and method of its making can be utilized in production of paper for banknotes, stock, documents, identification cards, etc.

Paper according to the known invention is made with a protective tape, placed into the paper with possibility of free or at least partial access. The protective tape has a width of 2 mm. The paper includes at least two paper layers, made by separate papermaking machines. And the

protective tape is placed into the first paper layer. The second paper layer has a thickness 10-50%, preferably 20%, of total paper thickness. The protective tape can be permeable for liquids at the edge of one or both sides in the tape longitudinal direction. And at least these permeable parts are fastened in fibrous mass of paper [3].

Also there is known an invention related to product possessing an authentication tool.

This invention relates to printed materials, especially to decorative-informational, mainly printed, products, in particular to stock, documents, bulletins, labels, packing of popular goods, etc., possessing authentication tools.

Such a product contains a base possessing an authentication tool implemented in the form of optically changing element, wherein the authentication tool includes two liquid-crystal type thermal indicators forming at least one group. The thermal indicators within one group are characterized in that they have in liquid-crystal state at least the same color within the temperature ranges forming a sequence, in which the minimal temperature of posterior temperature range is greater than the maximal temperature of previous temperature range. And the thermal indicator groups are positioned on the base separately.

Authentication of a decorative-informational product consists in reading of digital code from authentication tool and comparison with digital code corresponding to the original decorative-informational product.

Special code reading device has embedded a light source, a system that detects one or more given color of light, reflected from authentication tool, a microprocessor with memory, in which the code of the original decorative-informational product is stored, and a light and sound indication element [4].

Disadvantages of the known products are low authentication precision, since it is difficult to distinguish even low-quality fabrication from original decorative-informational products, technological complexity of protection making, and difficulties in authentication at any stage of product usage, including automatic authentication.

The closest to present invention technical solution is the invention related to a paper, defended from counterfeit (variants); an important document (variants), made from this paper; a multilayer protective element (variants), used on an important document; a transferable material for transfer of such a protective element to an important document and methods of a transferable material and an important document with protective element making.

This invention is also related to protection tools of a paper for important documents such as banknotes, certificates or analogous important documents. Such a paper has at least one multilayer protective element that allows to create at least one visually controllable optical effect. The

protective element is placed at least partially on the surface of counterfeit protected paper and has at least one integrated circuit.

In addition the protective element has at least one layer containing pigments, mainly interference or liquid-crystal ones, with changeable optical characteristics, thus providing an obtainment of simple and low-cost important document that allows to create visually controllable optical effect and control it automatically at the same time [5].

In other words, the closest analogue (prototype) aims to create a protective element for stock that allows to create visually controllable optical effect and control it automatically simultaneously. At the same time a defended from counterfeit paper and an important document should be simple and cheap to make.

To solve above problem according to the closes analogue it is proposed to use multilayer protective element that allows to create at least one visually controllable optical effect, wherein the protective element is placed at least partially on the surface of counterfeit protected paper and has at least one integrated circuit.

Providing the protective elements with integrate circuit and subsequent circuit transfer and fastening on the paper without loosing of functional characteristics considerably complicate and raise a price of paper protective element making process.

The objective of present invention is creation of an identification mark that is simple to make and transfer to identifying product (for example rolled material); allows a visual control; provides automatic authenticity control of the material at least at the stage of personalizing information application, thus providing high quality of rolled documents protection, for example check or control tapes used in cash registers or in similar systems; guarantees the counterfeit detection of such a tape at any stage of control.

The task is achieved by providing a possessing diffraction relief structures layer of a placed on the paper and designated for counterfeit protection multilayer identification mark, having at least one layer, possessing diffraction relief structures that allow to create at least one visually controllable optical effect, with region, angular dispersion of which for given light wavelength, direction of light source and given order of diffraction maximum has corresponding value; wherein the multilayer protective element is fully placed on a paper along element transverse axis, and region, done along element transverse axis, is placed along the full length and oriented in dependence on light source direction.

Diffraction maximum of the first order is usually considered.

Also, the invention related to a paper (two variants), protected from counterfeit by placed on it identification marks, made in according to above conditions, has the same objective.

Summary of the Invention

The gist of the present invention according to the first paper implementation variant is the following: when placing of n identification marks, made according to Claims 1-2, on a paper in longitudinal and transverse directions with specified spacing and origin, region angular dispersion of every subsequent mark in longitudinal direction differ from region angular dispersion of every previous mark of the same direction on specified value, wherein distinctiveness repetition is periodical. In addition, literal and digital symbol can correspond to each angular dispersion value at constant wavelength.

The gist of the present invention according to the second paper implementation variant is the following: when placing of n identification marks, made according to Claims 1-2, on a paper in longitudinal and transverse directions with specified spacing and origin, region angular dispersion of every mark in longitudinal direction has constant value.

Meanwhile, according to all variants of paper implementation edge identification marks, placed at least along one paper edge in longitudinal direction, form $\frac{1}{2}$ part of the identification mark, literal and digital symbol can correspond to each angular dispersion value at constant wavelength or for different wavelengths.

The method of a check or control tape obtainment from the paper, realized in according to above conditions with placed on it identification marks, solves the problem of obtainment of check or control tapes, defended from counterfeit and intended for utilizing in, for example, cash registers, in order not only to visual but automatic authentication control, from the paper, made in according to above conditions and the first or the second realization variants.

This method of check or control tape obtainment from the paper, realized in according to Claims 3-4, including placing of identification marks on the paper by any known methods and paper cutting, contains the identification marks making in according to above conditions and Claims 1-2.

Wherein after marks placing the paper is cut into rolls in accordance with check or control tapes characteristics in such a way that identification marks are located along at least one edge of check or control tape in longitudinal direction, meanwhile the size of edge mark along longitudinal check or control tape axis is $\frac{1}{2}$ part of identification mark.

Meanwhile during paper cutting into rolls every roll is given an individual serial number, placed at the beginning and the end of the roll and possibly duplicated along full area of the roll.

Brief Description of the Attached Figures

Fig. 1 is a schematic drawing of identification mark in section (a), in plan (b), where

1 is an identification mark;

2 is a paper;

3 is a region of diffraction relief structure with given angular dispersion;

4 is a protective transparent layer;

5 is a reflecting layer;

6 is a glued layer;

7 and 7* are regions with random position of diffraction relief structures.

Fig. 2 is a schematic drawing of positioning sequence of n-identification marks 1 on a paper 2 (on Fig. 2 is not shown) in longitudinal direction with different angular dispersion (D_1 , D_2 , D_3) of region 3 (the first variant of paper implementation), where

λ is a wavelength of monochromatic radiation source;

α is an incidence angle of monochromatic radiation of control device with wavelength λ ;

φ is an observation angle of, for example, the first diffraction maximum.

A wavelength λ of control device monochromatic radiation source and incidence angle α are constant, and observation angle of the first diffraction maximum φ is variable, depends on angular dispersion (D_1 , D_2 , D_3) and give information about authenticity of reading information to control device

Fig. 3 is a schematic drawing of positioning sequence of n-identification marks 1 on a paper 2 (on Fig. 3 is not shown) in longitudinal direction with constant angular dispersion (D) of region 3 (the second variant of paper implementation).

A wavelength λ of control device monochromatic radiation source is variable and incidence angle α is constant. In the second variant of the paper 2 implementation the observation angle of the first diffraction maximum φ is variable as in the first case and depends on wavelength λ of control device monochromatic radiation source

Fig. 4 illustrates variants of marks 1 positioning on paper 2 (a, b, c, d) with different spacing and origin, where

8 is a line of origin;

9 is a paper cutting line;

(t_1 , t_3) is a longitudinal spacing between marks 1;

(t_2 , t_4) is a transversal spacing between marks 1.

Detailed Description Preferred Embodiments

An identification mark 1 of Fig. 1a, placed on a paper 2 and intended for paper counterfeit protection, is multilayer construction, containing a transparent protective layer 4, under which

there is a region 3 of diffraction relief structure with angular dispersion value corresponded to given light wavelength and given diffraction maximum order.

A reflective layer 5, located under a region 3, is to return a light beam to observer or control device. A glued layer 6, located directly on a paper 2 is to fasten an identification mark 1 is specified point of paper 2.

An identification mark 1 has a region 3 of diffraction relief structure with given angular dispersion value, which occupies the whole area of identification mark (Fig. 1b)

A region 3 of diffraction relief structure with given angular dispersion value is oriented in definite way on an identification mark 1. In addition, an orientation of region 3 on a identification mark 1 is completely depended on location of monochromatic light source of control device.

Apart from this region an identification mark 1 can include regions 7 and 7* (Fig. 1b) with random positioning of diffraction relief structures, having different angular dispersion value and orientation, which are to disguise a region 3.

Fig. 2 is a schematic drawing of longitudinal positioning of identification marks 1 on a paper 2 (the paper 2 is not shown on Fig. 2) with periodical changing of the first order diffraction maximum observation angle φ (the first variant of paper implementation),

According to the first variant, an angular dispersion of a region 3 of one mark (D_1) differ from angular dispersion (D_2) of a subsequent mark, and angular dispersion (D_3) of a subsequent mark (D_3) differ from angular dispersion (D_1 and D_2) of previous marks, after that values of angular dispersion are repeated.

The presence of identification marks 1 on a paper 2 with regions (3, 7 and 7*) of diffraction relief structures (for example holograms) allows to visually control the documents authenticity, for example check or control tapes, at the making stage, during their obtainment by utilizing them organization, at the stage of tape passing through cash register in the case of its preliminary personalization, and at the stage of tape storage after its personalization. A check with identification mark 1 is a secure document and comes to customer.

The first variant of paper 2 implementation that includes positioning of identification marks 1 in longitudinal direction with periodic sequence and different angular dispersion of a region 3 (D_1 , D_2 , D_3) allows to organize a automatic control of check and control tapes from this paper with the help of special control device at any stage for control tapes and up to personalization stage inclusive for check tape.

According to the first variant of paper 2 implementation an authentication control of a paper 2 is realized as follows.

An monochromatic light radiation of constant wavelength λ comes to a region 3 at constant incidence angle α . Meanwhile, the first, for example, order diffraction maximum angle for angular dispersion D_1 is φ_1 .

While a check or control tape moves through control device or cash register, equipped with control device, to the next position, where a region 3 has another angular dispersion value (D_2), and, wavelength λ and incidence angle α remains the same, angle of the first order diffraction maximum changes to φ_2 .

Then the process is repeated for a region 3 with angular dispersion (D_3). To each angle of the first order diffraction maximum one can map definite symbol, that makes it possible to code the tapes. It should be noted that this principle is applicable for rolled material.

Fig. 3 is a schematic drawing of longitudinal positioning of identification marks 1 on a paper 2 (the paper 2 is not shown on Fig. 2) according to the second variant of paper implementation.

According to the second variant, each application mark 1, placed on a paper in longitudinal direction, has a regions 3 with equal angular dispersion values (D). The visual control methods for both variants are the same.

But the automatic control performed by control device is realized by another principle.

Since observation angle of the k -th order diffraction maximum including the first one depends on wavelength λ , the angle of the first order diffraction maximum at constant for given wavelength angular dispersion value (D) of a region 3 for different monochromatic light sources wavelengths ($\lambda_1, \lambda_2, \lambda_3$), which mark 1, and thus region 3, passes sequentially, changes ($\varphi_1, \varphi_2, \varphi_3$).

At the same time as in the variant to each angle of the first order diffraction maximum one can map definite symbol that makes it possible to code the tapes also.

In both variants of paper 2 implementation with identification marks 1 fabrications and imitations on check or control tape detected by visual and automatic control.

All other protective elements inherent in holograms, such as multidimensional images, hidden image, microtext, guilloche elements, etc., can present on a mark.

In addition, by using tapes characteristics and their necessary motion during personalization one can perform automatic instrument control and tapes coding at the expense of a region 3 of mark 1 with definite angle dispersion value.

Fig. 4 (a, b, c, d) illustrates the making a check and/or control tape method of the present invention.

According to the claimed method of check tape, for example, making, identification marks 1 are applied to a paper 2 by any known method, for example by hot stamping method.

After marks 1 application to a paper 2 it is cut along cutting lines 9 (Fig. 4 a, b, c, d) into check and/or control tapes for cash registers or control devices.

The cutting of a paper 2 is done in such a way that identification marks 2 are located either along one edge of check or control tape or along both edges. At the same time size of each edge mark in both cases has to be $\frac{1}{2}$ of identification mark 1.

Obtained by this method check or control tape is passed through cash register or control device for authentication.

Fig. 4 (a, b, c, d) shows different ways of made according to Claims 1-2 identification marks 1 position on paper 2, made according to any variants of the present invention, taking into account marks spacing both in longitudinal and transversal direction.

A marks spacing in longitudinal and transversal direction of one paper can vary (Fig. 4d) that gives the possibility to obtain different product mix of tapes after their cutting that differ by width and coiling length.

A tape of required width is obtained in dependence on specified spacing both in longitudinal and transversal direction.

Moreover, Fig. 4 (a, b, c, d) also illustrates process of a paper 2 cutting along a cutting line 9 into tapes with different location of $\frac{1}{2}$ of identification mark.

Fig 4a illustrates the case when a origin line 8 has zero shift, that is marks in transversal direction are on the same level, but spacing between marks 1 in longitudinal and transversal direction is constant.

Cutting line 9 of a paper 2 in this case are realized in such a way that check or control tape has identification mark along one edge and size of edge mark is $\frac{1}{2}$ of the identification mark 1. The paper cutting by two adjacent marks is also possible. That gives a check or control tape with opposite marks position.

Fig 4b illustrates the case when there is a shift from origin line 8 in transversal direction through a row that is through a row the origin differs by value equal to half of spacing in longitudinal direction. That results in marks 1 position on a paper 2 as on a chessboard.

In thus case cutting lines 9 passed through marks in such a way that allows to obtain tapes with two-side as on a chessboard position of edge marks on check or control tape remaining size of edge marks equal to $\frac{1}{2}$ of the identification mark 1

Fig 4c shows position of marks 1 on paper 2 with increasing mark location shift from origin line 8. This variant of marks application is preferable when marks 1 are transferred to paper 2 from transfer material by hot stamping method while paper roll and transfer material roll with marks are perpendicular.

In this case foil is consumed economically and check and control tapes making costs decrease. Cutting of such a paper can be done irrespective of whether edge marks are positioned in one-side or two-side manner.

Fig 4d shows position of marks 1 on paper 2 with different longitudinal (t_1 , t_3) and transversal (t_2 , t_4) spacing. Here marks shift from origin line 8 is zero, that is marks in transversal direction are positioned on the same level.

In this case check or control tape is cut from paper 2 along cutting lines 9 into rolls of different width that is conditioned by cash register or control device requirements.

It should be also noted, that during paper cutting process each roll, corresponded by one or another parameters of check or control tape, is given a serial number for the purpose of its identification in the case of authentication, which is applied by special device at the beginning and the end of a roll obligatory and along a whole roll when necessary.

The identification mark, variants of paper making, been intended for cutting into check and/or control tapes, methods of making of check and/or control tapes from such a material, claimed in the present invention, are simple to make, low-cost, do not require expensive equipment, and are tested in manufacturing environment.

All protection objects are applicable in industry and have high inventive level.

References:

1. Patent №2102246 RU, IPC: B42D 15/00, G07D 7/00, publication date 20.01.1998;
2. Patent №2288105 RU, IPC: B42D 15/00, B42D 15/10, publication date.27.11, bulletin.№33;
3. Patent №2125938 RU, IPC: B44F 1/12, B42D 15/00, D21H 21/42, D21F 11/00, publication date 10.02.1999;
4. Patent №2133200 RU, IPC: B42D15/00, B44F 1/12, publication date.20.07.1999;
5. Patent №2265524 RU, IPC: B42D15/00, B42D 15/10, publication date.20.06.2004;

Claims

1. An identification mark, placed on a paper and intended for paper counterfeit protection, represented itself at least one multilayer protective element that allows to create at least one visually controllable optical effect by at least one layer with diffraction relief structures, characterized in that the layer with diffraction relief structures has a region, angular dispersion of which for given light wavelength, direction of light source and given order of diffraction maximum has corresponding value, wherein the multilayer protective element is fully placed on the paper, along element transverse axis, and region, done along element transverse axis, is placed along the full length and oriented in dependence on light source direction.

2. An identification mark according to Claim 1 characterized in that the first order of diffraction maximum is considered as a rule.

3. A paper, defended from counterfeit with at least one identification mark, made according to Claims 1-2 and placed on the paper front, characterized in that when placing of n identification marks on the paper in longitudinal and transverse directions with specified spacing and origin, region angular dispersion of every subsequent mark in longitudinal direction differs from region angular dispersion of every previous mark of the same direction on specified value, wherein distinctiveness repetition is periodical.

4. A paper according to Claim 3, characterized in that literal and digital symbol can correspond to each angular dispersion value at constant wavelength.

5. A paper, defended from counterfeit with at least one identification mark, made according to Claims 1-2 and placed on the paper front, characterized in that when placing of n identification marks on the paper in longitudinal and transverse directions with specified spacing and origin, region angular dispersion of every mark in longitudinal direction has constant value.

6. A paper according to Claim 3 or Claim 5, characterized in that the edge identification marks, placed at least along one paper edge in longitudinal direction, form $\frac{1}{2}$ part of the identification mark.

7. A paper according to Claim 5, characterized in that literal and digital symbol can correspond to each region angular dispersion value for different wavelength.

8. A method of check or control tape obtainment from the paper, realized in according to Claims 3-7, including placing of identification marks on the paper surface by any known methods and paper cutting, characterized in that identification marks are made in accordance with Claims 1-2, wherein after marks placing the paper is cut into rolls in accordance with check or control tapes characteristics in such a way that identification marks are located along at least

one edge of check or control tape in longitudinal direction, meanwhile the size of edge mark along longitudinal check or control tape axis is $\frac{1}{2}$ part of identification mark

9. A method according to Claim 8, characterized in that during paper cutting into rolls every roll is given an individual serial number, placed at the beginning and the end of the roll and possibly duplicated along full area of the roll.

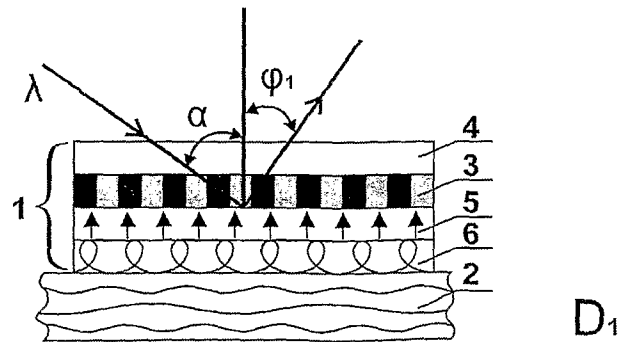
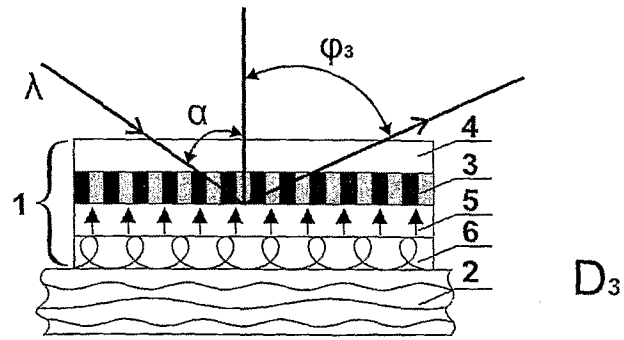
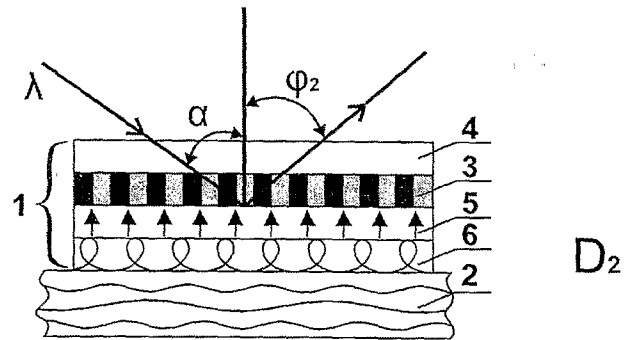
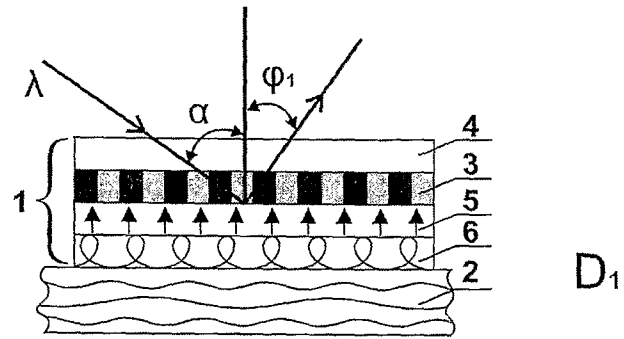
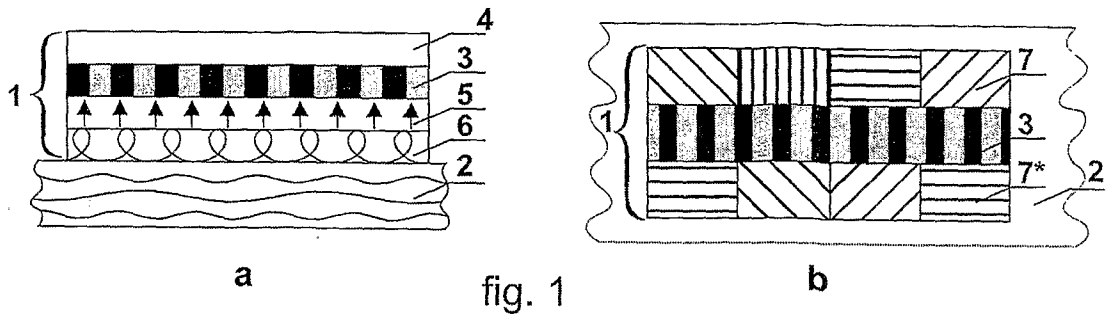
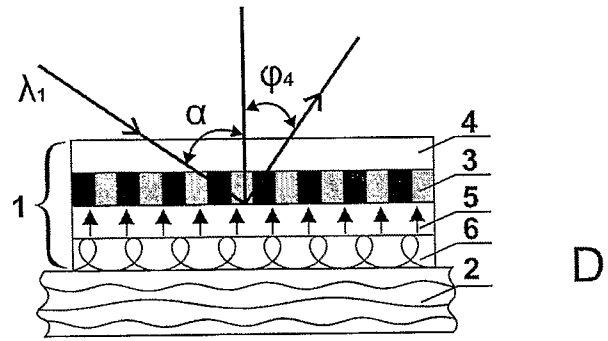
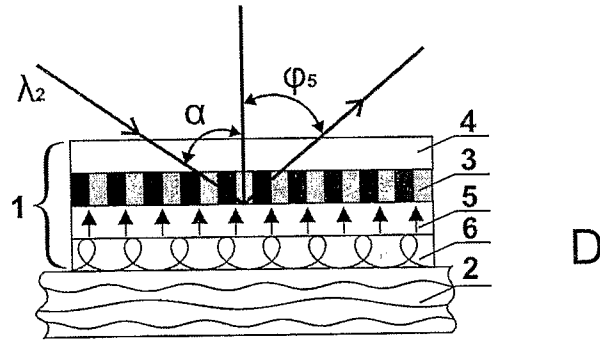


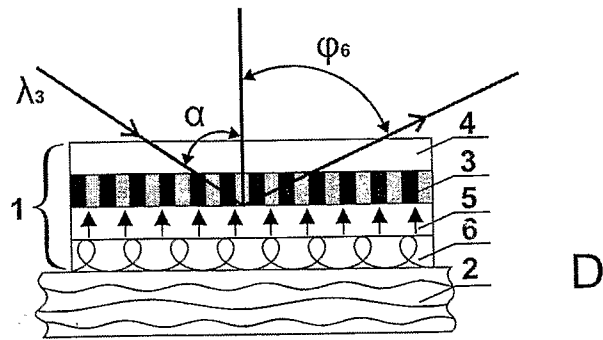
fig. 2



D



D



D

fig. 3

3/3

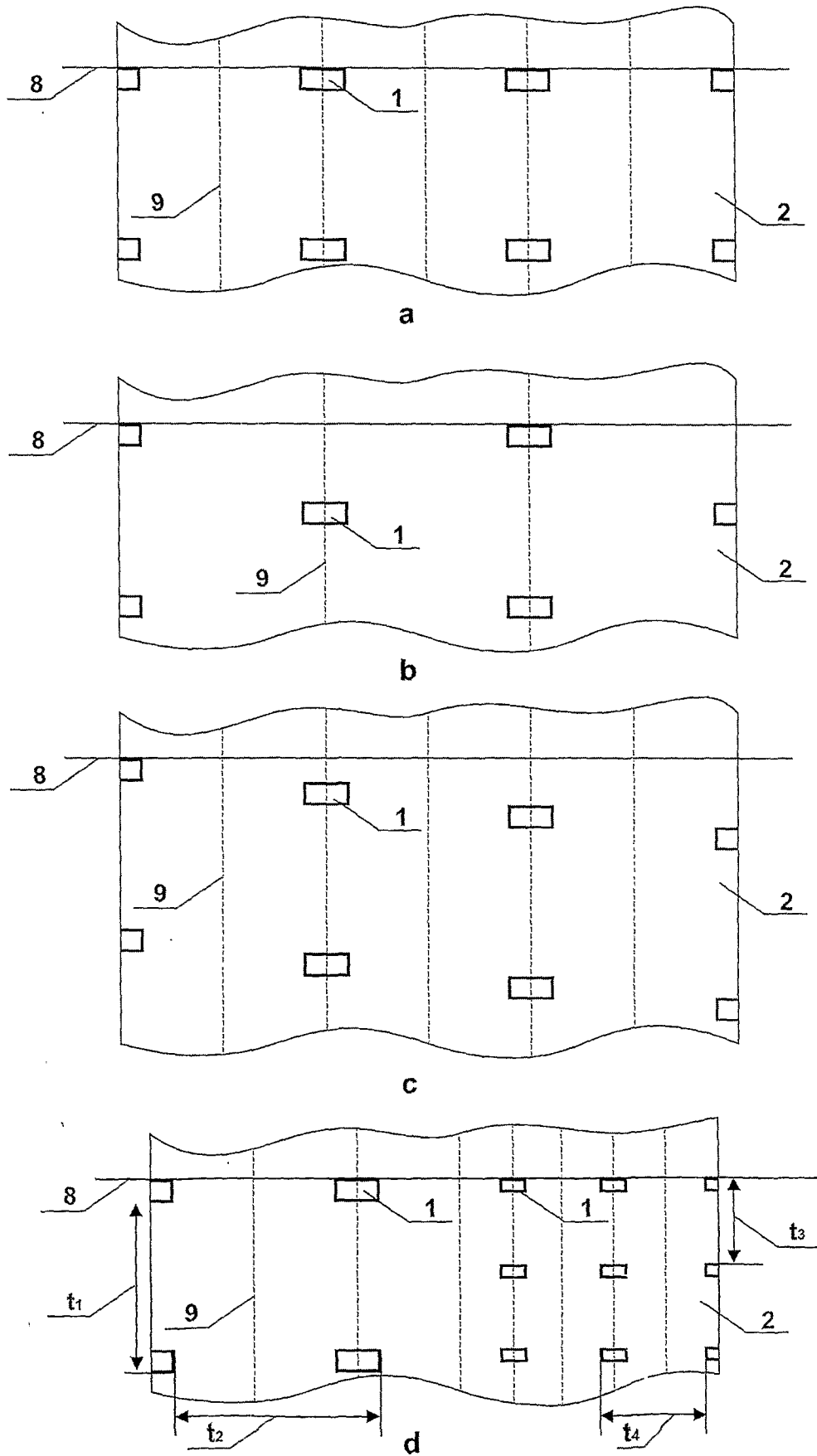


fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/BY2010/000008

A. CLASSIFICATION OF SUBJECT MATTER
INV. G07D7/12 G07D7/00

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)
G07D

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 practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/128590 A1 (SCHILLING ANDREAS [CH] ET AL SCHILLING ANDREAS [CH] ET AL) 16 June 2005 (2005-06-16) paragraphs [0018] - [0033] paragraphs [0036], [0038], [0044], [0045] figures 1-3,6,7	1-9
X	US 4 034 211 A (HORST WILLIAM R ET AL) 5 July 1977 (1977-07-05) column 3, line 57 - column 7, line 40 figures 1-4	1-9
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Further documents are listed in the continuation of Box C.

See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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