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(54) METHOD AND DEVICE FOR PRODUCING FRAUD-PROOF PAPER AND FRAUD-PROOF PAPER

(57) The invention relates to fraud-proof paper and to a method and device for the production thereof. The inventive method consists in forming a first paper web provided with a protective band whose width is equal to or less than 2 mm and which is incorporated into the web during the formation thereof with the aid of a cylinder mould machine in such a way that free-access areas (windows) are formed on protruded elements of the face side of the web. Said protective band is incorporated into the first paper web during the formation thereof and after formation of the free access areas which is associated with the formation of a fibre layer representing 35-50 % of the mass of the first paper web. A second paper web devoid of the protective band is produced simultaneously with the first web and afterwards is applied to the back side thereof in such a way that when they are connected to each other the defects of the said back side are hidden. Afterwards, the thus obtained two-layer material is pressed and dried. The protruded elements are embodied in the form of waterproof elements. An additional protective element is incorporated into the first and/or the second paper web during the production thereof. For the purpose of said invention, a protective band having a width ranging from 2 to 20 mm and comprising additional protective elements is used.

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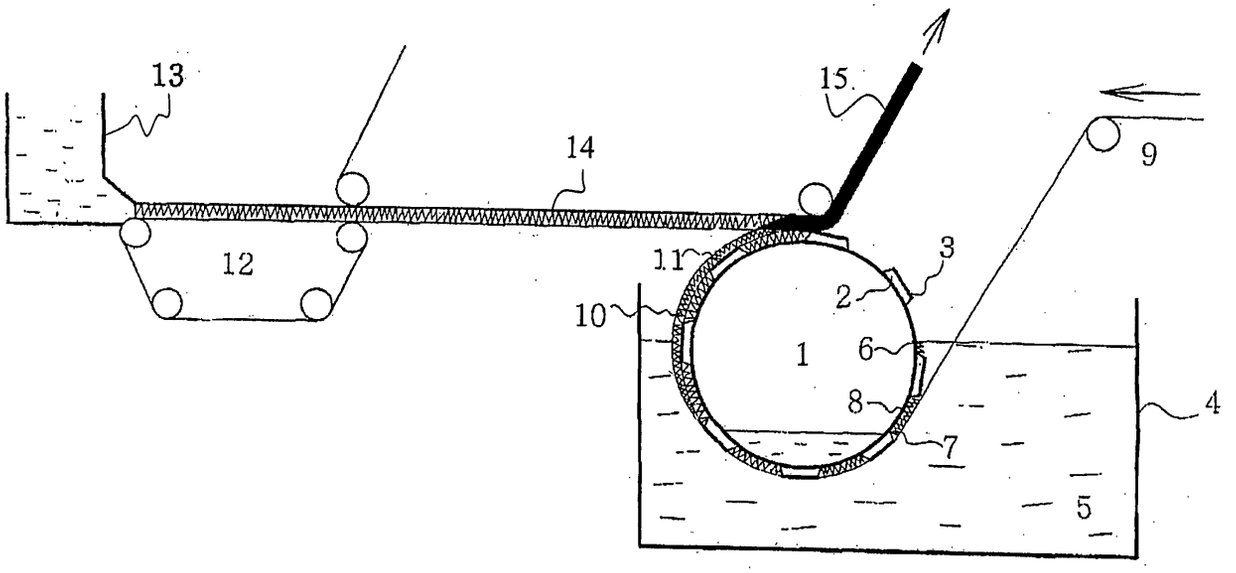

Fig. 1

Description

Field of the Invention

[0001] The instant invention relates to a device and method for producing paper protected against counterfeiting and to paper produced by this method.

Background Art

[0002] Different elements, for example, strips or threads, are introduced for protection into paper protected against counterfeiting and intended for the production of banknotes, documents and other similar usage.

[0003] A method and paper-making machine are known for the production of paper protected against counterfeiting, in accordance with which a protective strip is fed onto a cylinder mould outside a fibrous mass in such a manner that it is placed on raised portions on the cylinder (projecting elements). In the places where the strip (thread) is placed on the projecting elements prior to immersion into the mass, a paper layer is not formed on the side facing the cylinder, so that the thread turns out to be freely accessible to the surface exactly in these places (see EP 0 059 056 A1, 1 September 1982).

[0004] However, this method does not make it possible to form paper with wide threads without defects in the reverse side of the paper sheet, the side which is not in contact with the cylinder, since one cylinder is used in this method.

[0005] The analog most similar to the invention being described is a method and device for producing paper protected against counterfeiting, in which a first paper sheet is formed with a protective strip having a width of more than 2 mm, which is embedded into this sheet during its formation on a cylinder mould with the formation of zones of free access on the face side of the sheet on projecting elements, a second paper sheet which does not contain a protective strip and which after completion of the formation of the first paper sheet is applied onto the rear side of the first paper sheet is formed parallel with the formation of the first paper sheet with a protective strip and the sheets are connected to close defects on the rear side of the first paper sheet, with subsequent pressing and drying (see RU, 2125938 C1, 10 February 1999).

[0006] In accordance with this known device and method, the protective strip is embedded into the first paper sheet during its formation on the cylinder in the following manner: the protective strip is fed onto projecting elements of the cylinder outside a fibrous mass. The formation of a paper layer around the protective strip takes place during the passage of the cylinder through a bath with a paper mass, and zones of free access (windows) are formed in the zones where the strip is in contact with the projecting elements. With a 2 - 4 mm width of the protective strip, defects occur on the reverse side of the first paper sheet during the formation of the first layer of paper, which defects are closed by the second paper sheet formed on another device.

[0007] Elements having the form of a rectangle are used as the projecting elements. These elements are obtained by stamping the grid of a cylinder along its circumference in a predetermined zone of embedding the protective strip and the surface of the cylinder has the form of railroad ties.

[0008] This technical solution has limited possibilities in respect to protecting paper against counterfeiting, in particular:

1. It does not make it possible to embed a protective strip with a width of more than 4 mm into the first paper sheet, since there is not time for the fiber of the paper mass to penetrate into the narrow slit between the protective strip and the surface of the cylinder in the zones between the projecting elements,
2. It does not make it possible to form zones for free access (windows) at large distances from each other, since when there is a large distance between the projecting elements, the protective strip is in contact with the surface of the cylinder and this does not make it possible to form a paper layer between the windows,
3. It does not make it possible to form a sheet with windows that have a complex geometrical shape, which results in a reduction of the protectiveness of the paper against counterfeiting.

Summary of the Invention

[0009] The object of the claimed invention is to create a method and device for producing paper, which would provide the possibility of enhancing the degree of protectiveness of the paper against counterfeiting and of improving its quality as a result of using a protective strip of any width (up to 20 mm), and also producing paper with windows having a regular or irregular geometrical shape, wherein windows with a sequential combination of different figures may be used, the width of the windows may be equal to the width of the protective strip, or also be narrower or wider and the distances between the windows may be selected to be any independent of the diameter of the cylinder.

[0010] The aforesaid object in accordance with one aspect of the invention is achieved in that in a method for producing paper protected against counterfeiting, a first paper sheet with a protective strip having a width of more than 2 mm is formed. The strip is embedded into this sheet during its formation on a cylinder mould with the formation of zones of free access on the face side of the sheet on projecting elements, a second paper sheet being formed in parallel with the formation of the first paper sheet with a protective strip, the second paper sheet not containing a protective strip and after completion of the formation of the first paper sheet is placed on

the rear side of the first paper sheet, and they are connected to close the defects on the rear side of the first paper sheet, subsequently pressed and dried, in which in accordance with the invention, the protective strip is embedded into the first paper sheet during its formation after the formation of zones of free access with the simultaneous creation of a fibrous layer with a mass comprising 35-50% of the mass of the first paper sheet.

[0011] Water-impermeable elements may be used as the projecting elements.

[0012] An additional protective element, such as watermarks, protective fibers, chads or combinations thereof, etc. is introduced into the first paper sheet comprising the protective strip.

[0013] During the process of forming the second paper sheet, which does not contain a protective strip, an additional protective element, such as watermarks, protective fibers, chads or combinations thereof, etc. may also be introduced into that sheet.

[0014] In the method in accordance with the invention, the protective element, introduced into the first paper sheet, obtained, for example, by the method of stamping a forming grid or filigree, may form with the zones of free access a single figure (visual figure), visible when the paper is looked at in transmitted light. This figure may also be text, a combination of letters or something similar.

[0015] In the method in accordance with the invention, an additional protective element, such as watermarks, protective fibers, chads or combinations thereof, etc., is introduced into both the first paper sheet comprising a protective strip and into the second paper sheet, which does not comprise a protective strip, in the process of their formation.

[0016] A protective strip with a width of 2 - 20 mm is used.

[0017] Furthermore, a protective strip is used that is provided with an additional protective feature, for example, printed and/or metallized and/or demetallized symbols and/or optically changing effects, diffraction pictures, holograms, interference effects and/or magnetic codes and/or fluorescent substances, etc.

[0018] The second subject matter of the instant invention is paper protected against counterfeiting and made by the method described above.

[0019] Paper protected against counterfeiting, in accordance with the invention, consists of a first paper sheet with a protective strip having a width of 2 - 20 mm, a fibrous layer positioned on the face side and having zones for free access (windows), which have a regular geometrical form such as a rectangle or square or rhombus or triangle or circle or ellipse or star or an irregular geometrical form, or combinations thereof.

[0020] The protective strip in the first paper sheet is provided with an additional protective feature, for example, with printed and/or metallized and/or demetallized symbols and/or optically changing effects, diffraction images, holograms, interference effects and/or magnetic codes and/or fluorescent substances.

[0021] The paper consists of two paper layers in which the first paper sheet containing a protective strip also comprises an additional protective element, such as watermarks, protective fibers, chads and combinations thereof, while the second paper sheet, not containing a protective strip, comprises an additional protective element, such as watermarks, protective fibers, chads or combinations thereof.

[0022] The paper according to the invention may also consist of two paper layers, wherein the first paper sheet comprises a protective strip, while the second paper sheet does not comprise a protective strip, which include therein an additional protective element — watermarks, protective fiber, chads or combinations thereof.

[0023] The paper acquires additional protective properties during the formation of zones of free access to a thread by using a light watermark obtained by the method of stamping a forming grid or filigree, which have a length greater than the width of the protective strip.

[0024] In this case the zones of free access on the strip, visible in reflected light, and elements of the watermark, which are visible in transmitted light, form a single image (visual image).

[0025] The stated object is also achieved in that in a device for producing paper, used to carry out the method in accordance with the invention and comprising: a cylindrical paper-making machine to form a first sheet, comprising a cylinder mould, which has a grid with elements projecting relative to the general surface of the cylinder and a bath for accommodation of the paper mass; and a device for forming a second sheet, also comprising a forming grid, in accordance with the invention the surface of the aforesaid elements has water-impermeable regions. The device for forming the second sheet may be either a cylindrical or a planar device for forming a paper sheet. Wherein the aforesaid projecting elements have a regular or irregular geometrical form or combinations thereof.

[0026] The inventors of the instant invention have established that the formation of a fibrous layer takes place over the whole area of the cylinder except for the water-impermeable regions, which provides the possibility to form a fibrous layer with the simultaneous formation of shaped zones of free access (windows) from a lengthy fibrous mass, after which embedment of the protective strip takes place with the subsequent formation of the reverse side of the first paper sheet in order to provide the possibility to increase the protectiveness and enhance the design of the paper.

Brief Description of the Drawings

[0027] In order to facilitate understanding of the invention, drawings are presented, wherein:

Fig. 1 is a diagram of the device for carrying out the claimed method;

Fig. 2 is a view of the paper in transmitted light in accordance with one variant of carrying out the invention.

Best Method of Carrying Out the Invention

[0028] An example of a device for producing paper is shown in Fig. 1, the device comprising a cylinder mould 1 having projecting elements 2 formed by stamping a grid, like convex elements above the general surface of the cylinder. However, these elements may be formed with the aid of filigree, and also by stamping a grid with the formation of convex zones as compared with the general surface of the cylinder. Elements 2, on the surface of which water-impermeable regions 3 are made, are shown in the drawing. These regions may have a regular geometrical form, such as a rectangle, square, rhombus, triangle, circle, ellipse or star, and also an irregular geometrical form or a combination thereof. There is a paper mass 5 in a bath 4. The device for formation of a second paper sheet 14, schematically shown in Fig. 1, in this example is a flat-grid forming device, comprising a forming grid 12 and a device 13 for filling in the paper mass.

[0029] The method in accordance with the invention comprises the following steps. The water-impermeable regions are loaded into the bath 4 with the paper mass 5. In the section from level 6 of the surface of the paper mass in the bath to level 7 of the paper mass inside the forming cylinder, a paper layer is formed on the grid of the cylinder with a mass that is 35 - 50% of the mass of the first layer with the simultaneous formation of zones of free access (windows) of a corresponding geometric form. After completion of the formation of the layer with windows 8, a protective strip 9 is fed onto the grid cylinder at level 7 of the paper mass, after which the formation of the paper layer on the reverse side of a first paper sheet 10 is continued to the level 6. As a result a paper sheet with windows 11 for free access to the protective strip 9 is obtained. Simultaneously a second paper sheet 14 is formed on another device, the second sheet being firmly connected by known methods to the first paper sheet 10 in order to close the defects formed on the reverse side of the first sheet. Further an obtained multilayer sheet 15 is pressed and dried on the paper-making machine. A strip having a width of 2 - 20 mm, provided with an additional protective feature, such as printed and/or metallized and/or demetallized symbols and/or optically changing effects, diffraction images, holograms, interference effects and/or magnetic codes and/or fluorescent substances, etc., is used as the protective strip.

[0030] In order to form watermarks, a stamped grid of the cylinder 1 and a forming grid 12 are used, while protective fibers and/or chads are added to the paper mass before forming the first and/or second paper layer.

[0031] Fig. 2 shows a view of the paper in transmitted light, wherein the zone of free access forms with the watermark a single visual image.

[0032] The proposed method for producing paper and the device for carrying out the method make it possible to attain the following advantages:

1. The possibility of using a protective strip of any width from 2 to 20 mm to enhance the protectiveness of paper against counterfeiting.
2. The use of windows having a regular or irregular geometrical form, a combination of windows of different form, a different distance between windows in order to enhance the protectiveness and design of the paper and articles prepared therefrom.
3. Enhancement of the protective properties of paper by superposing the zones of free access to the protective strip, which are visible in reflected light, and the protective elements of the paper sheet, for example, in the form of a watermark visible in transmitted light.
4. The use of a more lengthy fibrous mass, this making it possible to also produce paper with higher physicomechanical strength indexes.

Industrial Applicability

[0033] The proposed method and device for producing paper protected against counterfeiting make it possible to produce paper with higher physicomechanical strength indexes by using a more lengthy fibrous mass, since in the proposed method the direct deposition of fibers onto the surface of the cylinder takes place, including the zones located between the windows.

[0034] The method and device for producing paper protected against counterfeiting in accordance with the invention and paper produced by this method may find use in the production of different kinds of paper, such as banknote, document, check, passport, excise, et alias, protected against counterfeiting with a protective strip.

Claims

1. A method for producing paper protected against counterfeiting, in which a first paper sheet with a protective strip having a width of more than 2 mm is formed, the strip is embedded into this sheet during its formation on a cylinder mould with the formation of zones of free access on the face side of the sheet on projecting elements, a second paper sheet is formed in parallel with the formation of the first paper sheet with a protective strip, and after completion of the formation of the first paper sheet the second paper sheet, not containing a protective strip, is placed on the rear side of the first paper sheet, and they are connected to close the defects on the rear side of the first paper sheet, subsequently pressed and dried, **characterized in that** the protective strip is embedded into the first paper sheet

during its formation after the formation of zones of free access with the simultaneous creation of a fibrous layer with a mass comprising 35 - 50% of the mass of the first paper sheet.

2. The method according to claim 1, **characterized in that** water-impermeable elements are used as the projecting elements.

3. The method according to claim 1, **characterized in that** an additional protective element, such as watermarks, protective fibers, chads or combinations thereof, etc. is introduced into the first paper sheet comprising the protective strip in the process of its formation.

4. The method according to claim 3, **characterized in that** the zones of free access to the protective strip, which are seen in reflected light, and the protective elements of the paper sheet in the form of a watermark form a single image (visual image).

5. The method according to claim 1, **characterized in that** during the process of forming the second paper sheet, which does not contain a protective strip, an additional protective element, such as watermarks, protective fibers, chads or combinations thereof is introduced into that sheet.

6. The method according to claim 1, **characterized in that** an additional protective element, such as watermarks, protective fibers, chads or combinations thereof, is introduced into the first paper sheet comprising a protective strip and into the second paper sheet, which does not comprise a protective strip, in the process of their formation.

7. The method according to claim 1, **characterized in that** a protective strip having a width of 2 - 20 mm is used.

8. The method according to claim 1, **characterized in that** a protective strip that is provided with an additional protective element such as printed and/or metallized and/or demetallized symbols and/or optically changing effects, diffraction pictures, holograms, interference effects and/or magnetic codes and/or fluorescent substances, is used.

9. Paper protected against counterfeiting, **characterized in that** it is produced by the method according to any one of claims 1 - 8.

10. A device for producing paper for implementation of the method according to claims 1 - 8, comprising:

a) a cylindrical paper-making machine to form a first sheet comprising:

- a cylinder mould (1) having a grid with elements (2) projecting from the general surface of the cylinder;
- a bath (4) for accommodating a paper mass (5); and

b) a device for formation of a second sheet, comprising a forming grid (12) and a device (13) for filling in the paper mass,

characterized in that the surface of said elements (2) has water-impermeable regions (3).

11. The device according to claim 10, **characterized in that** said projecting elements (2) have a regular or irregular geometrical form or combinations thereof.

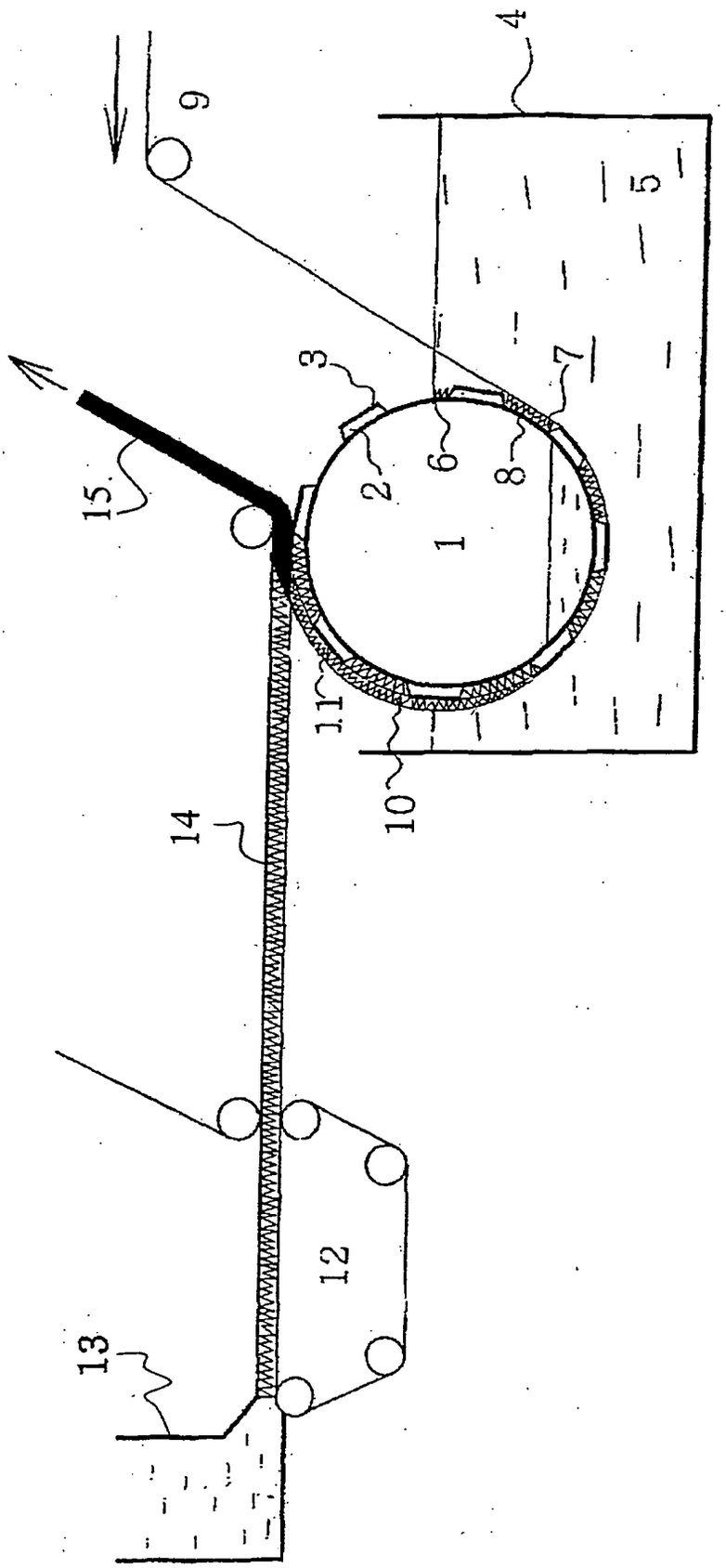

Fig. 1

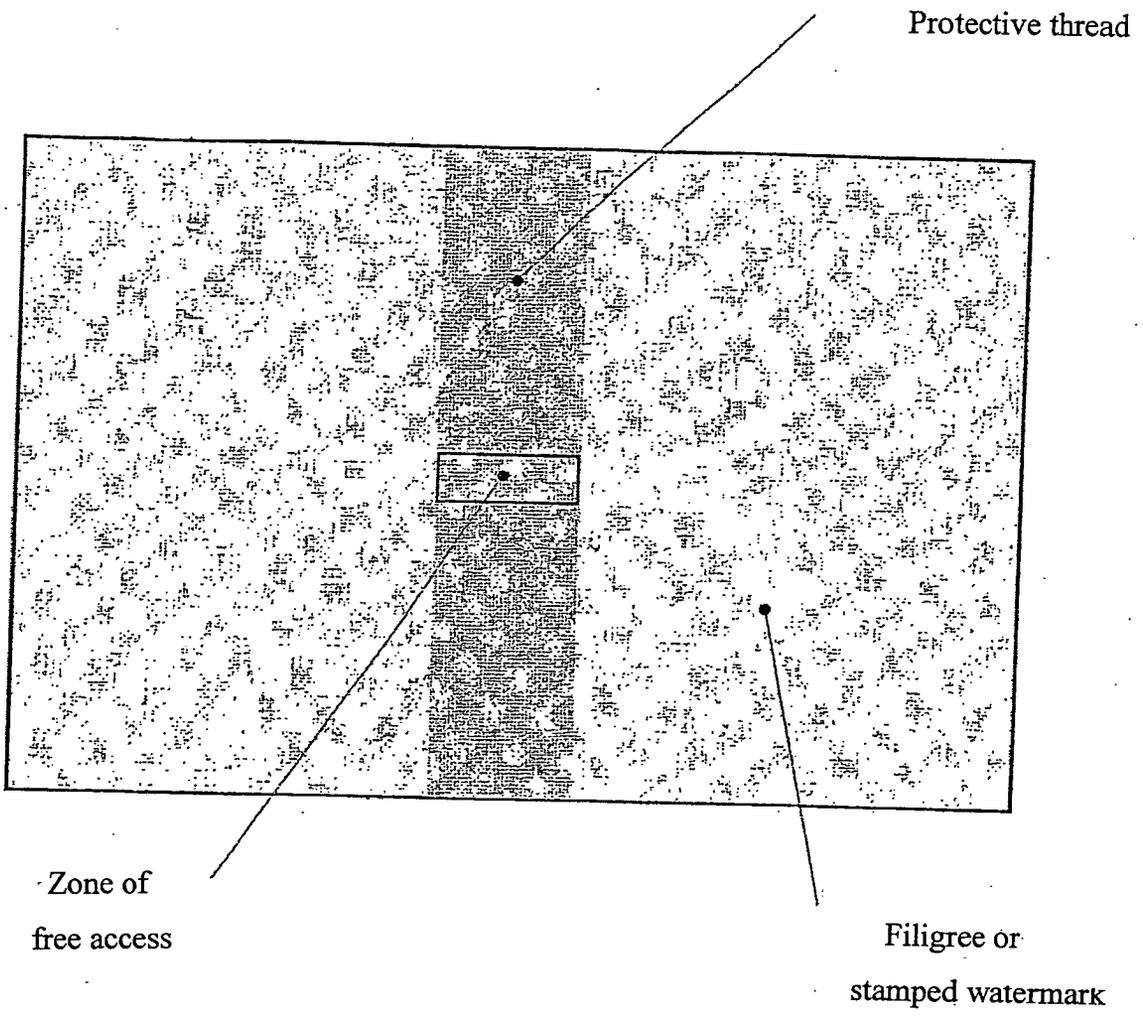
Protective thread
Zone of
free access
Filigree or
stamped watermark

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 03/00367

A. CLASSIFICATION OF SUBJECT MATTER

D21F 11/00, D21H 21/40,21/42, B42D 15/10

According to International Patent Classification (IPC) or to both national classification and IPC МПК-7:

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols) МПК-7:

D21F 11/00, D21H 21/40-21/44, B42D 15/00,15/10, B41M 3/10,3/14, B44F 1/12

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 2125938 C1 (GIZEKE UND DEVRINT GMBKH) 10.02.1999	1-11
A	RU 2135667 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVEN-NOSTYU "MK-TS" ("MEZHDUNARODNAYA KNIGA A-TSENNIE BUMAGI") 27.08.1999	1-11
A	EP 0059056 A1 (PORTALS LIMITED) 01.09.1982	1-11
A	RU 2170788 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVEN-NOSTYU "MK-TS" ("MEZHDUNARODNAYA KNIGA-TSENNIE BUMAGI") 20.07.2001	1-11

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

* Special categories of cited documents:

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

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 September 2003 (29.09.2003)	**13 November 2003 (13.11.2003)**
Name and mailing address of the ISA/ **RU**	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 03/00367

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Unity of invention exists only when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding "special technical features". The expression "special technical features" is defined in PCT Rule 13.2 as meaning those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art. In the present claims, unity of invention is lacking between the "device" (claim 10) and the "method" and "paper" (claims 1 and 9) since claim 10 does not have a "special technical feature" which is the same as or corresponds to the "special technical feature" of claims 1, 9. The special technical feature for claims 1 and 9 is "incorporating a protective strip into a first paper web during the formation thereof and after creating free access areas simultaneously with the formation of a fibre layer with a mass of 35-50 % that of the first paper web". The special technical feature of claim 10 is the presence of impermeable portions on the protruding elements.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)