



(86) Date de dépôt PCT/PCT Filing Date: 2002/05/15
 (87) Date publication PCT/PCT Publication Date: 2002/11/28
 (45) Date de délivrance/Issue Date: 2010/02/02
 (85) Entrée phase nationale/National Entry: 2003/11/06
 (86) N° demande PCT/PCT Application No.: EP 2002/005360
 (87) N° publication PCT/PCT Publication No.: 2002/094577
 (30) Priorité/Priority: 2001/05/18 (DE101 24 630.7)

(51) Cl.Int./Int.Cl. *B42D 15/00* (2006.01)
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(54) Titre : PAPIER DE VALEUR ET SON PROCEDE DE PRODUCTION
 (54) Title: PAPER OF VALUE AND METHOD FOR PRODUCING IT

(57) **Abrégé/Abstract:**

The invention relates to a paper of value, in particular a bank note, and to a method for producing it. The paper of value has a security element and a protective layer with a matt surface which is omitted in the area of the security element. The omitted area may be provided with a protective lacquer layer formed of gloss lacquer.

Abstract

The invention relates to a paper of value, in particular a bank note, and to a method for producing it. The paper of value has a security element and a protective layer with a matt surface which is omitted in the area of the security element. The omitted area may be provided with a protective lacquer layer formed of gloss lacquer.

Paper of value and method for producing it

This invention relates to security papers and papers of value, in particular bank notes, having a security element and provided with a dirt-repellent protective layer, and to a method for producing said papers of value.

Security prints, such as bank notes as well as shares, bonds, documents and
5 vouchers, checks, high-quality admission tickets, identification documents and
passports, are provided with elaborate printed images to increase their forgery-
proofness, using sophisticated and limitedly accessible printing processes, such as
intaglio, at least for individual parts of the images. Papers of value are additionally
equipped with so-called security elements that are difficult to imitate and permit even
10 laymen to check the authenticity of the paper of value. Such security elements may be
for example window security threads visible in certain areas on the surface of the
paper of value, applied foils having a transparent or metalized embossed hologram,
blind embossings, so-called "latent images" produced by printing technology or by
printing and embossing technology and rendering different information at different
15 viewing angles, prints containing optically variable pigments and appearing in
varying colors at different viewing angles, or prints of metallic effect inks having
metallic luster in a gold, silver, or bronze tone for example. The security elements
may be already incorporated in or applied to the starting material, for example paper,
of the paper of value, or produced between or after further processing steps of the
20 paper of value, depending on the embodiment.

It is known to provide papers of value with dirt-repellent protective layers to extend their life and fitness for circulation. EP 0 256 170 B2 proposes for example providing printed bills with a protective layer containing cellulose ester and micronized wax and applied to the bills all over.

Common protective lacquer layers frequently have the disadvantage that their surface is very smooth and glossy, which causes problems both in the production and processing of the papers of value and in the machine checking of the papers of value by means of optical sensors. Furthermore, conventional protective lacquer layers
5 frequently have an adverse effect on the visual appearance of security elements.

The problem of the invention is to propose a long-lived paper of value and method for producing it that permit troublefree processing of the papers of value and their checking by means of optical sensors while simultaneously guaranteeing that the security elements are readily perceptible visually.

10 This problem is solved according to the invention by the features of the independent claims. A still unprinted or already printed paper of value is equipped on at least one side with a protective layer formed by a matt lacquer or a thin plastic foil with a matt surface, said protective layer being interrupted, i.e. omitted, in the area of a security element. Since the predominant portion of the surface is covered with a
15 protective layer, the paper of value is protected by the dirt-repellant properties of the lacquer layer or foil, while forming the protective layer surface of matt lacquer or as a matted foil permits reliable handling and processing of the papers of value due to the microroughness. It is also possible to apply a matt lacquer to the side of a thin plastic cover foil ending up on the outside and to laminate said foil to the paper of value.

20 While papers of value with smooth protective lacquering or foils tend to slip easily when being deposited, stacked and grasped, matt protective layers have the advantage of a better grip and are therefore easier and safer to handle. Furthermore, protective lacquering with matt lacquer has the advantage of retaining the users' accustomed perception of the papers of value by the sense of touch, while very
25 smooth coatings have an adverse effect not only on the haptic impression but also on the accustomed optical impression of a paper of value due to the glossy or even "greasy" appearance. A matt protective layer furthermore causes much less reflection

than usual glossy protective layers, thereby permitting troublefree machine checking of the papers of value with the optical sensors customarily used.

In the area of a security element, however, the matt protective layer is interrupted. This avoids negative and dimming properties that a matt-lacquer or foil coating can have on the visual perception of a security element. Many security elements, such as metalized embossed holograms which are applied to a paper of value as an applied foil, or pigments of crosslinked liquid crystals embedded in resistant polymer layers, already have a protective and dirt-repellent surface to begin with. An additional matt protective layer would weaken their visual effect and reduce their brilliance without substantially improving the protection of such security elements.

If the attention of the user of a paper of value is to be directed specifically to a security element, however, it is advantageous to apply a protective layer consisting of gloss lacquer to the partial area of the paper-of-value surface where the security element is located and where the matt protective layer has been omitted. Security elements that are not glossy to begin with, or whose gloss is to be strengthened, can be thereby enhanced optically and emphasized visually. This also makes it easier for the unpracticed user to find the security elements in the paper of value. A surface is usually perceived as glossy when it has structural inhomogeneities whose dimensions are in the range of the light wavelength or less. In particular in cases where the security element does not already have a protective outer layer, as usually with applied foils, the life of the security element is also extended by the gloss lacquer layer applied thereover. This holds in particular for metallic effect ink prints, but also for blind embossings and so-called "latent images" executed by printing technology, which are subject to strong soiling and abrasion without a protective lacquer cover. The strikingness and visual effect of the partial area of the protective lacquer layer executed with gloss lacquer can be further increased by adding optically variable pigments to the gloss lacquer. These are largely transparent pigments that produce a

striking interplay of colors varying with the viewing angle. Some examples are pearlescent pigments, thin film pigments such as so-called "Iriodin®", or crosslinked liquid crystal polymers.

Improved checkability of the papers of value is also obtained by mixing so-called feature substances into the gloss lacquer provided for partial lacquering. These are substances that are uniquely checkable and detectable due to special physical properties like magnetism, wavelength-selective absorption, luminescence or electric conductivity. Particularly preferred feature substances are ones that can also be checked by the paper-of-value user without any great equipment expense but nevertheless not be forged or only with enormous effort. Some examples are special fluorescent or phosphorescent substances that can be excited only within narrow wave ranges for example.

The inventive paper of value is preferably made of paper, for instance so-called "security paper" as is usual in bank-note printing and has a special feel and sound. The paper of value can be printed with any desired signs, including any symbols, printed images and patterns. The present invention can be applied especially advantageously to paper substrates that have been printed by intaglio. For high-quality prints this printing process requires substrates with sufficient surface roughness to guarantee reliable and clean ink transfer from the printing plate to the substrate to be printed. The high pressure with which the substrate is pressed against the printing plate causes the paper surface to be greatly compacted and smoothed in the unengraved, i.e. non-ink-carrying, areas of the printing plate. This can give rise even on uncoated paper substrates to an undesirable gloss, which can be reduced by a subsequently applied matt lacquer protective layer. The invention is not limited to paper substrates, however, but can fundamentally also be transferred to plastic and composite materials, which are now being increasingly used in security printing. Composite materials are for example multilayer substrates having layers of plastic

and paper. A further variant consists of mat-like layers containing both cellulose or cotton fibers and plastic fibers.

The protective function of the protective lacquer layer or foil relates in particular to its ability to repel dirt and increase moisture and abrasion resistance. The protective layer is expediently applied on both sides, i.e. the front and back, of the paper of value. For matt execution of the protective layer, a matt lacquer of the type 57 0600/50 MHM can be used for example. If partial areas of the paper-of-value surface are to be provided with a glossy protective lacquer layer, a suitable gloss lacquer for this purpose is a lacquer of the type 57 0199/50 MHM for example. It is preferable to use transparent and colorless lacquers, which do not change the color of the paper of value, for the protective lacquer layer, regardless of whether it is executed only as matt lacquer or also as gloss lacquer.

Soiling tests have shown that good results are achieved by applying a quantity of about 2 to 15 grams per square meter of liquid, as yet uncured lacquer to produce the protective lacquer layer. The lacquer layer is preferably applied by flexography and screen printing. Flexography is an especially fast and economically working printing process that permits the transfer of sufficient quantities of lacquer. Use of a chamber doctor blade guarantees a reliable and troublefree production process. In flexography, about 2 to 8 grams of liquid lacquer per square meter of substrate surface is preferably transferred. Screen printing is preferably used for applying especially large quantities of lacquer in the range of about 5 to 15 grams per square meter.

Lacquering of the papers of value is done especially economically if it is performed not on the individual paper of value but on a paper-of-value sheet including a relatively large number of for example 24 to 60 individual papers of value. The protective lacquer can fundamentally also be applied to a continuous substrate web that is wound off a roll. Laminating a protective foil is usually likewise

done in a continuous process by which the paper of value and protective foil are taken off a roll. If the security elements are spaced-apart individual elements, the foil can contain the omitted areas as likewise spaced-apart holes. During lamination, the areas of the security elements are brought together in exact register with the holes. If the
5 security elements are strip- or band-shaped, they extend over the total paper of value and thus along the total substrate web. In this case, the protective foil can be laminated on in sheetlike strips having no holes. Two adjacent foil strips are laminated on at a distance apart so that the area for the security element is left out.

For the protective lacquer one preferably uses aqueous dispersion lacquers,
10 which are not only relatively inexpensive but also uncritical from the point of view of industrial safety and environmental protection and can be handled and processed with little effort. Dispersion lacquers are particularly suitable for producing matt surfaces.

However, radiation-curing lacquer systems, which crosslink under the influence of ultraviolet (UV) radiation for example, are preferably used if large dry layer
15 thicknesses are desired. Radiation-curing lacquers are also advantageous if especially high gloss is to be achieved. In an especially preferred embodiment, the main portion of the paper-of-value surface is covered with an aqueous dispersion lacquer to produce a matt surface, while the partial area omitted in this lacquering, where a security element is located, is provided with a gloss lacquer that is radiation-curing.

20 The successive lacquerings of the surface portions with matt or gloss lacquer are preferably effected in exact register, the partial area omitted in the matt lacquering being printed exactly with gloss lacquer. If exactly registered execution is impossible for reasons of production engineering, the execution is overlapping, whereby the permitted overlap zone is preferably no greater than about 2 millimeters.

25 The matt and glossy areas of the protective layer are clearly distinguishable visually in the inventive paper of value due to their different gloss. What is crucial is not the absolute gloss value of the particular area, however, but the relative difference

between them. For checking by measurement technology, the surface to be measured can be illuminated at a defined angle and the reflected light measured photoelectrically. If measurement is done for example using a reflectometer at an angle of 60° according to DIN 67530, or ISO 2813, ASTM D523 and BS 3900 Part 5 D5, the measured gloss units are preferably between about 5 and 10 gloss units for matt areas and preferably between about 15 and 35 gloss units for glossy areas. The difference between matt and glossy areas is preferably more than 10 gloss units to permit them to be well distinguished visually.

The inventive papers of value are furthermore testable without trouble by means of optical sensors in machine testing, since a clearly predominant portion of the paper-of-value surface is covered with a matt lacquer or matt protective foil and thus reflectionless. Since the omitted partial area of the paper of value optionally covered with gloss lacquer constitutes only a small fraction of its total surface, optical sensors can be aligned without problems in machine paper-of-value testing so that their detection area does not include the partial area omitted in the matt lacquering or from the matt protective foil.

According to a preferred example of the invention, a document has a print of metallic effect ink as a security element, as mentioned above. The surroundings of said security element are lacquered with a water-base flexographic or screen printing lacquer as matt lacquer, and an oleographic lacquer applied to the security element as gloss lacquer. This avoids chemical decomposition of the metallic component of the metallic effect ink and a resulting clouding of the metallic luster. In this variant it is also possible to apply the oleographic lacquer to the security element and then apply the water-base matt lacquer all over, that is, also over the security element. The previously applied oleographic lacquer prevents the water-base lacquer from being accepted in the area of the security element.

According to a further preferred embodiment of the invention, the area of the paper of value where a security element is to be applied is additionally pretreated to achieve an optimal execution and/or optical effect of the security element. Said pretreatment can consist for example of applying a suitable background. If the security element has for example a fine line print with line widths in a range of about 50 microns and more, a higher resolution and sharper contours are obtained in particular on rough substrate surfaces if the background is smoothed for example by an additional partial print. Instead of a print, the background for the security element can also be pretreated by coating part of the surface of a paper web with suitable coating mixtures. Special pretreatment of the background is also of advantage for blind embossings that are to render fine and extremely fine structures in the range of for example 100 microns and less. A plastically deformable coating, for example of polymers, partially applied prior to embossing results not only in better and more brilliant rendition of the fine structures but also stabilizes them permanently.

While the invention has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims, including equivalents to elements described therein.

Claims

1. A paper of value having at least one security element and at least one side of the paper of value having a protective layer, wherein the protective layer has a matt surface and is omitted in an area of the security element.
2. A paper of value according to claim 1, wherein said protective layer is provided on both sides of said paper of value.
3. A paper of value according to either of claims 1 or 2, wherein the paper of value has an additional coating smoothing a background of said paper of value at least in the area of the security element.
4. A paper of value according to any one of claims 1 to 3, wherein the security element has a fine line print.
5. A paper of value according to any one of claims 1 to 4, wherein the security element has a print of metallic effect ink.
6. A paper of value according to any one of claims 1 to 5, wherein the security element has a blind embossing.
7. A paper of value according to any one of claims 1 to 6, wherein the protective layer is transparent and colorless.
8. A paper of value according to any one of claims 1 to 7, wherein the area of the security element omitted from the matt protective layer has a protective layer formed as gloss lacquer.
9. A paper of value according to claim 8, wherein the gloss lacquer contains optically variable pigments.
10. A paper of value according to either of claims 8 or 9, wherein the gloss lacquer contains feature substances.

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11. A paper of value according to either of claims 9 or 10, wherein the gloss lacquer is an oleographic lacquer.

12. A paper of value according to any one of claims 1 to 11, wherein the matt protective layer is formed as a lacquer layer of matt lacquer.

13. A paper of value according to any one of claims 1 to 11, wherein the matt protective layer is formed as a plastic foil.

14. A method for producing a paper of value having at least one security element wherein a protective layer having or forming a matt surface is applied to at least one side of the paper of value, and an area of the security element or an area provided for the security element is omitted from said application.

15. A method according to claim 14, wherein the protective layer is applied to both sides of the paper of value.

16. A method according to either of claims 14 or 15, wherein a transparent and colorless protective layer is applied.

17. A method according to any one of claims 14 to 16, wherein a gloss lacquer is applied in the omitted area of the security element or the omitted area provided for the security element.

18. A method according to claim 17, wherein an oleographic lacquer is applied as a gloss lacquer.

19. A method according to any one of claims 14 to 18, wherein a matt lacquer is applied as a matt protective layer.

20. A method according to any one of claims 14 to 19, wherein the protective layer is applied in a quantity of 2 to 15 grams per square meter.

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21. A method according to any one of claims 14 to 20, wherein the protective layer is applied by flexography or screen printing.

22. A method according to claim 21, wherein the protective layer is applied by flexography in a quantity of 2 to 8 grams per square meter.

23. A method according to claim 21, wherein the protective layer is applied by screen printing in a quantity of 5 to 15 grams per square meter.

24. A method according to any one of claims 14 to 23, wherein lacquering is performed on a paper of value sheet including a plurality of single copies.

25. A method according to any one of claims 14 to 24, wherein a water-base dispersion lacquer is applied as said protective layer.

26. A method according to any one of claims 14 to 24, wherein a radiation-curing lacquer is applied as said protective layer and cured by radiation.

27. A method according to any one of claims 19 to 26, wherein an aqueous dispersion lacquer is applied as a matt lacquer, and a radiation-curing lacquer is applied in the area of the security element as gloss lacquer.

28. A method according to any one of claims 14 to 18, wherein a plastic foil is laminated on as said protective layer.

29. A method according to claim 28, wherein the plastic foil has omitted areas in the form of holes that are positioned during lamination in exact register with at least one security element or the area provided for the security elements.

30. A method according to claim 28, wherein the plastic foil is laminated on in continuous strips and two adjacent strips are spaced apart at a distance forming said omitted area for a continuous security element.