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(54) **IMPROVEMENTS IN SECURITY PAPERS AND DOCUMENTS**

VERBESSERUNGEN AN SICHERHEITSPAPIEREN UND -DOKUMENTEN

AMÉLIORATIONS DE PAPIERS ET DOCUMENTS DE SÉCURITÉ

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Description

[0001] This present invention is directed towards a security paper comprising first and second layers of fibrous substrate, the first layer having at least one aperture therethrough. A security additive is located within a predetermined region at least partially surrounding the at least one aperture. The disclosure further provides a method of manufacturing the security paper and security documents comprising the security paper.

[0002] Security documents and booklets such as passports, passbooks, identification documents, certificates, licences and cheque books commonly comprise one or more data pages on which information is provided. For example, as disclosed in WO-A-2010/040987, a passport booklet typically comprises a cover (having a front and a back) and a plurality of internal pages (sometimes known as visa pages) therebetween. Typically the visa pages are made from paper having a grammage of around 85 gsm and are sewn together. The cover is adhered to the outside of the visa pages and thereby protecting the stitch line. An RFID chip or similar device can be provided within the cover for electronic detection and further security.

[0003] At least one data page is provided integrally with one of the visa pages, usually sewn into the stitch line and/or as part of the cover. The data pages commonly comprise one or more base layers of a fibrous substrate, such as paper, overlaid by a layer of polymer laminate, usually applied as a film or lacquer. The fibrous substrate layers are usually made, for example, from paper or cotton fibres and usually have a grammage of around 110 gsm.

[0004] The base layer typically has a number of security features, such as watermarks and machine readable printing. In particular, cylinder mould or electrotype watermarks may be formed in the fibrous substrate during manufacture. Personalised information relating to the owner of the security document, such as their name, address, nationality, date of birth and photograph, may be subsequently printed onto the base layer before the laminate layer is applied.

[0005] The laminate layer usually has one or more further security features, such as holograms, colour changing inks or other optically variable elements. Holograms can be provided in alignment with the personalised information and/or security features of the base layer. For example, the laminate layer may be arranged to make a watermark in the base layer visible only when viewed from certain angles. The laminate layer is attached to the fibrous substrate by an adhesive, which prevents the removal of the laminate layer without destroying the personalised information printed on the base layer.

[0006] However, it has been found that counterfeiters are able to manufacture counterfeit security documents from original security documents by splitting the base layer through the plane of the ply. This enables the laminate layer and personalised information to be separated from the part of the base layer containing one or more security elements, such as a watermark. The counterfeiter can print new personalised information on this part of the base layer and then apply a new laminate layer containing reproduced security features within it. As a result, the reproduced data page will include a base layer having some of the security features of the original base layer.

[0007] WO-A-2011/110799 addresses the problem of counterfeiters splitting banknotes in two along the plane of the note and subsequently forming a counterfeited banknote comprising the front of the genuine note adhered to the back of a counterfeit note. In WO-A-2011/110799 a security substrate is provided with two sets of regions, one set being located on either surface of the substrate, and both of which are required to be present to form a machine readable code. If the banknote is split, the machine readable code will not be formed and the counterfeit can be recognised. However, such an arrangement is not suitable in security documents not having a machine readable code and/or not having the sets of regions on both sides of the security substrate. This is particularly the case for passports, although is also applicable to other security documents.

[0008] Patent document GB 2 433 470 A, discloses a security paper comprising a fibrous security tape incorporated into a fibrous substrate and having apertures provided in the tape.

[0009] An object of the present invention is to improve the security of security documents by preventing adaptation by counterfeiters, whether by splitting or other means, and by improving the ability of any such adaption to be recognised by a machine or eye.

[0010] The invention therefore provides a security paper comprising: a first layer of fibrous substrate and a second layer of fibrous substrate overlying the first layer, said first layer providing a first surface of the security paper and said second layer providing a second surface of the security paper, the first layer having at least one aperture therethrough such that the second layer is not overlaid by the fibrous substrate of the first layer at the at least one aperture; and a security additive located within a predetermined region, said predetermined region at least partially surrounding the at least one aperture, wherein the predetermined region only extends over, or under, part of the surface area of the first surface.

[0011] In preferred embodiments the predetermined region entirely surrounds the at least one aperture. Preferably the predetermined region extends adjacent to the first surface such that the security additive is provided on the first surface. The predetermined region may extend at least partially into the thickness of the first layer from the first surface such that the security additive is substantially embedded within the first layer. The predetermined region preferably extends within the thickness of the first layer such that the security additive is detectable when the first layer is split, thereby exposing the security additive. In particular, at least 75% of the security additive

in the predetermined region is fully embedded within the first layer and more preferably at least 90% of the security additive in the predetermined region is fully embedded within the first layer. The predetermined region preferably does not substantially extend into the thickness of the first layer from the first surface such that security additive is substantially only located at the first surface.

[0012] In one embodiment the security additive is substantially not machine readable at the first surface and/or is not substantially visible to the naked eye when the first surface is viewed in reflected and/or transmitted light. In an alternative embodiment the security additive is substantially detectable at the surfaces of the security paper by a machine and/or is substantially visible to the naked eye when the security paper is viewed in reflected and/or transmitted light.

[0013] The predetermined region may only partially extend over the security paper at and/or underneath the first surface in a shape or an elongate strip extending from a first edge to an opposing second edge of the security paper.

[0014] The security additive is preferably arranged to provide a coloured, metallic, photochromic, iridescent, luminescent, fluorescent, infrared transmitting and/or the like effect. Preferably the security additive comprises at least one of a plurality of security fibres, a plurality of security particles, a plurality of planchettes and/or a colourant.

[0015] In the embodiments in which the security additive comprises security fibres, the length of the security fibres preferably lies in the range 1 to 10 mm, more preferably 2 to 7 mm long and yet more preferably 3 to 5 mm. Preferably the width of the security fibres lies in the range 20 to 100 μm, and is preferably approximately 50 μm. The security fibres may be dyed, printed upon and/or coated with suitable chemical compositions to provide coloured, metallic, photochromic, iridescent, luminescent, fluorescent, infrared transmitting and/or the like effect.

[0016] In the embodiments in which the security additive comprises planchettes, a shape of the planchettes is preferably a symbol, logo or other shape conveying recognisable information. In the embodiments in which the security additive comprises a colourant, the colourant preferably comprises a dye and/or a pigment.

[0017] In preferred embodiments the security paper further comprises a security deposit on the first surface at least partially overlapping the at least one aperture such that the security deposit is located on the second layer exposed within the at least one aperture. The security deposit preferably forms shapes, patterns and/or other indicia. In particular, the security deposit may be visible to the naked eye or machine readable. Preferably the security paper comprises a plurality of regions of the security deposit wherein at least two regions are disposed within at least one aperture. Preferably the security deposit is an ink. The security deposit which overlaps the at least one aperture may be visible in reflected light incident upon the second surface.

[0018] In one embodiment a security illuminate is provided on the second surface overlapping the at least one aperture, said security illuminate being visible through the at least one aperture in reflected light incident upon the first surface. Preferably the security paper further comprises at least one further security feature selected from a watermark, an electrotype, print and/or a security thread.

[0019] In an embodiment the security paper has a single ply comprising the first and second layers. In an alternative embodiment the security paper has first and second plies, the first ply comprising the first layer and the second ply comprising second layer.

[0020] The present invention further provides a security document comprising the aforementioned security paper. The security document is preferably a document of value selected from a banknote, a cheque, a certificate, a passport, a passport page, an identification card and a drivers licence. In particular, the security deposit at least partially forms personalised information relating to the owner of the security document.

[0021] A transparent or semi-transparent protective layer is preferably provided on the security paper at the first surface, said protective layer covering the at least one aperture, the predetermined region of security additive and, where present, the security deposit. In preferred embodiments the protective layer is a laminate film or a lacquer layer. The protective layer is preferably arranged such that when the first layer is split through its thickness into first and second portions, a hole is provided in the first portion through the protective layer and the overlapping security deposit and protective layer are provided on the second portion.

[0022] The present invention further provides a method of manufacturing a security paper comprising the steps of: depositing fibrous stock on a support surface to form a fibrous substrate, said support surface having controlled drainage zones for restricting drainage through the support surface to form a first layer of fibrous substrate having at least one aperture therethrough; depositing a security additive in a predetermined region in the first layer, said predetermined region at least partially surrounding the at least one aperture, wherein the predetermined region only extends over, or under, part of the surface area of a first surface of the first layer; and forming a second layer of fibrous substrate and combining the first and second layers.

[0023] The fibrous substrate is preferably formed on the support surface at a predetermined distance below the level of fibrous stock. The predetermined distance is preferably 50 mm to 1000 mm.

[0024] Preferably the second layer is formed by depositing fibrous stock on a second support surface to form the second layer of a fibrous substrate. Further preferably the first and second layers are combined and subsequently dried in a drying step and/or yet further preferably the first and second layers are separately dried in a drying

step and subsequently combined.

[0025] In preferred embodiments the controlled drainage zones are formed from at least one of a blinding material affixed to the support surface, an electrotype affixed to the support surface and embossed regions in the support surface.

[0026] The method preferably further comprises, after combining the first and second layers, the step of depositing a security deposit on the first surface of the first layer to at least partially overlap at least one aperture such that it is located on the second layer exposed within the at least one aperture. Further preferably the step of depositing the security deposit further comprises:

(a) identifying the at least one aperture;
(b) calculating the position of the at least one aperture in the first layer; and
(c) depositing the security deposit in a predetermined position relative to the at least one aperture.

[0027] The present invention further provides a method of manufacturing a security document comprising the aforementioned method of manufacturing a security paper. The method preferably comprises the step of applying a transparent or semi-transparent protective layer to the first surface. Further preferably, during the application of the protective layer, an adhesive and/or lacquer is pressed into a region underneath the surface of the fibrous substrate.

[0028] By way of example only, embodiments of a security paper, its method of manufacture and a security document incorporating the security paper are now described with reference to, and as show in, the accompanying drawings, in which:

Figure 1 is a plan view of a first surface of a security paper of the present invention;
Figure 2 is a cross-sectional side elevation of the security paper of Figure 1 through section A-A;
Figure 3 is a cross-sectional side elevation of the security paper of Figure 1 through section B-B;
Figure 4 is a cross-sectional side elevation of the security paper of Figure 1 through section C-C;
Figure 5 is a plan view of a security document of the present invention;
Figure 6 is a cross-sectional side elevation of a portion of the security paper of Figure 1 after splitting along a split plane;
Figure 7 is a cross-sectional side elevation of a section of a paper-making machine for use in a method of manufacturing the security paper of Figure 1; and
Figure 8 is a detailed cross-sectional side elevation of a small section of the paper-making machine of Figure 6.

[0029] Figures 1 to 4 illustrate a first embodiment of a security paper 10 of the present invention. The security paper 10 comprises first and second layers 11, 12 of fibrous substrate. A first surface 13 of the security paper 10 is therefore formed by a surface of the first layer 11, and a second surface 14 of the security paper 10 is formed by a surface of the second layer 12.

[0030] The first layer 11 comprises a main body 15 of a substantially uniform or similar thickness. The main body 15 preferably has a grammage of approximately 40 to 150 gsm and more preferably 60 to 120 gsm. The main body 15 preferably forms at least 50% of the area of the first layer 11, more preferably at least 75% of the area of the first layer 11 and more preferably at least 90% of the area of the first layer 11.

[0031] The security paper 10 further comprises at least one aperture 16 formed in the first surface 13 and a security additive 17 located in a predetermined region at least partially surrounding the security additive 17. Preferably, a security deposit 18 is located at least partially overlapping the at least one aperture 16 on the first surface 13. Each will be described in further detail below.

[0032] The at least one aperture 16 extends through the entire thickness of the first layer 11 from the first surface 13 such that the second layer 12 is visible therethrough. The term "thickness" is to be interpreted within the meaning well known in the art, i.e. the dimension of the first layer 11 between its major surfaces. The at least one aperture 16 may form up to 50% of the surface area of the first surface 13 of the security paper 10, more preferably up to 25% of the surface area of the first surface 13 of the security paper 10 and yet more preferably up to 10% of the surface area of the first surface 13 of the security paper 10.

[0033] Each aperture 16 may be provided in any suitable shape, for example, as illustrated in Figure 1, in the form of simple shapes, such as circles, ovals or squares. In the case of there being a plurality of apertures 16, they may all be identically shaped. Alternatively, one or more apertures 16 may be shaped to convey recognisable information, such as in the form of symbols, words, codes, numbers or the like. In a particular example, where the security paper forms part of a security document in the form of a passport, the aperture 16 may be provided in the geographical shape of the country which issues the passport. One or more apertures 16 may be shaped to match the outline or perimeter of the shape of the security deposit 18. For example, the security deposit 18 may display a logo relating to the issuing authority of the security document 20 and the aperture 16 may be provided in the outline of said logo.

[0034] Each aperture 16 may be dispersed at a random location in the first surface 13 of the security paper 10 and, if there is a plurality apertures 16, they may have no recognisable registration to one another in their relative locations. However, in a preferred embodiment of the invention, at least aperture 16 is located in a predetermined location in the security paper 10 such that an inspector, such as a security official, of the document can detect when it is not located in the correct place.

[0035] The security additive 17 is located in a prede-

termined region. The predetermined region may extend from the first surface 13 away from the first layer 11 such that the security additive 17 is located on (i.e. not embedded within) the first surface 13. Furthermore or in addition, the predetermined region defines a predetermined volume of fibrous substrate in the first layer 11 such that the security additive 17 is at least partially embedded and dispersed within the first layer 11.

[0036] In embodiments of the present invention, such as those illustrated in Figures 1 to 5, the predetermined region is located at, or extends from, the first surface 13 in a manner such that the security additive 17 is substantially present, and detectable, at the first surface 13. The security additive 17 is, therefore, visible to the human eye when viewed in reflected light incident upon the first surface 13, i.e. when the security paper 10 is viewed from the same side of the security paper 10 as a light source. In addition, the security additive 17 may be machine detectable when the first surface 13 is interrogated by a machine (for example if the machine is searching for magnetic or electrical conductivity in the security paper 10). However, the security additive 17 is substantially not visible when viewed in reflected light incident on the second surface 14.

[0037] In the illustrated embodiments the predetermined region extends from the first surface 13 into the first layer 11. Furthermore, the thickness (or depth) of the predetermined region from the first surface 13 is less than the thickness of the first layer 11 (i.e. it is always the same thickness as or less thick than the depth of the aperture 16). In another embodiment the predetermined region extends a substantially negligible distance into the first layer 11 such that substantially all of the security additive 17 is exposed at the first surface 13.

[0038] In the embodiments where visibility and/or detectability of the security additive 17 at the first surface 13 is desired, the security additive 17 may be dispersed throughout the predetermined region at a constant or varying density. However, preferably the security additive 17 is provided at a higher density at the first surface 13 (whether embedded or located on top of the first surface 13) to improve its detection by a human eye and/or machine.

[0039] In alternative embodiments substantially no security additive 17 is provided at the first surface 13 such that it is not visible in reflected light incident upon the first surface 13 and/or not machine detectable at the first surface 13. Thus it is preferred that the predetermined region does not extend to the first surface 13 and/or to the interface between the first and second layers 11, 12. However, during manufacture of the security paper 10, some of the security additive 17 may be embedded at or on the first surface 13 and/or the interface. Therefore, the predetermined region may extend from the first surface 13 to the interface between the first and second layers 11, 12 (i.e. throughout the thickness of the first layer 11), but the density of the security additive 17 is greater within the layer 11 and predetermined region than adjacent to or at the first and second surfaces 13, 14. Preferably the density is greater within the central 80% of the thickness of the layer 11 than within the 10% of the thicknesses of the layer 11 adjacent to each of the first and/or second surfaces 12, 13. More preferably the density is greater within the central 90% of the thickness of the layer 11 than within the 5% of the thicknesses of the layer 11 adjacent to each of the first and/or second surfaces 12, 13.

[0040] An advantage of such a variation in density is that the security additive 17 will be substantially undetectable until the security paper 10 has been split. Thus at least 75%, and more preferably at least 90%, of the security additive 17 in the predetermined region may be fully embedded within the first layer 11.

[0041] The predetermined region may extend over, or under, the whole of the surface area of the first surface 13 or may only extend over, or under, part of the surface area of the first surface 13. In particular the predetermined region is provided in one or more shapes, such as squares, circles, logos, symbols or the like, or in an elongate strip extending from a first edge to an opposing second edge of the security paper 10 (as is illustrated in Figures 1 to 4). In a particular embodiment, the security additive 17 is provided within an elongate strip having a width lying in the range 10 to 60 mm and more preferably in the range 25 to 50 mm. The elongate strip may extend from a first edge to an opposing second edge of the security paper 10.

[0042] In one embodiment, the security additive 17 is provided in the form of a band of security fibres (as will be discussed in further detail below) and is arranged to substantially not visible to the naked eye or machine detectable at the first surface 13. The band is approximately 40 mm wide and runs along the full length of the security paper 10 having a length of 0.125 m. The surface area of the band is 0.005 m^2 when viewed from the first surface 13, the predetermined region being the volume between this area of the first surface 13 and the corresponding opposing area at the interface with the second layer 12. The number of individual security fibres present in this band is three hundred, providing a bulk density of 60,000 security fibres per m^2. The number of security fibres present at the first surface 13 will be no greater than 12.5% of the three hundred and more preferably no greater than 5%. Some security fibres (5 to 12.5%) will be present at the interface between the first and second layers 11, 12. The remainder of the security fibres (i.e. 75%-90% or two hundred and twenty-five to two hundred and seventy) will be present within the first layer 11 and fully embedded therein.

[0043] The predetermined regions of security additive 17 at least partially surround at least one aperture 16 throughout the thickness of the predetermined region. In particular, the predetermined region of security additive 17 entirely surrounds at least one aperture 16 at the first surface 13. It will be appreciated that, if the security additive 17 is formed of particulate matter, such as fibres,

particles or planchettes (as will be discussed below) then it may not entirely surround the aperture 16 (i.e. there will not be security additive 17 present over the entire surface of fibrous substrate at the aperture 16). However, the predetermined region will surround the aperture 16 such that the particulate matter is deposited around it and there may be at least some of the particulate matter present at the surface of the fibrous substrate around the aperture 16.

[0044] As illustrated in Figures 1 and 4, the security additive 17 may not be present adjacent to all of the apertures 16. In alternative embodiments the security additive 17 may only be present adjacent to less than 75% of the perimeter of one or more apertures 16 at the first surface 13.

[0045] Depending upon the thickness of the first layer 11 and the size or composition of the security additive 17, the security additive 17 may or may not be visible in transmitted light, i.e. when the security paper 10 is viewed from the opposing side of the security paper 10 to a light source. Preferably the security additive 17 is visible in transmitted light such that it can be easily detected by an inspector. This can be achieved by ensuring that the security additive 17 is of a substantially different opacity to the first layer 11 of fibrous substrate.

[0046] The security additive 17 comprises one or more physical entities carrying one or more security features of a suitable composition and preferably comprises a plurality of security fibres, security particles, planchettes and/or a colourant. The security fibres, planchettes and/or particles may be of any type and/or size suitable which are visible to the human eye and/or machine readable when at the first surface 13. A mix of different types and sizes of security fibres, planchettes and/or particles may be provided to improve the different security elements of the security additive 17 and thus security paper 10.

[0047] The term "security fibres" is known in the art and generally refers to predominantly fibrous and elongate (i.e. substantially one dimensional shaped) elements which are distinguishable by the human eye and/or a machine from the fibrous substrate forming the first layer 11. EP-B-2342085, which is incorporated herein by reference, discloses particularly suitable security fibres.

[0048] Security fibres are usually made from materials such as paper, silks, polyester, nylon, rayon and/or other artificial fibres. The security fibres (and any other form of security additive 17) may be arranged to produce coloured, metallic, photochromic, iridescent, luminescent, fluorescent, infrared transmitting and/or the like effects. The security fibres may be dyed, printed upon and/or coated with suitable chemical compositions to achieve such effects. For example, as in EP-B-2342085, the security fibres may be formed of paper strips comprising printed regions of different colours and unprinted regions. In preferred embodiments the security fibres are only visible to the naked eye in UV light and not visible to the naked eye in visible light.

[0049] In addition, the security fibres (and any other suitable form of security additive 17) may be machine readable, but not readily visible to the naked eye when viewed in reflected light incident on the fibres and/or transmitted light. For example, the security fibres may be magnetic or electrically conductive fibres which can be detected by electrical or magnetic detection means, such as those as disclosed in WO-A-9826379.

[0050] The security fibres preferably have a length in the range 1 to 10 mm, more preferably in the range 2 to 7 mm and more preferably in the range 3 to 5 mm. The width of the security fibres is preferably from 20 to 100 μm and more preferably approximately 50 μm. The linear density of the security fibres, particularly if formed from nylon, viscose or rayon, is preferably in a range 5×10^{-7} to 30×10^{-7} kg/m (5 to 30 dtex) and more preferably in a range 9×10^{-7} to 28×10^{-7} kg/m (9 to 28 dtex).

[0051] As is known in the art, planchettes are generally formed of a small disc of paper. EP-B-2032372, the contents of which are incorporated herein by reference, discloses a method of manufacture of planchettes suitable for the present invention. The planchettes may be formed as a symbol, logo or other shape conveying recognisable information. The planchettes may be dyed, printed upon and/or coated with suitable chemical compositions to produce coloured, photochromic, iridescent, luminescent, fluorescent, infrared transmitting and/or the like effects. In a similar manner to the security fibres, the maximum dimension of the planchettes is preferably in the range 1 to 10 mm, more preferably in the range 2 to 7 mm and more preferably in the range 3 to 5 mm.

[0052] Colourants generally comprise chemical agents to produce coloured, photochromic, iridescent, luminescent, fluorescent, infrared transmitting and/or the like effects. The colourant may comprise a dye selected from at least one of, for example, a direct dye, an acid dye or a basic dye. The dye may include one or more florescent agents which display a coloured effect under ultraviolet or infrared light. Alternatively or in addition, the colourant may comprise a pigment selected from at least one of, for example, an organic pigment, a natural or synthetic mineral pigment (such as kaolin and/or calcium carbonate and/or silica and/or titanium dioxide), an iridescent pigment (such as of the mica titanium type) and plastic pigments (for example hollow plastic microspheres based on a styrene polymer such as styrene acrylic). The colourant may comprise combinations of different dyes and/or pigments to produce different colours and effects. The colourant may be provided as a continuous layer or in a plurality of discrete, dispersed regions within the predetermined region.

[0053] A coloured security additive 17 may be visible to the naked eye when viewed in reflected light in the visible light spectrum. In this specification the term visible light spectrum refers to electromagnetic waves having a wavelength of between approximately 400nm and approximately 700nm. If the security additive 17 is, for example, fluorescent, it may only be visible in ultraviolet

light (i.e. having a wavelength of between approximately 40nm and approximately 400nm). Furthermore or alternatively, the security additive 17 may only be visible in the infrared spectrum (i.e. having a wavelength of between approximately 700nm and approximately 1000nm).

[0054] The security deposit 18 is preferably provided in one or more regions on the first surface 13 of the first layer 11, preferably in the form of printed ink (although other embodiments will be described below). The security deposit 18 preferably forms one or more shapes, patterns, or other indicia visually recognisable to a user or machine readable. For example, the security deposit 18 may form a logo, picture, code, letters, numbers, symbols and/or other such elements.

[0055] The security paper 10 may be used to form a security document 20, as illustrated in Figure 5 as a personalised data page of a passport. In this example the security deposit 18 is provided in the form of personal data 21 and/or one or more machine readable zones 22. The personal data 21 can comprise any suitable data relating to the owner of the security document 20, such as their name, address, nationality, date of birth, photograph 23 and/or additional biometric information. The machine readable zone 22 preferably comprises letters, numbers and/or other symbols, which can be scanned and processed using optical recognition to retrieve (possibly coded) data.

[0056] As is illustrated in Figures 1 and 5, the security deposit 18 at least partially overlaps (i.e. overlies) at least one aperture 16. Preferably the security deposit 18 at least partially overlaps at least one aperture 16 which is at least partially surrounded by the security additive 17. Thus, as is best shown in Figure 4, where the security deposit 18 is provided in an aperture 16 it will pass through the first layer 11 and deposit on the second layer 12 such that it is visible through the aperture 16. As a result, as will be described in further detail below, when the first layer 11 is split through its thickness into first and second portions, or the first and second layers 11, 12 are separated along the interface therebetween, a hole is provided in the first portion and the overlapping security deposit 18 is provided on the second portion.

[0057] Each aperture 16 may be only partially covered with the security deposit 18. In particular, only one or two elements, such as one or two letters or symbols, of the personal data 21 may be provided in each aperture 16. The personal data 21 in the aperture 16 may only be recognisable to a user or machine when combined with the personal data 21 provided on the main body 15 of the security paper 10 (whether over the predetermined region(s) of security additive 17 or not). Furthermore, elements or indicia (such as individual letters or numbers) may be partially formed in an aperture 16 and partially on the main body 15. The security deposit 18 may also be provided over the entire area of an aperture 16.

[0058] Further preferably, where the predetermined region of security additive 17 extends to or over the first surface 13, the security deposit 18 at least partially overlies the predetermined region of security additive 17. Thus the security additive and security deposit 18 may be in contact with one another. In such embodiments it is important to ensure that the security deposit 18 and security additive 17 are compatible with each other. For example, if the security deposit 18 is applied in the form of a liquid ink, the security additive 17 will need to not be substantially hydrophilic or hydrophobic such that the security deposit 18 can be applied cleanly in its one or more regions.

[0059] The security deposit 18 is visible in reflected light incident upon the first surface 13, i.e. when the security paper 10 is viewed from the same side of the security paper 10 as a light source. If the thickness of the security paper 10 at the apertures 16 is sufficiently small, they may also be visible in reflected light (particularly at their edges) incident on the first surface 13. Furthermore, if the security deposit 18 is sufficiently opaque and, if the thickness of the security paper 10 at the apertures 16 is sufficiently small, the security deposit 18 on the first surface 13 will be visible in reflected light incident upon the second surface 14. The apertures 16 will be visible in transmitted light, i.e. when the security paper 10 is viewed from the opposing side of the security paper 10 to a light source. The security deposit 18 will also be visible through the apertures 16 when the second surface 14 is viewed in transmitted light.

[0060] The security additive 17, security deposit 18 and/or at least one aperture 16 may be registered to one another visually by the human eye and/or by a machine. In particular, they are registered to one another such that they are positioned in a predetermined, recognisable position relative to one another and/or to one or more edges of the security paper 10. The registration may be the same between a plurality of security papers 10 such that a security official and/or machine can easily detect a deviance from the common registration. The registration between the features makes the security paper 10 harder to reproduce by a counterfeiter as they will not only need to reproduce the at least one aperture 16, security additive 17 and/or security deposit 18, but will also need to ensure that they are correctly positioned relative to one another.

[0061] For example, there may be registration in reflected light between an aperture 16 and the security additive 17 in that, as illustrated in Figure 1, the security additive 17 surrounds or frames the aperture 16 at the first surface 13 and thus the two features interact in a registerable manner relative to one another. The at least one aperture 16 may be located in a predetermined position and, if not in the predetermined position, a security official can detect a counterfeit. The security additive 17 may only be visible in UV light and, therefore, the registration may only be detectable upon application of UV light.

[0062] Furthermore, the security deposit 18 may be registered to the security additive 17 and/or at least one

aperture 16. The security deposit 18 is registered to at least one aperture 16 as it at least partially overlies at least one aperture. The security deposit 18 may also be provided to match the shape of the predetermined regions of security additive 17, particularly when the predetermined regions include security additive 17 on the first surface 13. For example, the security deposit 18 may be provided as indicia falling entirely within the predetermined region of security additive 17 at the first surface 13. Alternatively, the security deposit 18 could form indicia only partially overlying the security additive 17.

[0063] In preferred embodiments the position of the at least one aperture 16 is detectable by a machine such that, during manufacture, the security deposit 18 can be provided in a predetermined positional relationship to at least one aperture 16 (as will be discussed in further detail below).

[0064] Furthermore, the first layer 11 may also comprise one or more security features, although the security features may not be provided in the at least one aperture 16, predetermined region of security additive 17 and/or security deposit 18 as they may form self-contained security features. One such additional security feature is a cylinder mould watermark, in which some regions of the watermark are more dense, or thicker, than the uniform thickness of the main body 15 and/or some regions of the watermarks are less dense, or thinner, than the uniform thickness of the main body 15. Another security feature is an electrotype watermark, in which some regions of the electrotype watermark are less dense than the uniform thickness of the main body 15.

[0065] In a preferred embodiment the at least one aperture 16 forms part of a larger watermark. At least one aperture 16 may form part of a larger image generated in combination with other watermarks which will have both regions of increased and reduced thicknesses.

[0066] Security threads and patches are another suitable security feature which may be applied to first layer 11 or embedded therein in any known manner. For example, a security thread or patch may be applied to a surface of the first layer 11, partially embedded therein, fully embedded therein and/or is exposed at windows in the first surface 13.

[0067] The second layer 12 is preferably of a substantially uniform thickness and is preferably relatively thin, for example having a grammage of approximately 10 to 50 gsm and more preferably of approximately 15 to 30 gsm. In particular, the second layer is substantially thinner than the first layer 11. The second layer 12 may also be provided with one or more security features such as a cylinder mould watermark, an electrotype watermark, security threads, security patches and security fibres. Printing may also be applied to the second surface 14 formed by the second layer 12 using any known printing techniques, such as dye-sublimation, screen, flexography, lithography, intaglio, gravure, dye diffusion, laser, inkjet toner, letterpress and toner transfer.

[0068] Although discussed herein as first and second layers 11, 12, it will be appreciated that as a result of the security paper 10 formation process (as is discussed below) the first and second layers 11, 12 may not be entirely distinct from one another. In particular, if combined whilst wet, the first and second layers 11, 12 will form a single ply. However, the second layer 12 can still be distinguished from the first layer 11 by virtue of the at least one aperture 16 not extending into the second layer 12. Thus it is still possible to identify the second layer 12 at the at least one aperture 16 even if it has been substantially combined with the first layer 11 over the main body 15 of the first layer 11.

[0069] However, in an alternative embodiment the first and second layers 11, 12 are combined after drying, thereby forming a two-ply security paper 10, and thus are substantially distinct from one another. Further layers may also be added to form three or more ply paper.

[0070] As previously discussed, the security paper 10 may be used to form a security document 20, particularly passports. However, the security document 20 may be any other suitable document of value. In particular, the security document 20 may be a banknote, cheque, certificate, passport, passport page, identification card or drivers licence. Personal data provided thereon by the security deposit 18 may relate to the owner of the security document 20.

[0071] The security document 20, particularly if it is a passport, may further comprise a protective layer 24 attached to the first surface 13 of the security paper 10 over the personal data 21 and machine readable zone 22. The protective layer 24, typically approximately 10μm thick and transparent or semi-transparent, may comprise a lacquer layer or polymeric film, the application of which will be described in further detail below. Preferably, the protective layer 24 includes one or more security features, such as holograms, colour changing inks or other optically variable elements to make it more difficult to reproduce by a counterfeiter. The security features may be applied using a transfer layer such that they are provided underneath the protective layer 24. Thus the protective layer 24 protects against wear of the security paper 10 as well as providing a security function to the security document 20.

[0072] The security document 20 may further comprise an identification feature embedded within, or on, the first and/or second layer 11, 12. The identification feature may be of any type suitable for storing data relating to the document, such as personalisation data relating to the owner of the document or bibliographic data, which can be electronically read by a computer processor and suitable transmitter and/or receiver. In particular, the identification feature is an RFID chip or NFC tag. In the case of a passport, identity document or the like in which the security document 20 relates to the identity of the owner the identification feature stores biometric data relating to the owner, such as iris information, fingerprint information or face recognition data.

[0073] The security function of the present invention

when the security paper 10 is split through its plane is best illustrated with reference to Figures 4 and 6. Typically a counterfeiter would attempt to adapt the security document 20 such that the personalised information 21 and machine readable code 22 relates to a different person other than the original owner of the security document 20, but retain the security features (particularly the identification feature) provided in the first and/or second layers 11, 12 to avoid detection. To do so, they would attempt to split the security paper 10, along a split plane 25 between the first and second surfaces 13, 14, into a first portion (not shown in Figure 6) and a second portion 26.

[0074] The first portion, which includes the first surface 13, at least part of the first layer 11 and any security deposit 18 thereon or security additive 17 therein, is discarded by the counterfeiter. The counterfeiter would then attempt to reuse the second portion 26, which includes the second surface 14 and at least part of the first and/or second layers 11, 12, by applying new security deposit 18 and/or security additive 17 thereon, for example in the form of a new layer of fibrous substrate.

[0075] The split plane 25 is a plane of failure typically inherent within layers of fibrous substrate of at least 40 gsm and above. Typically the split plane 25 is towards the centre of a layer of fibrous substrate (i.e. midway between its surfaces) and is substantially parallel to the opposing surfaces of the layer. Therefore, as illustrated in Figure 4, particularly where the second layer 12 is thinner than the first layer 11, the split plane 25 will tend to be towards the centre of the first layer 11. However, it will be appreciated that the split plane 25 could instead be along the interface between the first and second layers 11, 12.

[0076] In the present invention the second portion 26 formed after the splitting of the security paper 10 will still include at least some of the security deposit 18 (as illustrated in Figure 6). This is because, during splitting of the security paper 10, any security deposit 18 provided on the second layer 12 through the apertures 16 in the first layer 11 will still be present on the second portion 26. In addition, portions of any protective layer 24 provided over the first surface 13 may also be left attached to the second portion 26 in the apertures 16. However, if the protective layer 24 is sufficiently thick, it will not be separated during the splitting of the security paper 10 and would remain attached to the first portion (the security deposit 18 would still remain attached to the second portion 26). The second portion 26 may also include some of the security additive 17 if the split plane 25 passes through the predetermined region of security additive 17.

[0077] Therefore, a counterfeiter would not be able to effectively reuse the second portion 26 to form a new counterfeit security document since, if it were reused, the counterfeit security document could be readily identified by virtue of the presence of the security deposit 18 and possibly protective layer 24 remaining on the second portion 26. In addition, any remaining protective layer 24 would significantly disrupt the printing of ink or the like on top of the second portion 26. Furthermore, it would be very difficult for the counterfeiter to achieve the correct registration between the at least one aperture 16, the security additive 17, the security deposit 18 and/or the edges of the security paper 10. If the security additive 17 was substantially not visible to the naked eye and/or machine readable at the first surface 13, the counterfeiter will not be able to effectively re-use the second portion 26 as the exposed security additive 17 would be evident to a security official.

[0078] Figures 7 and 8 illustrate a section of a cylinder mould papermaking machine 30 suitable for use in the manufacture of the security paper 10 of the present invention. The machine 30 comprises first and second cylinder moulds 31, 32 rotating in first and second vats 33, 34 of aqueous fibrous stock 35, 36. The cylinder moulds 31, 32 are covered with porous support surfaces, such as porous wire meshes, which form first and second cylinder mould covers 37, 38.

[0079] The fibrous stock 35, 36 may comprise a range of fibre types, including synthetic or natural fibres, or a mixture of both. The actual preparation of the fibres is unrestricted by the invention, and will depend upon the effect desired in the first and second fibrous substrate layers 11, 12. As a general consideration, security paper 10 used for security documents, such as banknotes, passports, identification cards and so on, needs to be hard wearing, resilient, and self-supporting, and so an appropriate fibre mix is preferably selected.

[0080] As the cylinder moulds 31, 32 rotate the liquid within the fibrous stock 35, 36 passes through the porous support surfaces of the cylinder mould covers 37, 38. The fibres are deposited on the support surfaces and the first and second layers 11, 12 are thereby formed, the first layer 11 being formed on the first cylinder mould 31 and the second layer 12 being formed on the second cylinder mould 32. The arrangement for forming the second layer 12 is known in the art as a "short former". As previously discussed herein, the first fibrous substrate layer 11 has a grammage of around 90 gsm and the second fibrous substrate layer 12 has a grammage of around 20 gsm.

[0081] Controlled drainage zones 39 are formed on the first cylinder mould cover 37 for forming the apertures 16 in the first layer 11. The shape of the controlled drainage zones 39 is selected to correspond to the desired shape of the apertures 16 in the security paper 10. There may be a plurality of controlled drainage zones 39 provided around the first cylinder mould cover 37.

[0082] As the first cylinder mould 31 rotates, the liquid from the fibrous stock 35 passes through the porous support surface and the fibres are deposited on the first cylinder mould cover 37. Due to the controlled drainage zones 39, little or no covering of fibres is provided on them. Some fibres may form on the controlled drainage zones 39, but the substrate cannot properly form thereon as insufficient fibres will deposit. If necessary, any such

unwanted fibres can be removed during subsequent processing steps. Therefore, the first layer 11 will be formed with apertures 16 corresponding to the controlled drainage zones 39.

[0083] The controlled drainage zones 39 may be formed by fixing a blinding material to the first cylinder mould cover 37, for example by welding a metal thereto. Alternative materials include wax, polymer or another material which can be securely attached to the first cylinder mould cover 37 to prevent drainage of liquid from the fibrous stock 35 and hence fibre deposition. Similar arrangements are disclosed in WO-A-00/39391 and WO-A-2004/001130, the contents of which are incorporated herein by reference. Such methods are particularly suited to forming the apertures 16 through the thickness of the first layer 11. In order to prevent the deposition of fibres to form apertures 16 the blinding material may be sufficiently large to prevent fibres from bridging it and/or it may be substantially impervious to the fluid carrying the fibres in the fibrous stock 35. For example, the blinding material may be formed of a polymer resin, metal or ceramic body.

[0084] Alternatively, or in addition, the controlled drainage zones 39 may be formed by electrotypes having regions of a relatively large height. Electrotypes, as is well-known and has been described in, for example, US-B-1901049 and US-B-2009185, are provided in the form of thin pieces of metal, attached to the first cylinder mould cover 37, having raised regions. The electrotypes comprise regions of relatively large height (i.e. extending away from the first cylinder mould cover 37) which cause areas no fibre deposition, thereby forming the apertures 16. As previously discussed, the apertures 16 may form part of a larger, electrotype watermark and are formed by part of an electrotype forming a larger image.

[0085] In yet a further arrangement, the controlled drainage zones 39 may be formed using embossed regions in the first cylinder mould cover 37, in manner similar to the process used to produce cylinder mould watermarks (and, indeed, the apertures 16 may form part of such a watermark). The embossed regions may comprise areas of substantial height difference, which create areas of little or no fibre deposition to form the apertures 16 of reduced thickness.

[0086] At a position within the first vat 33 just before or after the fibrous substrate starts to be formed on the first cylinder mould cover 37, the security additive 17 is injected into the vat adjacent to the first cylinder mould cover 37. As illustrated, in an embodiment an additive injector 27, such as in the form of a thin tube, receives the security additive 17 from a security additive reservoir (not shown) and injects it into the fibrous stock 35. A pump is provided to draw the security additive 17 from the reservoir and direct it along the additive injector 27.

[0087] The security additive 17 is drawn to, and to a degree mixes with, the fibrous substrate initially forming on the first cylinder mould cover 37 by the pressure difference created adjacent thereto by the rotation of the first cylinder mould 31. By providing the security additive 17 at the point the fibrous substrate begins to form it will be provided at the first surface 13 adjacent to the at least one aperture 16. By delaying the addition of the security additive 17 until a thin layer of fibrous substrate has already formed on the cylinder mould cover 37, substantially no security additive 17 will be formed at the first surface 13. The security additive 17 will not form at the controlled drainage zones 39 and thus will not be present in the at least one aperture 16.

[0088] In particular, where a stripe of the security additive 17 is to be formed, the additive injector 27 injects security additive 17 over a restricted distance along the axis of rotation of the first cylinder mould cover 37. However, if the security additive 17 is to be provided across the entire first layer 11, the additive injector 27 extends all the way along the first cylinder mould cover 37 along its axis of rotation, or a plurality of additive injectors 27 are provided.

[0089] Preferably the flow of fibrous stock 35 towards the first cylinder mould cover 37 is as laminar as possible at the initial point of formation of the first layer 11 thereon. A laminar flow ensures that the first layer 11 forms with optimum fibre orientation. Furthermore, if a stripe of security additive 17 is being formed, a laminar flow assists in ensuring that the edges of the stripe are neat and straight.

[0090] A suitable method for forming such a laminar flow is to delay the formation of the fibrous stock 35 such that the initial formation point 29 is below the top surface of the fibrous stock 35 in the first vat 33. For example, and as illustrated in Figures 7 and 8, a sealing means 28 may be provided to form a seal with the first cylinder mould cover 37 below the top surface of the fibrous stock 35. The seal prevents fibrous substrate forming on the first cylinder mould cover 37 above it. The sealing means 28 may comprise a plastic sheet or the like, which is sufficiently hard wearing to prevent disintegration through continuous contact with the first cylinder mould cover 37. Alternatively, a baffle may be provided adjacent to, but not sealed to, the first cylinder mould cover 37 to allow only a small amount of fibrous substrate to form thereon until the initial formation point 29 illustrated.

[0091] In the first vat 33 the fibrous stock 35 will tend to be less turbulent below its surface and, with the initial formation point 29 below the surface, the laminar characteristics of the flow of fibrous stock 35 towards the first cylinder mould cover 37 will be improved. In addition, liquid pressure or head is generated adjacent to the initial formation point 29 and assists in forming the laminar flow, as well as increasing the rate at which the first layer 11 forms on the first cylinder mould cover 37. For example, suitable head has been found to be generated when the initial formation point 29 is arranged to be 50 mm to 1000 mm below the surface, and more preferably 50 mm to 500 mm below the surface.

[0092] The security additive 17 can also, whether in addition or as an alternative to the aforementioned ap-

plication method, be applied by spraying it onto the first layer 11 after it has formed on the first cylinder mould cover 37. As a result, the predetermined region of security additive 17 will extend away from the first surface 13 of the first layer 11 and the security additive 17 will be located on the first layer 11. The security additive 17 may be coated in an adhesive substance or the like to ensure that it remains adhered to the first layer 11. Preferably the first layer 11 is still wet such that the security additive 17 effectively adheres thereto. Furthermore, the security additive 17 is preferably applied before the first and second layers 11, 12 are combined (see below) such that it will not be provided on the second layer 12 through the at least one aperture 16.

[0093] During the formation of the first and second layers 11, 12, various techniques may be employed to include the aforementioned security features therein using any suitable method known in the art. For example, the first and/or second cylinder mould covers 37, 38 may additionally comprise embossed regions to form cylinder mould watermarks in the security paper 10 separate from the apertures 16. Electrotypes can also be used to form electrotype watermarks (i.e. light tonal regions) in the first and/or second layers 11, 12 separately from the apertures 16. A security thread may also be embedded in (wholly or partially) the fibrous substrate as it forms on the first and/or second cylinder mould cover 37, 38. Security fibres may be injected into fibrous stock 35, 36 adjacent to the first and/or second cylinder mould covers 37, 38 such that they are embedded within the first and/or second layer 11, 12. Any of the techniques disclosed in WO-A-00/39391, WO-A-2004/001130, US-B-1901049, US-B-2009185 and EP-A-059056 may be employed to incorporate the security features in the first and/or second layers 11, 12.

[0094] Once sufficient fibrous substrate has been deposited on the cylinder mould covers 37, 38 such that the first and second layers 11, 12 are formed, they are couched from the first and second cylinder mould covers 37, 38 as a continuous web, for example by a couch roll 40 for the first layer 11 and a felt 41 for the second layer 12. The couch roll 40 rotates in contact with the first cylinder mould cover 31 and is used to transfer the first layer 11 from the first cylinder mould cover 31 to the felt 41 (formex) which carries the web from the wet end of the papermaking machine 30 to a press section (not shown in the drawings). The felt 41 feeds the second layer 12 into the first layer 11 at the point where the first layer 11 is couched from the first cylinder mould 31 onto the couch roll 40. The first and second layers 11, 12 are thereby combined to form a single ply prior to drying.

[0095] Water is extracted from the wet fibrous web and the web of paper undergoes a drying process. The dried web may then be cut along cutting lines to form a plurality of interim sheets, which are stacked in reams of typically 500 sheets. Preferably the dried security paper 10 has a grammage of in the range of approximately 70 to 180 gsm and more preferably in the range of approximately 90 to 150 gsm.

[0096] The security deposit 18 is applied to the first and second layers 11, 12, before or after the cutting process, such that it at least partially overlaps the at least one aperture 16, and particularly at least one aperture 16 at least partially surrounded by the security additive 17. In particular, a portion of the security deposit 18 containing non-variable information (such as the words "Name", "Date of Birth" etc) may be applied before cutting and a portion of the security deposit 18 containing variable or personalised information (such as the name or date of birth of the owner of the security document 20) may be applied after cutting.

[0097] The aforementioned registerability of the apertures 16 may be particularly suitable for the application of the latter security deposit 18, since the application machine can determine where the security deposit 18 needs to be applied by registration with the apertures 16. A suitable application machine is disclosed in WO-A-2009/037414, the contents of which are incorporated herein by reference. In broad terms, the application machine initially identifies the at least aperture 16, calculates its position on the security paper 10 (for example by determining the position of an edge or centre of an aperture 16) and subsequently applies the security deposit 18 in a predetermined position relative to the at least one aperture 16.

[0098] The security deposit 18 is formed of any suitable dispersed mass which can be easily separated when the security paper 10 is split such that some security deposit 18 remains on the second portion 26 discussed above. Preferably the security deposit 18 is an ink, but may comprise any other suitable composition which includes an identifiable property. For example, optically variable compositions such as liquid crystal pigments, interference pigments, optically variable magnetic interference pigments and optically variable pigments based on photonic crystal materials may be employed and applied using any suitable method. Ink for the non-variable information may be applied using, for example, offset, flexo, gravure, intaglio, screen or letterpress printing methods. The variable or personalised information may be applied using, for example, inkjet, xerography, a transfer process, laser marking, laser perforation or laser engraving.

[0099] Finally, the protective layer 24 may be applied to the first surface 13 over the security deposit 18 and may comprise a laminate film or lacquer layer or any other suitable transparent or semi-transparent layer. A lacquer layer may be applied directly to the first layer 11 using heat and/or high pressure and a hot-melt adhesive, or via a transfer layer. The laminate film is preferably a non-self-supporting layer applied by a transfer process, but may also be a polymeric, self-supporting layer, applied to the first surface 13 using adhesive and/or heat sealing. In either process it is preferable to ensure that the adhesive and/or lacquer is pressed into the porous structure of the fibrous substrate at the first surface 13 to provide a thin, relatively stiff, region, for example extending into

approximately 10% of the thickness of the first layer 11 from the first surface 13. This region not only provides added support to the first layer 11, but also assists in ensuring that the split plane 25 is within the first layer 11 as it will tend to be relatively close to the lacquer or adhesive pressed into the fibrous substrate.

[0100] In a further embodiment of the present invention, the security paper 10 is formed in the same manner as previously described and further comprises a region of security illuminate on the second surface 14. The security illuminate is positioned on the second surface 14 such that it at least partially overlaps one or more of the at least one aperture 16. The region of the security illuminate may overlap with the entire aperture 16 (when viewed from the side of the second surface 14) and may be in any suitable shape. The shape of the region may be arranged to be recognisable, such as being in the form of a square, circle, hexagon or the like, and may convey information, for example by being in the form of a word, symbol, logo or the like.

[0101] The security illuminate may or may not be visible to the human eye under standard illumination conditions, and could comprise a substance which is luminescent, fluorescent, phosphorescent, magnetically conductive, electrically conductive, photochromic and/or optically variable amplitude interference. The presence of the security illuminate may only be revealed by illumination at a non-visible wavelength such as ultraviolet light. The security illuminate could be identifiable both by a human viewer and by a machine.

[0102] The region of security illuminate is visible when illuminated and viewed in reflected light incident on the second surface 14. It is also visible when illuminated and viewed in reflected light incident on the first surface 13 through the aperture 16 since the fibrous substrate in those regions is sufficiently thin (i.e. it only comprises the second layer 12). Such an arrangement further increases the security of the document since the presence of the region of security illuminate can be easily identified from the first surface 13 when the registration of the security deposit 18, security additive 17 and/or at least one aperture 16 is inspected.

[0103] Other embodiments of the present invention will be apparent. In one embodiment the first and second layers 11, 12 are formed as separate plies, for example on separate papermaking machines, and subsequently dried. Each ply is subsequently joined to the other at the interface. In this embodiment the split plane 25 is highly likely to be along the interface between the two plies.

Claims

1. A security paper (10) comprising:

a first layer (11) of fibrous substrate and a second layer (12) of fibrous substrate overlying the first layer (11), said first layer (11) providing a first surface (13) of the security paper (10) and said second layer (12) providing a second surface (14) of the security paper (10), the first layer (11) having at least one aperture (16) therethrough such that the second layer (12) is not overlaid by the fibrous substrate of the first layer (11) at the at least one aperture (16); and
a security additive (17) located within a predetermined region, said predetermined region at least partially surrounding the at least one aperture (16), **characterised in that** the predetermined region only extends over, or under, part of the surface area of the first surface (13).

2. A security paper (10) as claimed in claim 1 wherein the predetermined region:

entirely surrounds the at least one aperture (16); and/or
extends adjacent to the first surface (13) such that the security additive (17) is provided on the first surface (13).

3. A security paper (10) as claimed in any one of the preceding claims wherein the predetermined region extends at least partially into the thickness of the first layer (11) from the first surface (13) such that the security additive (17) is substantially embedded within the first layer (11).

4. A security paper (10) as claimed in claim 3 wherein:

the predetermined region extends within the thickness of the first layer (11) such that the security additive (17) is detectable when the first layer (11) is split, thereby exposing the security additive (17); or
the predetermined region does not substantially extend into the thickness of the first layer (11) from the first surface (13) such that security additive (17) is substantially only located at the first surface (13).

5. A security paper (10) as claimed in any one of the preceding claims wherein:

the security additive (17) is substantially not machine (30) readable at the first surface (13) and/or is not substantially visible to the naked eye when the first surface (13) is viewed in reflected and/or transmitted light; or
the security additive (17) is substantially detectable at the surfaces of the security paper (10) by a machine (30) and/or is substantially visible to the naked eye when the security paper (10) is viewed in reflected and/or transmitted light.

6. A security paper (10) as claimed in any one of the

preceding claims wherein the predetermined region only partially extends over the security paper (10) at and/or underneath the first surface (13) in a shape or an elongate strip extending from a first edge to an opposing second edge of the security paper (10).

7. A security paper (10) as claimed in any one of the preceding claims wherein the security additive (17):

is arranged to provide a coloured, metallic, photochromic, iridescent, luminescent, fluorescent, infrared transmitting and/or the like effect; and/or
comprises at least one of a plurality of security fibres, a plurality of security particles, a plurality of planchettes and/or a colourant.

8. A security paper (10) as claimed in any one of the preceding claims:

further comprising a security deposit (18) on the first surface (13) at least partially overlapping the at least one aperture (16) such that the security deposit (18) is located on the second layer (12) exposed within the at least one aperture (16);
wherein a security illuminate is provided on the second surface (14) overlapping the at least one aperture (16), said security illuminate being visible through the at least one aperture (16) in reflected light incident upon the first surface (13); and/or
further comprising at least one further security feature selected from a watermark, an electrotype, print and/or a security thread.

9. A security paper (10) as claimed in any one of the preceding claims having:

a single ply comprising the first and second layers (11, 12); or
first and second plies, the first ply comprising the first layer (11) and the second ply comprising the second layer (12).

10. A security document (20) comprising the security paper (10) of any one of the preceding claims.

11. A security document (20) as claimed in claim 10 wherein the security document(20) is a document of value selected from a banknote, a cheque, a certificate, a passport, a passport page, an identification card and a drivers licence.

12. A method of manufacturing a security paper (10) comprising the steps of:

depositing fibrous stock (35) on a support surface to form a fibrous substrate, said support surface having controlled drainage zones (39) for restricting drainage through the support surface to form a first layer (11) of fibrous substrate having at least one aperture (16) therethrough;
depositing a security additive (17) in a predetermined region in the first layer (11), said predetermined region at least partially surrounding the at least one aperture (16),
characterised in that
the predetermined region only extends over, or under, part of the surface area of a first surface (13) of the first layer (11); and
forming a second layer (12) of fibrous substrate and combining the first and second layers (11, 12).

13. A method as claimed in claim 12 wherein:

the fibrous substrate is formed on the support surface at a predetermined distance below the level of fibrous stock (35);
the second layer (12) is formed by depositing fibrous stock (35) on a second support surface to form the second layer (12) of a fibrous substrate; and/or
the controlled drainage zones (39) are formed from at least one of a blinding material affixed to the support surface, an electrotype affixed to the support surface and embossed regions in the support surface.

14. A method as claimed in claim 12 or claim 13 further comprising, after combining the first and second layers (11, 12), the step of depositing a security deposit (18) on the first surface (13) of the first layer (11) to at least partially overlap at least one aperture (16) such that it is located on the second layer (12) exposed within the at least one aperture (16).

15. A method of manufacturing a security document (20) comprising the method of manufacturing a security paper (10) as claimed in any one of claims 12 to 14 and the step of applying a transparent or semi-transparent protective layer (24) to the first surface (13).

Patentansprüche

1. Sicherheitspapier (10), Folgendes umfassend:

eine erste Schicht (11) aus faserigem Substrat und eine zweite Schicht (12) aus faserigem Substrat, die über der ersten Schicht (11) liegt, wobei die erste Schicht (11) eine erste Oberfläche (13) des Sicherheitspapiers (10) bereitstellt und die zweite Schicht (12) eine zweite Oberfläche (14) des Sicherheitspapiers (10) bereitstellt, wo-

bei die erste Schicht (11) mindestens eine Öffnung (16) hindurch aufweist, derart, dass die zweite Schicht (12) nicht von dem faserigen Substrat der ersten Schicht (11) an der mindestens einen Öffnung (16) überlagert wird; und einen Sicherheitszusatz (17), der innerhalb eines vorbestimmten Bereichs angeordnet ist, wobei der vorbestimmte Bereich die mindestens eine Öffnung (16) zumindest teilweise umrundet, **dadurch gekennzeichnet, dass** sich der vorbestimmte Bereich nur über oder unter einem Teil des Oberflächenbereichs der ersten Oberfläche (13) erstreckt.

2. Sicherheitspapier (10) nach Anspruch 1, wobei der vorbestimmte Bereich:

die mindestens eine Öffnung (16) vollständig umrundet; und/oder
sich anschließend zu der ersten Oberfläche (13) erstreckt, derart dass der Sicherheitszusatz (17) auf der ersten Oberfläche (13) bereitgestellt wird.

3. Sicherheitspapier (10), nach einem der vorangehenden Ansprüche, wobei sich der vorbestimmte Bereich von der ersten Oberfläche (13) aus zumindest teilweise in die Dicke der ersten Schicht (11) hinein erstreckt, derart dass der Sicherheitszusatz (17) im Wesentlichen in der ersten Schicht (11) eingebettet ist.

4. Sicherheitspapier (10) nach Anspruch 3, wobei:

sich der vorgegebene Bereich innerhalb der Dicke der ersten Schicht (11) erstreckt, derart dass der Sicherheitszusatz (17) nachweisbar ist, wenn die erste Schicht (11) gespalten und dadurch der Sicherheitszusatz (17) freigelegt wird; oder
sich der vorbestimmte Bereich im Wesentlichen nicht in die Dicke der ersten Schicht (11) von der ersten Oberfläche (13) aus hinein erstreckt, derart dass der Sicherheitszusatz (17) im Wesentlichen nur an der ersten Oberfläche (13) angeordnet ist.

5. Sicherheitspapier (10), nach einem der vorangehenden Ansprüche, wobei:

der Sicherheitszusatz (17) im Wesentlichen an der ersten Oberfläche (13) nicht durch ein Maschine (30) lesbar ist und/oder für das bloße Auge im Wesentlichen nicht sichtbar ist, wenn die erste Oberfläche (13) in reflektiertem und/oder durchlässigem Licht betrachtet wird; oder
der Sicherheitszusatz (17) an den Oberflächen des Sicherheitspapiers (10) durch eine Maschine (30) im Wesentlichen nachweisbar und/oder mit bloßem Auge im Wesentlichen sichtbar ist, wenn das Sicherheitspapier (10) im reflektierten und/oder transmittierten Licht betrachtet wird.

6. Sicherheitspapier (10), nach einem der vorangehenden Ansprüche, wobei sich der vorgegebene Bereich nur teilweise über das Sicherheitspapier (10) an und/oder unter der ersten Oberfläche (13) in einer Form oder einem länglichen Streifen erstreckt, der sich von einem ersten Rand zu einem gegenüberliegenden zweiten Rand des Sicherheitspapiers (10) erstreckt.

7. Sicherheitspapier (10), nach einem der vorangehenden Ansprüche, wobei der Sicherheitszusatz (17):

so angeordnet ist, dass ein farbiger, metallischer, photochromer, irisierender, lumineszierender, fluoreszierender, infrarotdurchlässiger und/oder ähnlicher Effekt entsteht; und/oder
mindestens eine aus einer Vielzahl von Sicherheitsfasern, einer Vielzahl von Sicherheitspartikeln, einer Vielzahl von Planchetten und/oder einem Farbstoff umfasst.

8. Sicherheitspapier (10), nach einem der vorangehenden Ansprüche:

ferner umfassend eine Sicherheitsablagerung (18) auf der ersten Oberfläche (13), die die mindestens eine Öffnung (16) zumindest teilweise überlappt, derart dass die Sicherheitsablagerung (18) auf der zweiten Schicht (12) angeordnet ist, die innerhalb der mindestens einen Öffnung (16) freigelegt ist;
wobei eine Sicherheitsleuchte auf der zweiten Oberfläche (14), die die mindestens eine Öffnung (16) überlappt, bereitgestellt ist, wobei die Sicherheitsleuchte durch die mindestens eine Öffnung (16) im reflektierten Licht, das auf die erste Oberfläche (13) trifft, sichtbar ist; und/oder
ferner umfassend mindestens ein weiteres Sicherheitsmerkmal, ausgewählt aus einem Wasserzeichen, einem Elektrotyp, einem Druck und/oder einem Sicherheitsfaden.

9. Sicherheitspapier (10), nach einem der vorangehenden Ansprüche, mit:

eine einzelne Lage, umfassend die erste und zweite Schicht (11, 12); oder
erste und zweite Lagen, wobei die erste Lage die erste Schicht (11) und die zweite Lage die zweite Schicht (12) umfasst.

10. Sicherheitsdokument (20), umfassend das Sicherheitspapier (10) nach einem der vorhergehenden

Ansprüche.

11. Sicherheitsdokument (20) nach Anspruch 10, wobei das Sicherheitsdokument (20) ein Wertdokument ist, das ausgewählt ist aus einer Banknote, einem Scheck, einem Zertifikat, einem Reisepass, einer Passseite, einer Identifikationsausweis und einem Führerschein.

12. Verfahren zur Herstellung eines Sicherheitspapiers (10), umfassend die folgenden Schritte:

Abscheiden von faserigem Material (35) auf einer Trägeroberfläche, um ein faseriges Substrat zu bilden, wobei die Trägeroberfläche kontrollierte Drainagezonen (39) aufweist, um die Drainage durch die Trägeroberfläche zu begrenzen, um eine erste Schicht (11) aus faserigem Substrat mit mindestens einer Öffnung (16) hindurch zu bilden;
Abscheiden eines Sicherheitszusatzes (17) in einem vorbestimmten Bereich in der ersten Schicht (11), wobei der vorbestimmte Bereich die mindestens eine Öffnung (16) zumindest teilweise umrundet, **dadurch gekennzeichnet, dass** sich der vorbestimmte Bereich nur über oder unter einem Teil des Oberflächenbereichs einer ersten Oberfläche (13) der ersten Schicht (11) erstreckt; und
Bilden einer zweiten Schicht (12) aus faserigem Substrat und Kombinieren der ersten Schicht und der zweiten Schicht (11, 12).

13. Verfahren nach Anspruch 12, worin:

das faserige Substrat auf der Trägerfläche in einem vorbestimmten Abstand unterhalb des Niveaus des faserigen Materials (35) ausgebildet ist;
die zweite Schicht (12) durch Abscheiden von faserigem Material (35) auf einer zweiten Trägerfläche gebildet wird, um die zweite Schicht (12) eines faserigen Substrats zu bilden; und/oder
die kontrollierten Drainagezonen (39) aus mindestens einem von einem an der Trägerfläche befestigten Ausgleichsmaterial, einem an der Trägerfläche befestigten Elektrotyp und geprägten Bereichen in der Trägerfläche gebildet werden.

14. Verfahren nach Anspruch 12 oder Anspruch 13, ferner umfassend, nach dem Kombinieren der ersten Schicht und der zweiten Schicht (11, 12), den Schritt des Abscheidens einer Sicherheitsablagerung (18) auf der ersten Oberfläche (13) der ersten Schicht (11), um mindestens eine Öffnung (16) zumindest teilweise zu überlappen, derart dass sie auf der zweiten Schicht (12), die innerhalb der mindestens einen Öffnung (16) freiliegt, angeordnet ist.

15. Verfahren zur Herstellung eines Sicherheitsdokuments (20), umfassend das Verfahren zur Herstellung eines Sicherheitspapiers (10) nach einem der Ansprüche 12 bis 14 und den Schritt des Aufbringens einer transparenten oder halbtransparenten Schutzschicht (24) auf die erste Oberfläche (13).

Revendications

1. Papier de sécurité (10) comprenant :

une première couche (11) de substrat fibreux et une deuxième couche (12) de substrat fibreux superposée sur la première couche (11), ladite première couche (11) fournissant une première surface (13) du papier de sécurité (10) et ladite deuxième couche (12) fournissant une deuxième surface (14) du papier de sécurité (10), la première couche (11) ayant au moins une ouverture (16) à travers celle-ci de sorte que la deuxième couche (12) ne soit pas superposée par le substrat fibreux de la première couche (11) au niveau de l'au moins une ouverture (16) ; et
un additif de sécurité (17) situé dans une région prédéterminée, ladite région prédéterminée entourant au moins partiellement l'au moins une ouverture (16), **caractérisé en ce que** la région prédéterminée ne s'étend qu'au-dessus, ou en dessous, d'une partie de la superficie de la première surface (13).

2. Papier de sécurité (10) tel que revendiqué dans la revendication 1, dans lequel la région prédéterminée :

entoure entièrement l'au moins une ouverture (16) ; et/ou
s'étend de manière adjacente à la première surface (13) de sorte que l'additif de sécurité (17) soit prévu sur la première surface (13).

3. Papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel la région prédéterminée s'étend au moins partiellement dans l'épaisseur de la première couche (11) à partir de la première surface (13) de sorte que l'additif de sécurité (17) soit sensiblement intégré dans la première couche (11).

4. Papier de sécurité (10) tel que revendiqué dans la revendication 3, dans lequel :

la région prédéterminée s'étend dans l'épaisseur de la première couche (11) de sorte que

l'additif de sécurité (17) puisse être détecté lorsque la première couche (11) est scindée, exposant ainsi l'additif de sécurité (17) ; ou
la région prédéterminée ne s'étend pas sensiblement dans l'épaisseur de la première couche (11) à partir de la première surface (13) de sorte que l'additif de sécurité (17) soit sensiblement situé uniquement sur la première surface (13).

5. Papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel :

l'additif de sécurité (17) n'est sensiblement pas lisible par machine (30) sur la première surface (13) et/ou n'est sensiblement pas visible à l'oeil nu lorsque la première surface (13) est observée sous une lumière réfléchie et/ou transmise ; ou l'additif de sécurité (17) peut être sensiblement détecté sur les surfaces du papier de sécurité (10) par une machine (30) et/ou est sensiblement visible à l'oeil nu lorsque le papier de sécurité (10) est observé sous une lumière réfléchie et/ou transmise.

6. Papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel la région prédéterminée ne s'étend que partiellement au-dessus du papier de sécurité (10) au niveau et/ou en dessous de la première surface (13) sous une certaine forme ou une bande allongée s'étendant d'un premier bord à un deuxième bord opposé du papier de sécurité (10).

7. Papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel l'additif de sécurité (17) :

est agencé pour donner un effet coloré, métallique, photochromique, iridescent, luminescent, fluorescent, d'émission infrarouge et/ou autre analogue ; et/ou
comprend au moins l'un(e) parmi une pluralité de fibres de sécurité, une pluralité de particules de sécurité, une pluralité de motifs de contrôle et/ou un colorant.

8. Papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications précédentes :

comprenant en outre un dépôt de sécurité (18) sur la première surface (13) chevauchant au moins partiellement l'au moins une ouverture (16) de sorte que le dépôt de sécurité (18) soit situé sur la deuxième couche (12) exposée dans l'au moins une ouverture (16) ;
dans lequel un éclairage de sécurité est prévu sur la deuxième surface (14) chevauchant l'au moins une ouverture (16), ledit éclairage de sécurité étant visible à travers l'au moins une ouverture (16) sous une lumière réfléchie incidente sur la première surface (13) ; et/ou
comprenant en outre au moins une autre caractéristique de sécurité sélectionnée parmi un filigrane, un galvanoype, une impression et/ou un fil de sécurité.

9. Papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications précédentes, ayant :

un seul pli comprenant les première et deuxième couches (11, 12) ; ou
des premier et deuxième plis, le premier pli comprenant la première couche (11) et le deuxième pli comprenant la deuxième couche (12).

10. Document de sécurité (20) comprenant le papier de sécurité (10) de l'une quelconque des revendications précédentes.

11. Document de sécurité (20) tel que revendiqué dans la revendication 10, dans lequel le document de sécurité (20) est un document de valeur choisi parmi un billet de banque, un chèque, un certificat, un passeport, une page de passeport, une carte d'identité et un permis de conduire.

12. Procédé de fabrication d'un papier de sécurité (10) comprenant les étapes consistant :

à déposer une pâte fibreuse (35) sur une surface de support pour former un substrat fibreux, ladite surface de support ayant des zones d'égouttage régulé (39) pour limiter l'égouttage à travers la surface de support afin de former une première couche (11) de substrat fibreux ayant au moins une ouverture (16) à travers celle-ci ;
à déposer un additif de sécurité (17) dans une région prédéterminée dans la première couche (11), ladite région prédéterminée entourant au moins partiellement l'au moins une ouverture (16),
caractérisé en ce que
la région prédéterminée ne s'étend qu'au-dessus, ou en dessous, d'une partie de la superficie d'une première surface (13) de la première couche (11) ; et
à former une deuxième couche (12) de substrat fibreux et à combiner les première et deuxième couches (11, 12).

13. Procédé tel que revendiqué dans la revendication 12, dans lequel :

le substrat fibreux est formé sur la surface de

support à une distance prédéterminée en dessous du niveau de la pâte fibreuse (35) ;
la deuxième couche (12) est formée en déposant une pâte fibreuse (35) sur une deuxième surface de support pour former la deuxième couche (12) d'un substrat fibreux ; et/ou
les zones d'égouttage régulé (39) sont formées à partir d'au moins l'un parmi un matériau de gaufrage à sec fixé sur la surface de support, un galvanotype fixé sur la surface de support et des régions gaufrées dans la surface de support.

14. Procédé tel que revendiqué dans la revendication 12 ou 13, comprenant en outre, après la combinaison des première et deuxième couches (11, 12), l'étape consistant à déposer un dépôt de sécurité (18) sur la première surface (13) de la première couche (11) pour chevaucher, au moins partiellement, au moins une ouverture (16) de sorte qu'il soit situé sur la deuxième couche (12) exposée dans l'au moins une ouverture (16).

15. Procédé de fabrication d'un document de sécurité (20) comprenant le procédé de fabrication d'un papier de sécurité (10) tel que revendiqué dans l'une quelconque des revendications 12 à 14 et l'étape consistant à appliquer une couche de protection (24) transparente ou semi-transparente sur la première surface (13).

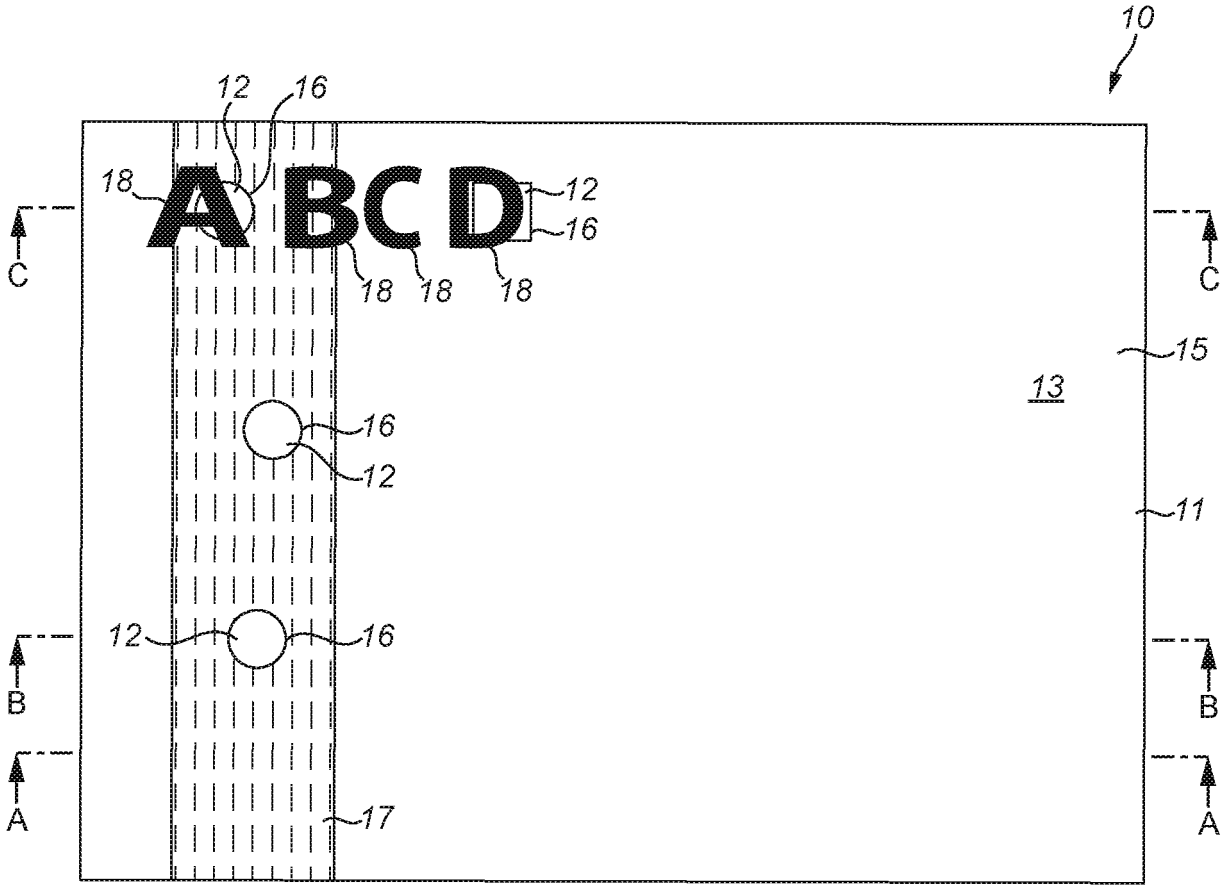


FIG. 1

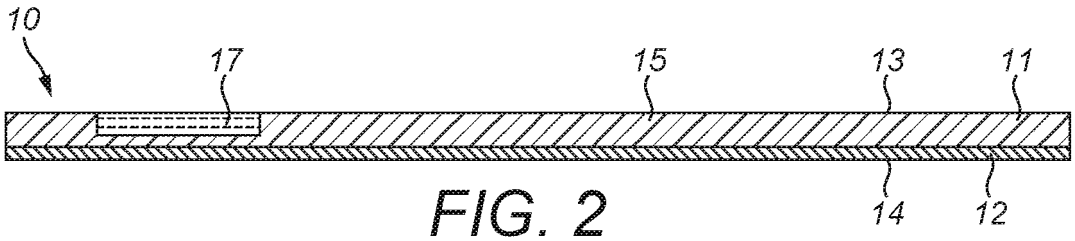


FIG. 2

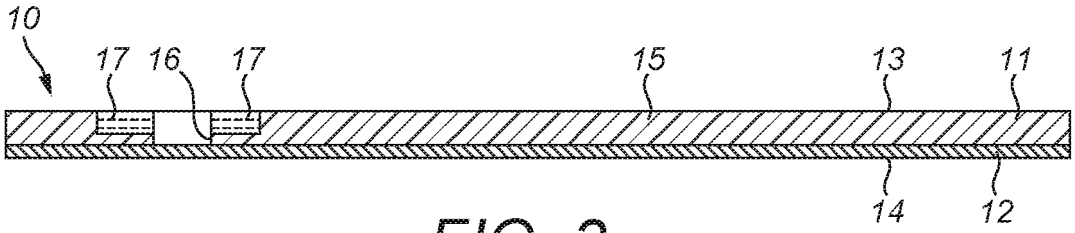


FIG. 3

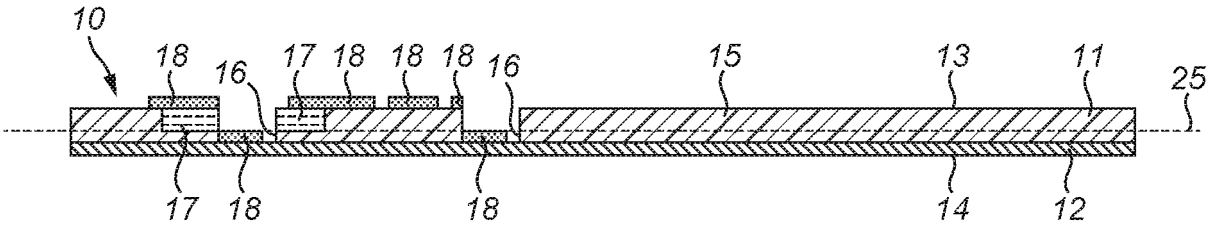
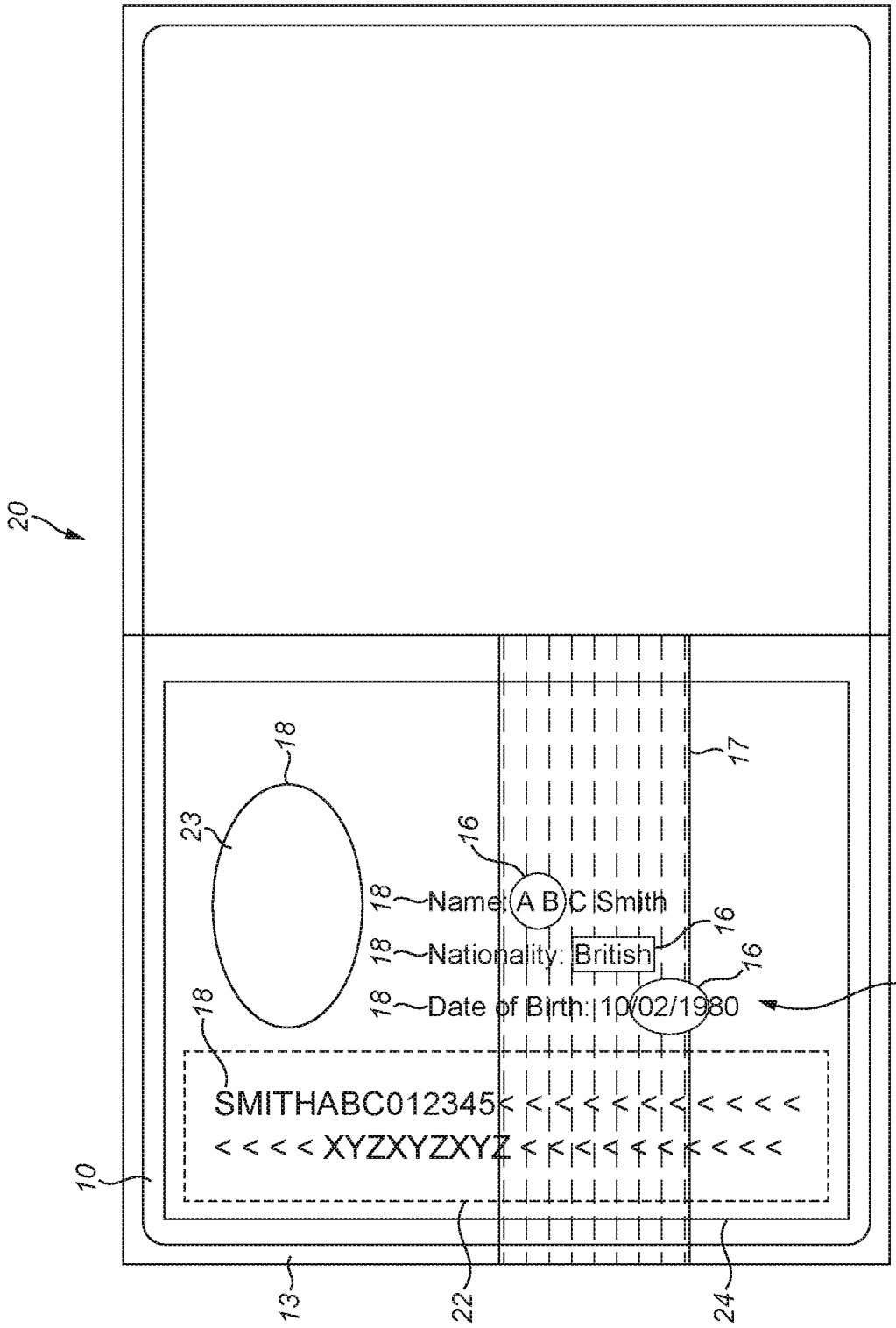


FIG. 4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Nationality: British
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Date of Birth: 10/02/1980
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FIG. 5

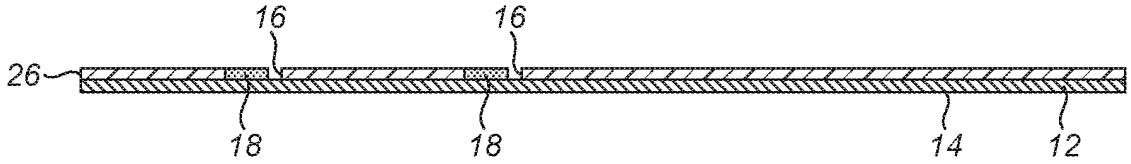

FIG. 6

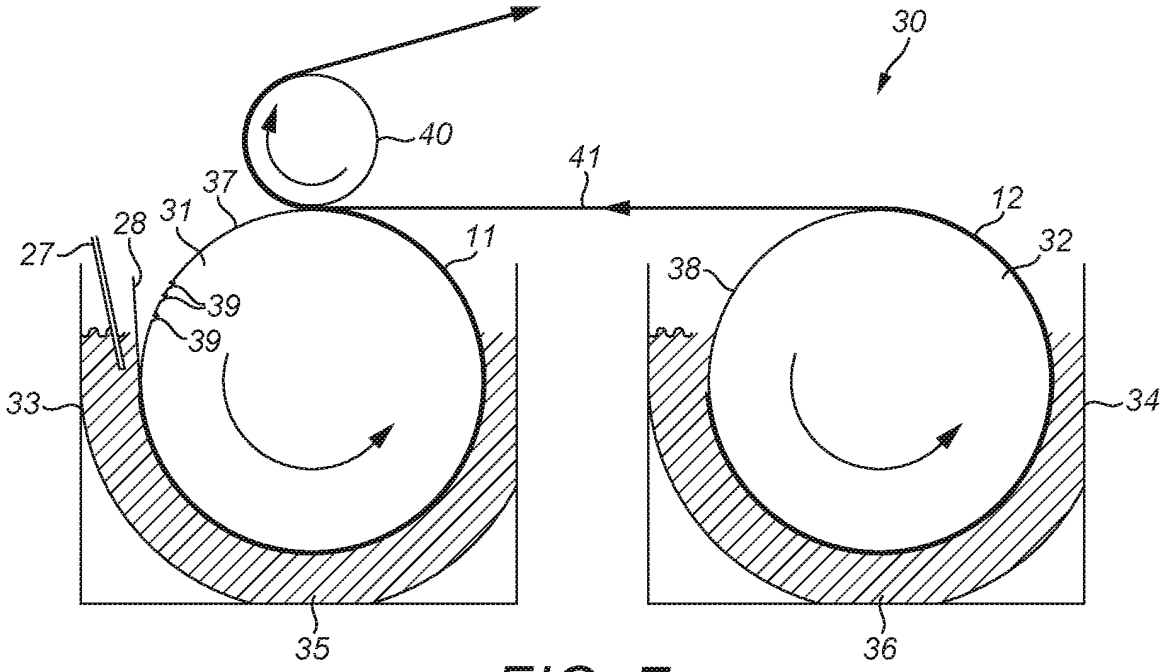

FIG. 7

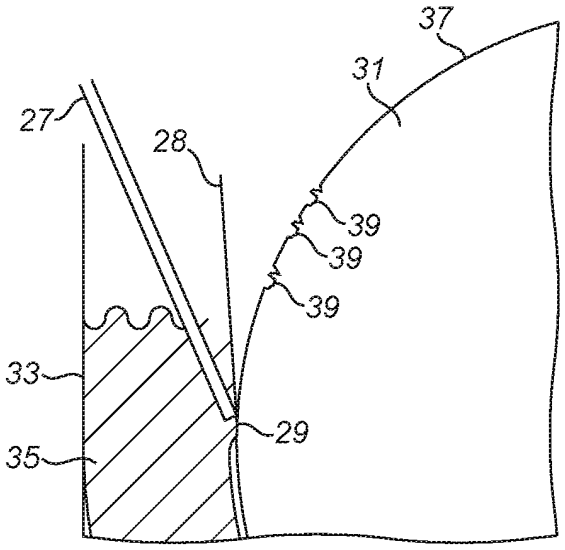

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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