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(54) **A process for obtaining security paper.**

(57) Such is applicable for obtaining paper such as that used in banknotes, identification documents or payment or gaming documents, the process using a paper-mill having two formes and an ink jet printer, the said printer being used to print letters, signs, symbols or any kind of codes on the inner face of one of the two layers of paper, when it is formed by the mill and before the said layer of paper is adhered to the other, by lamination, to make up a single sheet within which the imprint can be found, thereby being perfectly protected by both layers.

Both layers of the paper shall have weight, colour and opacity characteristics so that the imprint provided cannot be reproduced using a colour photocopier, scanner or like graphic reproduction means, and can however be fully visible and recognizable by transmitted light.

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OBJECT OF THE INVENTION

The object of this invention lies in the inclusion of an imprint by ink jet printer of printed signs between the two sheets in a paper-mill having two formers, using both formers, disguising the imprint with pigments and dyes on the pulp to yield paper that can in due course have different colours on its two faces, and using the same as an authentication or security element for the paper that is thus protected from reproduction by photocopier, scanner or the like, and for the documents manufactured using such paper. In a preferred embodiment of the invention the imprints can be in register on a selected part of the document. It is sometimes sufficient to provide watermarks on the paper and use the colours of the paper manufactured in two layers to achieve the anti-photocopying result provided by a subtle appearance of colour on the watermark that can only be seen when held against the light. Two formers are used in both cases.

BACKGROUND OF THE INVENTION

When making security paper elements are introduced that hinder the reproduction by counterfeiters and allow the public to recognise the same as such, taking security paper to mean paper that is primarily used for paper money, identification documents used by States for their citizens (ID cards, passports), and other types of valuable documents or notes, such as lottery tickets, cheques, credit and charge cards and so forth.

The easiness to reproduce the imprint by optical means and in particular using colour photocopiers makes it necessary for security paper manufacturers to provide means that may outwit the effect of such machines: colour photocopiers and scanners (working on the same principle), taking advantage of the deficiencies there are in the operation of such machines, using reflected light and the power of discrimination or sensitivity threshold available, hindering the reproduction of very faint colours.

It is easy to understand why emphasis is placed on the use of elements incorporated to the paper; as in the case of the paintings of a renowned classic author, it is technically easier to obtain an almost perfect reproduction of the appearance, because techniques have progressed over-much in this respect, than it is to obtain a good reproduction of the substrate upon which the work is based.

Just as it is more difficult to forge security paper made using the classic process with a round form and a shaded watermark, than it is to reproduce the imprint that completes the document and allows it to be used. This is why the techniques we

are referring to for protecting security documents are related to the stage of manufacture of the paper.

To protect the security paper from graphic reproduction processes, holograms and other devices are being used of late that change the appearance as the angle at which the light impinges upon the document changes, the cost being generally very high per unit. Another disadvantage is that the techniques for producing holograms are being rapidly disseminated and it will soon be easy to obtain holograms at will.

In the meantime security paper manufacturers are finding that holograms are elements with a scarcely flexible design that hugely endear the product, and must be used with other security elements such as an imprint on part of the same so that it may be identified as originally included as part of the security paper supplied to the security printers.

Security fibrils are also provided inside the paper, that are in essence plastic fibres made of a plastic material that may be coloured or not and that may be fluorescent under an ultraviolet light, thereby producing notes that are difficult to reproduce by photocopying or other graphic reproduction means.

These elements are inconvenient in their random distribution which means that they can be simulated with fluorescent felt-tip pen strokes. Many forgeries do not even take the same into account for a large part of the public is unaware of their existence.

An element that has also been incorporated to security paper to avoid the reproduction of security documents with a colour photocopier is an iridescent band of planchettes or confetti. Such are small plates of plastic material that are peculiar in that their appearance changes as the angle upon which the light impinges changes and are incorporated to security paper using a technique similar to that of Spanish patent 9102661.

Planchettes are effective elements in the battle against photocopiers but have the same disadvantage of a random distribution and many security printers deem that the unevenness they provide on the paper surface is inconvenient, and if great care is not taken in the paper-mill they could become detached during printing causing defects and flaws.

Other elements that have an important effect against reproduction and counterfeiting are security threads of all kinds; such are threads that generally have a rectangular section and are generally made of plastic material, although some may be made of or be provided with laminated metals.

In other cases micro-imprints are incorporated with a text that refers to the document, the issuing house or their face value. The effect of the threads

cannot be reproduced by photocopying for they are included in the pulp and are not accessible for reflected light, as used by a photocopier. Micro-printing on security threads is frequently used because it is very efficient.

In fact, though the position of security threads can sometimes be made out in a photocopy, the same almost disappears when viewed against the light, unlike real documents having a micro-printed thread, in which the thread is barely visible by reflection and yet the letters are perfectly legible if a magnifying glass is used.

The problem the inclusion of threads entails is that the width of the threads is generally limited to a size of 1 mm or the like. Thus, micro-texts are also limited to very small letter sizes. This is because the threads disturb the sheet of paper and may indeed break the same if very wide threads are inserted because there are no fibres where the thread is physically located to form the typical braiding of fibres that yield the sheet of paper.

Another disadvantage attached to the provision of security threads is that they may turn over when they are inserted in the sheet. Therefore, in order to make sure that the characters may be read against the light on either side of the document, texts are usually printed alternating a model and their specular image, in order that at least a complete text shall stand upright on one of its sides.

Another disadvantage of security threads is that if they are very substantial they can be removed from the sheet of paper and used for counterfeits, for instance using the same for reproductions of a higher face value and deceiving automatic identification machines, or else the public may simply reject the document due to the absence of an identification element that is deemed material. Therefore though the security thread is useful as an anti-photocopying element, it entails certain difficulties.

As micro-printing is an interesting characteristic some central banks use two security threads, one for identification by detecting machines sensitive to the presence of this element, and another in which the micro-printing effect is enhanced. In the latter case film printing and cutting techniques upon which the production of the security threads is based have been improved in order for the micro-imprint to be in register with the thread width and thus make the best of the possibilities of having a greater thread width and a greater letter height. This proves that it is interesting to offer the public an element that cannot be photocopied and can be immediately recognised by part of the public. Clearly two threads pose greater problems for security paper manufacturers than only one.

DESCRIPTION OF THE INVENTION

The technique of the present invention makes it possible to provide the paper with a security element that assists authentication and is beneficial as compared with known elements, inasmuch as it relies upon a process in which a paper-mill with two formers is required, which normally restricts the possibility of having the appropriate machinery.

If a micro-imprint is used, the signs or texts of such micro-imprint are provided without any substrate material (without contact with the material to be printed, in this case the sheet of paper) by means of an ink jet printer, and virtually without any practical limitation for the size of the text (letter height) in accordance with the limits available in security documents.

In fact, ink jet printers that are controlled by means of a console or computer terminal, produce texts, signs, letters including all kinds of symbols, that may be easily modified by computer processes and are hence very flexible.

In order for these symbols to be incorporated in such a way as to fully prevent the exact reproduction of the document and to be very difficult to execute by other means, it is sufficient to make the imprints on the inner face of one of the two still wet sheets of the security paper that is being formed in a security paper-mill with two formers. In this case, as the inks of ink jet printers are very short-lived and their solvent fraction rapidly evaporates, when the two layers of paper are joined in the same paper-mill the inks shall have almost dried and hence the pressure exerted by the paper-mill on joining the two layers and later wet pressing, surface sizing, drying and calendering stages shall not affect the newly formed imprints on the wet sheet, the latter being essentially unchanged upon completion of the paper making.

As in the case of the printing of sufficiently large symbols it could appear that the imprints are on the surface of the paper and this would have no merit nor would an especially distinguishing identification element be contributed, to prevent this the pulp is provided with loads and dyes that duly disguise the presence of the imprint inside.

In fact if the paper has a suitable degree of opacity provided by the loads and dyes in suitable quantities, the result of the ink jet printing inside the two layers of papers obtained with the invention is not visible to the outside and can mislead the photocopier, that cannot reproduce the printed symbols, these being however perfectly visible against the light, and fully visible to the public.

The use of dyes and loads in suitable quantities can cause the colour to lie just under the threshold at which photocopiers distinguish colours. The original paper can therefore have a given col-

our and the reproduction using a photocopier a different colour, that will generally be white or almost white, for the paper that is generally used for photocopies is white.

If further advantage is to be had of the potential of a mill having two formers, each layer can be made with a different shade in combinations that stand out even more in contrast with the main colours of the imprint on each side, in such a way that a photocopier cannot possibly reproduce the colour of the paper, for the background of the document would not have to be provided with a colour that is difficult to reproduce, being under the discrimination threshold of the photocopier, but with two base colours, that would both be difficult to reproduce.

When the photocopier works on both colours, as in the case of documents such as notes that have two sides, it would be too obvious that the reproduction is not like the original, for if the colours are carefully selected each side would have a colour differing slightly from the original, hence drawing the users' attention.

The type of sign or symbols to be printed with an ink jet printer would be of the type that is currently to be found on security threads that security paper is provided with, saving that in this case the size would not be limited by the dimensions of the security thread or substrate, such being as the case may be a reference to the paper manufacturers, or the issuing house, or the face value of the document, or the year of issue, and may vary at will, as may be most effective.

As a computer can be used to obtain all manner of signs or graphic symbols that can be printed perfectly, one of the most important features of this invention is that the imprint can be adjusted to the specific needs of a client.

In a preferred embodiment of the invention a pulse counter and a reference element in a security paper manufacturing mould and a phase control system having a microprocessor can be used to accurately establish the precise position and size lengthwise of the manufacture of the paper, of the code, in a manner similar to Spanish patent 9000858, owned by Fabrica Nacional de Moneda y Timbre, where the security paper sheets are marked with a code at the time of manufacture in the paper-mill.

With this latter variation of the basic invention it is possible to encode with a correlative or unique number or code every single note in the manufacture of security paper so that its affiliation and validity can be registered from the very moment of manufacture. It would suffice to provide a code relying upon a clock capable of giving the time in date, hours, minutes, seconds and hundredths of a second at the time the paper is produced, and

further add a note position code crosswise of the paper-mill.

If a decimal hour definition system is used changing the time into a decimal numbering of hours (with minutes, seconds and hundredths becoming a decimal fraction of an hour) and hexadecimal base numbering, for instance to give the time, an advantage can be had of the lesser need for digits to express the same quantity in each of the above concepts and secrecy and a difficulty to figure out the codes included in each note are added.

A time function to provide the codes is useful in that in the event of failure or breakdown of one of the markers or printers, there will be no need to modify the codes in the rest as in the case of conventional simple or correlative numbering, and upon a later quality control only notes with faulty or missing codes would have to be eliminated. Such coding would be priceless for establishing in the event of quality defect of a document all other details as to its manufacture, for it would be as a lot number included in food or pharmaceutical products packaged to be publicly sold.

If the coding is in the form of a bar-code this invention can be used for high-speed control using machines such as those there are at central banks. Bank machines detect whether other security elements are genuine, in other words using a great many other features and the bar-code could be used to find out the useful life of the note and make automatic statistics as to the degree of wear of the notes as a function of their age, without the bar-code affecting the overall appearance of the note as in countries such as Holland that have the bar-code on the outer surface of the note. The code subject hereof would moreover be inviolable whereas the code used in the Netherlands is on the outside.

As an alternative to black, dyes of different colours can be used to achieve strange or curious effects unattainable by other means.

Further advantage can be had of ink jet printing inside the sheet on the other extreme in which the colour and opacity of both layers of paper made in a paper-mill having two formers is such that the imprints appear clearly on the outside of the paper and on both sides. As the ink jet printing is unique and in order to reproduce an original document it is in general necessary to pass the document twice through the reproduction apparatus (photocopier, scanner and so forth), the physical inability to achieve a perfect coincidence between both faces means that upon holding the reproduction against the light the ink jet printed imprint inside the paper made carefully selecting the model to print shall be "runny" or blurred, and manipulation shall be obvious. In printing notes it is very common to use a

background printing technique called simultaneous printing in which the backgrounds of both faces have a so-called coincidence motif to achieve this same effect on holding the document against the light.

The latter effect can be enhanced causing part of the subject ink jet printer imprint to be sufficiently small in size and light in shade so as not to appear in reproductions, combined with part of the imprint being of a size and shade which shall cause the same to stand out and be easily reproduced, whence it will be clear on holding the counterfeit against the light that a part of the imprint is missing.

Sometimes, when making paper in a machine with two formers, so that one of the layers of paper has a watermark, it is not necessary to provide any kind of imprint, to achieve the effect of rendering photocopying difficult and for the user to be able to identify the document. It is sufficient to use different shades of paper, light enough so as not to be picked up in full by the reproducing apparatus (photocopier, scanner and so forth) and make the best of the idea that watermarks are usually celebrity figures.

The colour of the shaded areas is usually grey or bluish ("cold" shades) and the colour of the lights in portraits pink, orange or yellow ("warm" shades). From the standpoint of the colourimeter warm shades have positive or almost positive a and b coordinates in the CIELab system, whereas cold shades have negative or almost negative coordinates.

In the above light it would suffice to manufacture paper in two layers with one of the layers having a watermark, both colours being very faint and with a low degree of optical saturation (in other words essentially greys) the watermark layer however having cold shades and the other layer with warm shades.

Under these conditions not only against the light but merely by transparency a dichromatic effect may be observed on the watermark area that is not easy to reproduce by graphic reproduction means such as photocopiers and scanners, and in which the difference between the original and the copy can be clearly seen when held against the light.

PREFERRED EMBODIMENT OF THE INVENTION

The following practical embodiment of the invention is established as the preferred embodiment thereof.

EXAMPLE: A security paper is manufactured for paper money with two layers, one weighing 60 g/m², with a cotton composition and a colouring defined by the CIELab chromatic coordinates mea-

sured in a colourimeter at around L=92, a=-2.5, b=-1.5 and a layer weighing 30 g/m², with a cotton composition and chromatic coordinates L=90, a=0.5, b=1.5, the opacity according to the "printing" process being at around the interval of 86 to 93 %. In paper having such characteristics a number of ink jet printers are used to print a bar-code using black dyes, the code being provided with the date, hour, minutes, seconds and hundredths and the position number of the marker (and hence of the note crosswise to the paper-mill taking the leader side as reference) using a quartz clock fitted on the marker console. The imprint is provided on the 30 g/m² layer on the side that shall later be found inside the note when the two layers are joined. The 60 g/m² layer has a watermark with a portrait of the main character of the note that is repeated in each of the notes making up the paper. A synchrony system sends a pulse from an encoder or microprocessor and orders are given from the same to a set of markers arranged transversely to the mill in order to print only one code as defined above on each of the notes making up the paper for notes in register at the preset position in respect of the watermark. The code height is 9 mm and the overall length is 5 cm. The two layers thus formed are compressed, sized and dried to yield a single sheet. The paper is then used to print banknotes that are then issued.

Claims

1. A process for obtaining security paper, such as used in banknotes, identification documents and payment or gaming documents, using a paper-mill having two formes, characterised in that an ink jet printer is used to print letters, signs, symbols or codes on the surface of one of the layers of newly-formed paper that will later be laminated and adhered to the other in the same paper-mill to yield a single sheet of paper, leaving the imprint inside the sheet, at the interface between both layers, the paper of each of the two layers having weight, colour and opacity characteristics such that the imprint provided cannot be reproduced by a colour photocopier, scanner or like graphic reproduction means and may however be fully visible and recognizable by transmitted light, being inside the sheet so formed.
2. A process for obtaining security paper, such as used in banknotes, identification documents and payment or gaming documents, using a paper-mill having two formes, characterised in that an ink jet printer is used to print letters, signs, symbols or codes on the surface of one of the layers of newly-formed paper that will

later be laminated and adhered to the other in the same paper-mill to yield a single sheet of paper, leaving the imprint inside the sheet, at the interface between both layers, the paper of each of the two layers having weight, colour and opacity characteristics such that the imprint provided shall appear on a reproduction made using a colour photocopier, scanner or like graphic reproduction means, apparently complete, but in practice only partially, and so that if the counterfeit involves a copy of both sides of the original document, all or part of the reproduction of the imprint provided by an ink jet printer shall be seen duplicated as when an attempt is made at reproducing a coincident sign such as those used for security purposes in banknotes and however in the original document it may be fully visible and recognizable and unique by means of transmitted light, being inside the sheet so formed.

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3. A process for obtaining security paper, as in claims 1 and 2, characterised in that two different colours are used, one for each layer, preferably with such characteristics that they are difficult to reproduce by means of a photocopier, a scanner or the like as a result of a suitable combination of shade, degree of colour saturation and opacity.

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4. A process for obtaining security paper, as in claims 1 and 2, characterised in that one of the two layers, or both, carries a watermark made in a cylindrical mould such as that used to provide the shaded watermarks banknotes carry.

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5. A process for obtaining security paper, as in claims 1 and 2, characterised in that one of the two layers, or both, is made in a "Fourdrinier" or flat mill fitted with a dandy roll to produce watermarks in two shades.

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6. A process for obtaining security paper, as in the above claim, characterised in that the imprint has a printed height crosswise to the mill direction of between 3 and 20 mm, and preferably a height of between 3 and 11 mm.

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7. A process for obtaining security paper, as in claims 1 to 5, characterised in that the imprint is made of alphabetical signs, logotypes, shields or symbols standing for bodies, societies, institutions, companies or states, figures or symbols of any kind executed using computer methods such as a bar-code, the imprint being otherwise provided in register with the paper watermarks.

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8. A process for obtaining security paper, as in the above claims, characterised in that the imprint is a correlative or unique and progressive code comprising date, hour, minute, second, hundredth of a second and relative position within the sheet crosswise to manufacture starting on the leading side of the mills.

9. A process for obtaining security paper, as in the above claims, characterised in that the imprint is of a colour that relies on the substrate colour to draw the attention of the public, for instance a fluorescent colour, a colour complementing the chromatic shades of the paper background or a colour that can scarcely be distinguished by means using reflected light.



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EUROPEAN SEARCH REPORT

Application Number
EP 94 50 0020

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 453 131 (JAMES RIVER CORPORATION) * column 2, line 21 - line 30; figure 1 * * column 5, line 34 - line 44; claim 1 * ---	1-9	B41M3/14 B41M3/10 G03C5/08 D21H21/42 B42D15/00
X	FR-A-2 448 983 (GAO GESELLSCHAFT FUR AUTOMATION UND ORGANISATION MBH) * page 1, line 1 - line 5 * * page 7, line 4 - line 13; claims 1,3,4,11 * ---	1-9	
X	WO-A-92 16378 (AMBLEHURST LIMITED) * page 6, line 13 - line 21; figure 1 * * page 10, line 13 - line 19 * * page 14, line 16 - line 22 * * page 16, line 35 - page 17, line 10; claims 1,6,7,17 * -----	1-9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B41M G03C D21H B42D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 June 1994	Examiner Bacon, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			