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(54) **Copy-protected documents and printing method for obtaining copy-protected documents**

(57) The invention relates to documents, in particular so called security documents including banknotes and the like, which are protected against copying, and to a method for printing such documents.

According to the invention at least part of the information

on the documents consists of lines and/or parts of lines and/or dots having a width of less than 20 micron and preferably the distance between those lines and/or parts of lines and/or dots is not less than 200 micron.

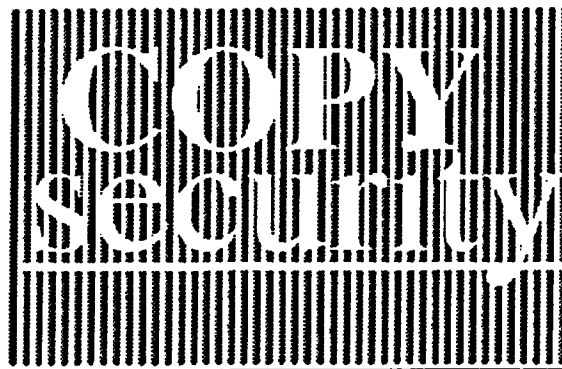


FIG. 1

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Description

The present invention relates to the protection of documents, in particular security documents, against counterfeiting by copying.

The expression "document" as used in this text refers to any support of visible information. Thus, a document according to this specification can consist of a sheet of paper or a sheet of any other material, or can even consist of any object, which sheet or object bears any information which is detectable with the eye.

The expression "information" as used in this text refers to any representation, image, text, message, symbol, pattern and the like, which may be applied in visible form on a document.

Counterfeiting of documents, in particular so called security documents, such as banknotes, shares, bonds, warrants, cheques, identity cards and other person identifying documents, visa, drivers licences, airplane tickets, bank cards, credit cards, post stamps, stickers for sealing and/or saving, food bonds, discount documents, diploma's, certificates, entrance documents, lottery tickets, securing stickers, and other secret or highly confidential documents, constitutes a severe problem. This problem has taken an increased importance with the development of colour photocopying equipment. In addition to the increasing quality of the colour reproductions, the number of colour copiers available on the market is steadily growing. The use of this equipment does not require special skills nor specialised technical knowledge in printing techniques and processes. The risk that such equipment is used for counterfeiting security documents, in particular for counterfeiting banknotes, is therefore constantly growing.

In order to protect security documents against counterfeiting, security printers use different printing processes such as wet or dry offset, intaglio, screen and typographical printing, using specific colours which are printed in rainbow and can not be obtained by a simple mixture of cyan, yellow, magenta and black; hybrid printing techniques are also used such as hot transfer for transferring foil, holograms, kinegrams, etc.

Furthermore, the paper of a security document such as a banknote is generally made of 100% cotton and is further protected by a watermark, a security thread, fluorescent fibers of different colours and length and/or by introducing different kinds of so called "planchettes" holding fluorescent, light-interference, or other eye or machine detectable characteristics.

Screened images and patterns generally used in the ordinary printing industry are generally avoided for this reason the design of e.g. a banknote is often completely based on images obtained by lines formed into security patterns and so called "guilloches".

Despite the mentioned security features, colour photocopying is to be considered a danger for the counterfeiting of banknotes, even when a number of the security features can not be reproduced or can only be reproduced with an unacceptably poor quality. Older

people, people with vision problems, less perceptive people or people under the stress of the circumstances are generally easy victims of colour photocopying counterfeited banknotes.

It has also been proposed to protect security documents by specific printing techniques involving that certain features of the information are modified upon copying. Examples of such copy-protection printing techniques are the so called Frequency Modulation (FREM) screening technique - as disclosed in EP 328 173 - and the so called Screen Angle Modulation (SAM) printing technique - as disclosed in EP 490 457.

These new developments, although providing interesting improvements with respect to the standard processes referred to above, however still have inherent drawbacks in respect of processability and/or effectiveness of their counterfeit protection.

The present invention now provides a new method for obtaining copy-protected documents which is based on a totally new concept.

Whereas known methods have sought to include provisions on the documents which are not reproducible by copying (watermark, metal security thread, fluorescence, etc.), or have sought that certain features of the information are modified upon copying (FREM technique, SAM technique), the method according to the invention involves that the information itself which is produced according to said method is not copied, i.e. the information itself disappears.

The invention is based on the finding that very fine lines, having a width in the order of 5 micron, can be produced with commercial wet-offset printing techniques, but that the currently known colour photocopiers are not able to reproduce fine lines having a width in the order of 20 micron or less. Thus, although the output resolution of a write-out laser is higher than a line thickness of 20 microns, it is not possible for colour copiers to reproduce such very fine lines even though the toners of the photocopiers have a particle size of 5 to 6 microns.

It has for instance been demonstrated that lines having a thickness of 14 microns, printed on a normal banknote paper using a common offset ink holding reflective pigments, with fluorescent characteristics under UV light infrared visible or invisible black ink and/or metallic inks, could easily be seen by the human eye but could not be detected by the colour photocopier and could not be reproduced by this type of machinery.

The invention accordingly provides a copy-protected document on which at least part of the information consists of lines and / or parts of lines and/or dots having a width of less than 20 micron.

It has furthermore been found that to obtain an optimal non-copy result, the distance between the printed fine lines in accordance with the invention should not be less than 100 micron preferably not less than 200 micron and most preferably not less than 250 micron to avoid that the colour copier integrates a number of lines as a broader line or surface covering colour shade.

Accordingly the invention preferably provides a copy-protected document on which at least part of the information consists of lines and / or parts of lines and/or dots having a width of less than 20 micron, whereas the distance between lines and / or dots is not less than 200 micron.

According to a preferred embodiment of the invention at least part of the information consists of a **pattern** of lines and / or dots having a width of less than 20 micron whereas the distance between lines and / or parts of lines and/or dots is not less than 200 micron.

The invention also provides a method for printing documents in which at least part of the information on the document is printed using lines and / or parts of lines and/or dots having a width of less than 20 micron whereas preferably the distance between lines and / or parts of lines and/or dots is not less than 200 micron.

According to a preferred embodiment of the printing method of the invention at least part of the information on the document is printed as a **pattern** of lines and / or dots having a width of less than 20 micron whereas the distance between lines and / or parts of lines and/or dots is not less than 200 micron.

The printing method of the invention is very suitably carried out using the wet offset printing technology. It has indeed been found that the proper plate making and print production with fine lines according to the invention can not or hardly be achieved with relief plates as used for dry offset technology. The reason for this seems to reside in the fact that the relief on top of the plates apparently limits the width of the fine lines to about 30 micron, due to the underwashing (photopolymer plates) or underetching (metal plates) phenomenon of the printing relief and due to breaking away of fine lines relief during the washing out, etching and/or printing process.

Wet-offset plates, generally known in the common printing industry as presensitised offset plates, do not have such relief, do not need to be washed out, neither to be etched in a way as described above for dry-offset plates. By moistening the plate before inking it maintains the ink acceptance of the printing parts and the refuse of ink of the non-printing parts.

Because of the absence of the relief, wet-offset plates permit to copy finer lines and to keep the fine lines on the plate during printing.

It is a further feature of the invention to integrate the concept of copy-protection of documents by means of fine lines with other copy-protection means.

Thus, according to a further embodiment of the invention, copy-protected documents are provided in which at least part of the information on the document consists of lines and / or parts of lines and/or dots having a width of less than 20 micron and being composed of colours of the so called PANTONE MATCHING SYSTEM (PMS) standard, which cannot be easily reproduced by a mixture of magenta, cyan, yellow and black.

Using such colours for printing the above mentioned very fine lines, respecting mutual distances between the lines leads to a pattern that can not be

reproduced by a colour photocopier.

In case the apparent density of the printing should be too high - f.e. resulting from the use of an excessive quantity of ink and/or pressure in the printing press so that the line width is extended and become larger than 20 microns on the printed paper - the colour reproduction will show an integration of lines into a full surface but still will produce a reproduction in a wrong colour shade.

The fine lines according to the invention may be oriented in any direction with respect to the length direction of the support, such as vertical, horizontal or any other direction, or in combinations of directions, either as isolated fine lines, or integrated and / or built into line structures and / or patterns and / or so called guilloches.

It is also of no importance whether the fine lines are printed in single colour or multi colour.

According to another interesting feature of the invention, information may be embedded in the fine line patterns protecting the documents. It has been found that this feature increases the perception by the human eye. Information can be embedded in different ways and/or combinations such as styling the length of the lines in such a way that they form a perceptible image; using varying line thicknesses in a modulated way so that the differences in thickness of the very fine lines form an image to the human eye whereby it has been taken care that no point of the line has a thickness above 20 microns; reserve the image in an equal tone very fine line pattern; printing an image using two printing plates whereby the second print makes an inprint and creates an image between the fine lines resulting from the first printing plate, etc.

Because of paper distortion due to the moisture of the plate and for reasons of print register, embedded information by inprinting a second colour should preferably be printed in a one-operation printing machine using a printing press preferably based on the satellite-construction principle such as a 4/4 Super-Simultan press, which is a wet-offset press specially used for printing banknotes and high security documents.

Thus, the fine line patterns according to the invention may for instance consist of patterns of parallel fine lines printed in alternating colours A and B, with line widths of below 20 micron, preferably from 5 to 20 micron, most preferably in the order of 10 to 14 micron, and with distances between the lines of at least 100 micron, preferably at least 200 micron, most preferably in the order of 250 micron, whereas the lines A are printed by a first printing plate and the lines B are printed by a second printing plate.

The fine line patterns according to the invention may for instance also consist of information patterns embedded in the patterns of fine lines, as illustrated in figure 1.

The patterns of fine lines may on the other hand also form the patterns of information, as illustrated by figure 2.

The copy-protection print according to the invention may furthermore also consist, for instance, of single col-

our printed patterns as illustrated in figure 3, combining horizontal and vertical fine lines. The information pattern "BNB" is embedded by using different line directions and different line widths inside the embedded pattern. Square dots are obtained by considering these dots as fine lines having a length equal to their width. Such dots are distinct from those resulting from a photographic or computer controlled screening technique and are not to be confused with those resulting from said letter techniques.

The copy-protection print according to the invention may on the other hand also consist, for instance, of single colour printed patterns as illustrated in figure 4. This embodiment of the invention is similar to that illustrated in figure 3, except that in addition in the information pattern "BNB" a guilloche pattern has been printed in offset underneath the fine line structure. The line patterns are printed on top and in register with the offset printing underneath.

It should be noted in respect of the figures that although in the practice of the invention lines are used with line widths of below 20 micron, preferably from 5 to 20 micron, most preferably in the order of 10 to 14 micron, and with distances between the lines of at least 100 micron, preferably at least 200 micron, most preferably in the order of 250 micron, for the sake of illustration the relative proportions of the line widths and line distances with respect to each other and with respect to the embedded information patterns or with respect to the information patterns formed by the lines, have NOT been observed.

Documents according to the invention may be printed on paper, either with or without watermark, or on totally or partly synthetic materials and substrates such as polyethylene, polyester, polypropylene, polycarbonate, or other plastic substrates, whether these substrates are transparant, translucent metallic substrates or any other substrate obtained by combining several of said substrates or opaque.

Documents according to the invention may also be coated, be it over part of, or the entire image, or over the total surface of the document. It is unimportant whether this coating is a varnish, a UV curing laquer, a gelatine layer or any other coating or layer having image receiving characteristics or not, or whether the documents are printed on substrates preprinted in offset or in another printing process like silkscreen, flexographic printing, typographical printing, gravure printing, intaglio printing, inkjet printing, hot transfer and/or cold transfer, wax printing or other printing systems, whereby one or several pigments have been used such as common reflective pigments, metal pigments, photochromatic pigments, light sensitive pigments, fluorescent pigments, phosphorescent pigments, magnetic pigments, pigments visible or invisible under infrared illumination or light interference pigments have been printed underneath or on top of the fine lines (of less than 20 microns line width), or whereby one or several of said pigments are used as pigment in the ink to print said fine lines.

According to the invention it is also possible to proceed in such manner that the fine lines are not printed directly onto the document but preprinted on a temporary substrate in order to be brought onto the final substrate by using a transfer technique, whether this transfer technique is a hot or a cold transfer technique.

On the other hand the fine lines may also be printed or transferred onto a transparant substrate in order to put this substrate as a protective layer over a preprinted document in order to protect this receiving document against unauthorised acces or fraude, by using laminating processes, glue or another adhesion technique, without importance if the document itself shows fine lines of less than 20 microns line width.

The fine lines may also be printed or transferred on a receiving document which is not preprinted but carrying an image or information brought onto the document by applying other techniques and processes than printing such as photography, DTR transfer, embossing, encoding by punching or other mechanical treatment, sputtering or any other technique permitting to bring information onto a substrate.

In accordance with the invention it is also possible to provide the fine lines not directly onto the surface of the document or substrate, but be put on the document or substrate as a sticker, an overlay sheet or other protecting securising item.

According to the invention the substrate may also be provided with a preprinted pattern of fine lines, constituting security information, which substrate can be used afterwards for receiving confidential or secret information using photocopy machines, digital printing presses and systems regardless the technology used by the printing press or system, data transmitting systems, computer printers, designing and landmap plotters and all other data writing and/or designing systems whether the system has been developped and/or used for civilian or military purposes. This is particularly usefull when it is an absolute necessity that the data and/or data sheets are reproduced and distributed in a controlled number of copies and/or when the recipients of such copies need a feature for checking authorized and approved copies out of fraudulent unauthorized ones.

Additional features of the invention will result from the following description of detailed embodiments provided by way of illustration, without limiting the scope of the invention.

Other embodiments of the invention and modifications with respect to the given embodiments will be readily understood by those skilled in the art and are considered to be within the scope of the invention.

EXAMPLE 1

A film with very fine lines having 14 microns thickness was obtained by using an Adobe Illustrator 3.2 software, a MacIntosh computer working in Postscript language, with a Scangraphic Imagesetter Scantext 2030 PS as plotter, used on its highest resolution of

3.252 DPI. For plotting the fine lines of 14 microns "Accumax Rapidaccess" film made by Kodak has been used. As contactfilm for copying the printing plate "Contact 2000 CA7" film made by Kodak was used.

The copy of 14 micron thick lines could be obtained on different wet-offset plates available on the market such as aluminium Polychrome GP 6 plates, Trimetallic plates and other commercial wet-offset plates. For determining the optimal exposure and development time of the plates, an UGRA controlestrip was added in order to control the different steps of platemaking. On the copy frame for plate copy the electrical power was stabilised, the vacuum system put to a maximum for having a maximum contact between the film and photosensible layer of the printing plate and the lamps controlled on light intensity, light distribution and stability.

Using this method and controlling very strictly every step of the platemaking, a wet-offset plate with only 14 microns thick lines was obtained.

EXAMPLE 2

A similar fine line pattern has also been plotted on a Barco 9700 plotter using a resolution of 10.160 DPI. This resulted in very fine curved guilloche lines of a very high quality. Vertical and horizontal lines on this apparatus resulted in very high quality lines of 10 to 11 microns. Curved lines plotted on this apparatus maintained a very high quality and did not show a broken effect up to a thickness of 14 to 15 microns being completely below the reproduction possibilities of the colour photocopiers.

EXAMPLE 3

Printing of the plates of examples 1 and 2 has been done on a GTO Heidelberg offsetpress which is a commercial known machine and on a Super-simultan 4/4 wet-offset press which is a printing press used for printing the offset printed images on banknotes and other security documents. Both these machines are equipped with a water/alcohol moistening system for wet-offset printing. All these machines were brought into optimal technical conditions, blankets, cylinders and inking rollers were controlled up to tolerances of 1/100 of a mm, print pressure during printing was kept severely under control and the print process was undertaken under thermostabilized working conditions.

EXAMPLE 4

The prints obtained in example 3 have been photocopied using standard commercial colour copiers. In particular use was made of a CANON CLC 500 colourcopy machine. On the obtained copies, the fine line pattern areas of the printed documents appeared as blank areas.

Claims

1. Copy-protected document, characterised in that at least part of the information on the document consists of lines and / or parts of lines and/or dots having a width of less than 20 micron.
2. Copy-protected document according to claim 1, characterised in that the distance between lines and / or parts of lines and/or dots is not less than 200 micron.
3. Copy-protected document according to claim 1, characterised in that at least part of the information consists of a pattern of lines and / or parts of lines and/or dots having a width of less than 20 micron whereas the distance between lines and / or dots is not less than 200 micron.
4. Copy-protected document according to claim 1, characterised in that at least part of the fine lines are composed using colours of the PMS standard.
5. Method for printing documents, characterised in that at least part of the information on the document is printed using lines and / or parts of lines and/or dots having a width of less than 20 micron.
6. Printing method according to claim 5, characterised in that the distance between lines and/or parts of lines and/or dots is not less than 200 micron.
7. Printing method according to claim 5, characterised in that at least part of the information on the document is printed according to a pattern of lines and / or parts of lines and/or dots having a width of less than 20 micron whereas the distance between lines and / or parts of lines and/or dots is not less than 200 micron.
8. Printing method according to claim 5, characterised in that at least part of the fine lines are composed using colours of the PMS standard.
9. Copy protected document, respectively printing method according to any one of the preceding claims, characterised in that information is embedded in the fine line patterns protecting the documents.
10. Copy protected document, respectively printing method according to claim 9, characterised in that the fine line patterns consist of information patterns embedded in the patterns of fine lines (as illustrated by figure 1), form the patterns of information (as illustrated by figure 2), consist of printed patterns combining horizontal and vertical fine lines with an information pattern embedded by using different line directions and different line widths inside the

embedded pattern (as illustrated by figure 3), optionally comprising a guilloche pattern printed in offset underneath the fine line structure (as illustrated by figure 4).

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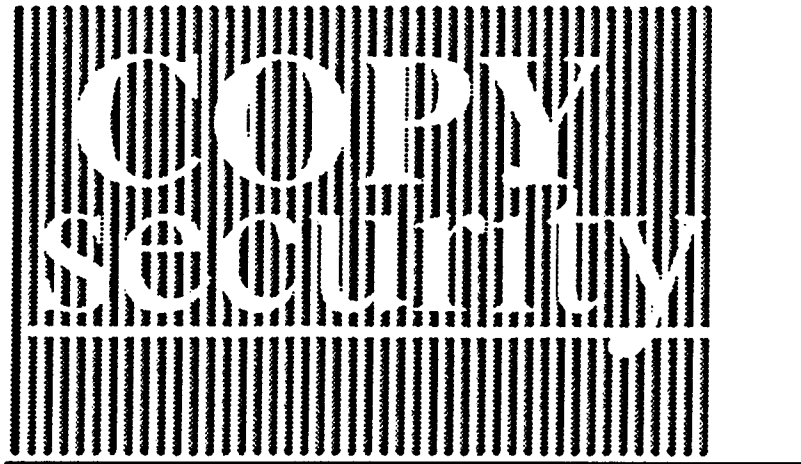


FIG. 1

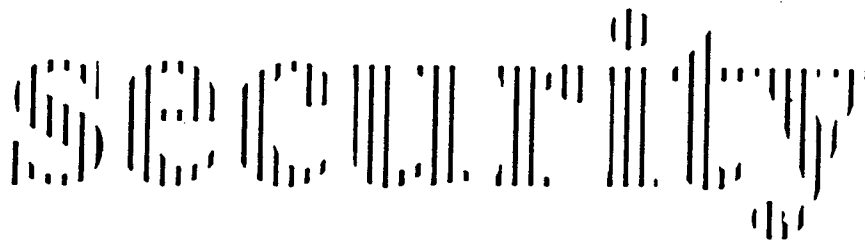


FIG. 2

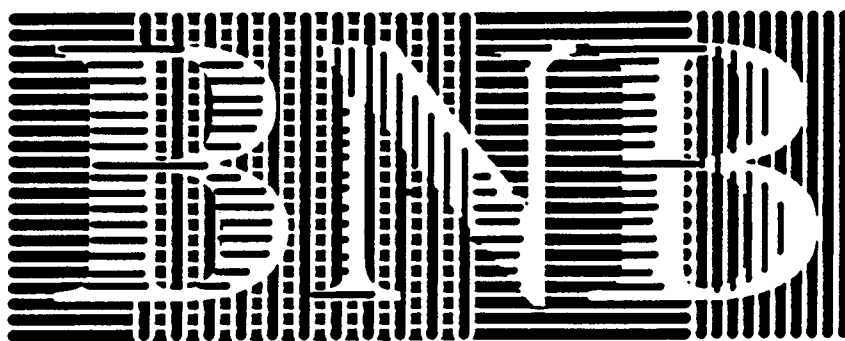


FIG. 3

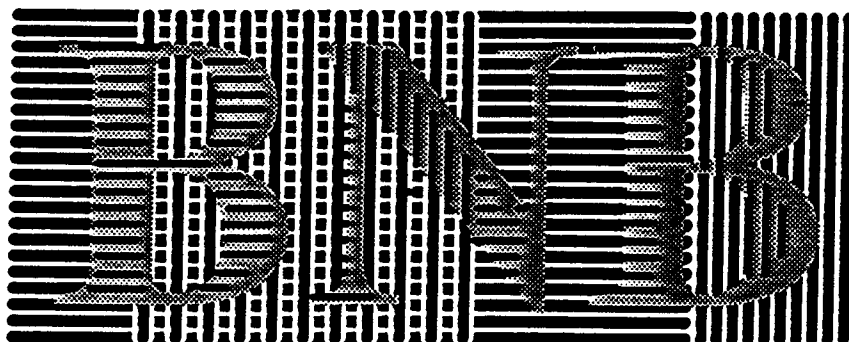


FIG. 4



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 0054

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-0 546 765 (MOORE BUSINESS FORMS) * column 3, line 29 - line 41 * ---	1-10	B42D15/00 B41M3/14
X	EP-A-0 384 897 (DE LA RUE GIORI) * claim 8 * ---	1-10	
A	GB-A-2 217 258 (SUOMEM PANKIN SETELIPAINO) * the whole document * -----	1,5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B42D B41M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 June 1995	Examiner Evans, 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			

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