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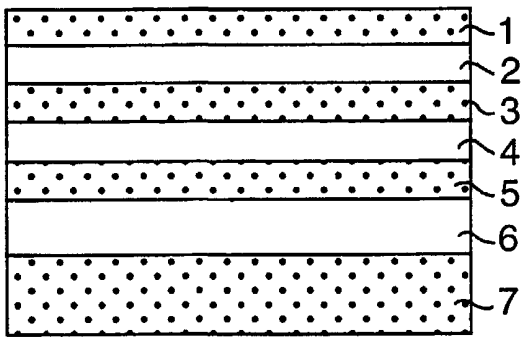
(54) Title: TAMPER EVIDENT DEVICE AND METHOD



(57) Abstract: A tamper evident device comprises a structure (3, 4) supported on a carrier (1) and generating an optically variable effect. A support layer (5) is secured to the opposite side of the structure from the carrier, and an adhesive (6) is provided on the support layer for securing the device to a substrate. The adhesive (6) comprises a material that will facilitate adhesion between the remainder of the device and the substrate at and around room temperature, the materials of the device being selected such that one or both of the optically variable effect generating structure (3, 4) and the substrate is damaged when an attempt is made to remove the device from the substrate to which it is adhered.

TAMPER EVIDENT DEVICE AND METHOD

The invention relates to a tamper evident device incorporating an optically variable effect generating structure.

Tamper evident devices incorporating such structures are well known for use as hot stamp labels and the like. These labels carry a heat activated adhesive which is brought into engagement with an article to be protected. Heat is applied by a die or the like so as to activate the underlying adhesive and then the label is adhered to the article. Such labels are used in a wide variety of applications.

Although hot stamp labels are suitable for use in a wide variety of applications, they are not well suited for use by individuals to protect items on an individual basis. More recently, therefore, cold transfer labels have been developed as described for example in EP-A-0466118 and GB-A-2300379. In these cases, a pressure sensitive adhesive is used. This will be covered by a protective layer during manufacture. When the label is to be used, the protective layer is peeled away and the label applied to the article.

A problem with these known cold transfer labels is that the pressure sensitive adhesive is a relatively soft material and unless it is provided as a relatively thick layer, a metallisation forming part of the optically variable effect generating structure can be abraded away. A thick adhesive layer, however, is undesirable since it significantly increases the overall thickness of the combined label and article. A label having a 50μm thickness is typical. Furthermore, the device can be removed using steam, mechanical attack or solvents. The thickness of earlier devices also allows items such as scalpels and/or knives to be worked underneath thus facilitating removal.

On the other hand, if the layer is too thin then the label will not adhere strongly to the article.

Abrasion resistance is reduced if the adhesive layer is either too thick or too thin which usually means there is a window of very limited adhesive resistance. Additionally, the transfer of the foil at room temperature can be problematic. On some occasions, some of the foil can be left on either the carrier of the substrate when the carrier is removed.

In accordance with one aspect of the present invention, a tamper evident device comprises a structure supported on a carrier and generating an optically variable effect; a support layer secured to the opposite side of the structure from the carrier; and an adhesive on the support layer for securing the device to a substrate, the adhesive comprising a material that will facilitate adhesion between the remainder of the device and the substrate at and around room temperature, the materials of the device being selected such that one or both of the optically variable effect generating structure and the substrate is damaged when an attempt is made to remove the device from the substrate to which it is adhered.

In accordance with a second aspect of the present invention, a method of manufacturing a tamper evidence device comprises providing an optically variable effect generating structure on a carrier; coating the side of the optically variable effect generating structure opposite to the carrier with a support layer material; hardening the support layer material; and providing an adhesive on the hardened support layer for securing the device to a substrate, the adhesive comprising a material that will facilitate adhesion between the remainder of the device and the substrate at and around room temperature, the materials of the device being selected such that one or both of the optically variable effect generating structure and the substrate is damaged when an attempt is made to remove the device from a substrate to which it is adhered.

In this new tamper evident device, we introduce a support layer between the optically variable effect

generating layer and the adhesive. The advantage of the support layer is that it reduces the ability to abrade or otherwise damage the optically variable effect generating structure while at the same time allowing a thinner adhesive layer to be used which still achieves good adherence to the articles which the device is secured. In addition, if the support layer is sufficiently heat resistant, it will allow a hot imaging process to be performed on the optical variable effect generating structure without damaging the structure. Such processes include laser printing techniques which have not been usable with known labels since the heat from those processes damages the optically variable effect generating structure. The presence of this support layer also aids transfer of the holographic image to the substrate by increasing the thickness and strength of the carried image.

The adhesive is preferably a pressure sensitive adhesive but could also be a cold cure adhesive, a two pack system or a UV curable adhesive.

By "at or around room temperature" we include temperatures which are a few degrees eg ± 5°C of room temperature. A typical range is 15-25°C.

The support layer maintains the integrity of the optically variable effect generating structure, for example during the application of heat or abrasion. This also allows the optically variable effect generating structure to be the top layer of the device once the carrier has been removed, that layer being printed and thus for all these reasons being much more difficult to covertly tamper with.

Preferably, the support layer comprises a curable material most preferably a UV curable material. However, other types of support layer could be used such as heat hardenable layers.

Typically, the support layer will contact the adhesive layer directly although it is envisaged that one or more additional layers could be provided between the two. The

support layer will directly contact the optically variable effect generating structure.

Preferably, the optically variable effect generating structure comprises a transmissive layer carrying a relief defining the optically variable effect and a reflection enhancing layer.

The reflection enhancing layer may comprise a metal but other enhancing layers such as those described in EP-A-0201323 could also be used.

The reflection enhancing layer can be continuous or in preferred examples is partially provided or discontinuous so that the optically variable effect generating structure is at least partially transmissive. Although this could be achieved using a discontinuous metallisation, a preferred solution is to use a substantially transparent (in the visible spectrum) high refractive index dielectric coating. Typically the refractive index will be greater than 1.7.

This latter construction is particularly advantageous when the device is to be used to add security to text or the like (for example a value amount on a cheque or other security item). The device can be adhered over the text allowing the text to be viewed through the optically variable effect.

Where indicia are provided on the surface of the optically variable effect generating structure, these indicia may comprise thermal printing, ink jet printing, embossed numbering, security print, overprinted security indicia or indicia receptive coatings.

Examples of articles which can be secured using the device include cheques, bank drafts, bank orders, security documents, share certificates, ID cards or any item where the value of the item depends on its authenticity.

An example of a device according to the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic cross-section through an example of a device prior to application to a substrate;

Figure 2 is a view similar to Figure 1 but showing the device adhered to a substrate;

Figure 3 is a view similar to Figure 2 following removal of the carrier layer;

Figure 4 is a schematic plan of a device adhered to a bank cheque or money order; and,

Figure 5 is a view similar to Figure 4 in which the device has been overwritten by a laser printer.

In the example shown in Figure 1, a polyethylene (PET) carrier layer 1 is provided to which a release layer 2, such as wax, is applied. Alternatively the release properties could be produced by corona treating the layer 1. An embossed lacquer layer 3 is applied to the release layer 2 and a suitable optically variable effect, surface relief structure is embossed into the layer 3. The optically variable effect is typically a hologram or diffraction grating although other forms known to persons skilled in the art could be used. The embossed surface is then provided with a reflection enhancing layer 4 which may be a metallisation such as aluminium or the like either continuously (as shown) or discontinuously, or a high refractive index, preferably visibly transparent, dielectric coating as for example disclosed in EP-A-0201323. Onto the layer 4, a UV curable lacquer in liquid form is applied and this is then UV cured to generate a support layer 5. This is then laminated to a protective releasable layer 7 which has been coated with a pressure sensitive adhesive (PSA) layer. Typically, these structures will be formed in sheets which can then by die cut ready for use.

The carrier layer 1 is typically between 5 and 100 microns thick, more preferably between 10 and 60 microns and even more preferably between 12 and 50 microns. The wax release layer 2 is typically less than 4 micron thick, more preferably less than 1 micron. The emboss lacquer layer 3 is usually less than 4 micron thick, more preferably less than 2 micron. The layer 4 is less than 1

micron thick. The PSA layer 6 is between 0.1 and 50 micron thick, more preferably between 2 and 25 micron and even more preferably between 5 and 12 micron.

In use, the glassine protective layer 7 is removed from the adhesive layer 6 and the device is then applied with minimal pressure to the substrate 8 of the item to be protected (Figure 2). The carrier layer 1 can then be peeled off as shown in Figure 3. The device is now extremely difficult to remove from the substrate 8.

The types of materials and thicknesses for the layers 5,6 is carefully chosen to optimise performance. For example, a UV lacquer layer 5 which is too hard will be brittle and break up when bent but if too soft it will allow the lacquer layer 3 and surface relief to be damaged too easily. Similarly, a PSA layer 6 which is too thin will result in the device not adhering firmly to the substrate 8 while a layer which is too thick will result in the device being more susceptible to damage.

There are many different applications of the invention and articles or items to which devices according to the invention can be applied. Particularly important examples include bank cheques or money orders in which labels according to the invention can be adhered over the signature and/or amount payable to prevent unauthorised upgrading. If the layer 4 is discontinuous or transparent then the value is still clearly visible through the device, providing the embossed lacquer layer 3, the support layer 5, and PSA layer 6 are transmissive to the detecting radiation for example visible light, infra-red, ultra-violet or any other part of the electromagnetic spectrum.

Thus, as shown in Figure 4, a label constructed in a similar way to the device shown in Figures 1-3 is shown at 10 adhered over a written value "20000".

The invention also allows this adhered label 10 to be overprinted using a laser printing technique as shown at 11 in Figure 5 without damaging the hologram.

The total thickness of the device (layers 2-6) once applied to an item for protection will typically be about 15 microns compared to 50 microns for a conventional tamper evident label.

The application of the invention is not limited to cheques and money orders. Any application that currently uses tamper evident labels/tags could also benefit from this invention. It is envisaged the invention could be used for application onto mass media products such as computer software and audio visual packaging.

The security of the invention could also be further enhanced by incorporating luminescent, magnetic and other machine readable materials into the construction of the layer 3.

Some specific examples of labels according to the invention will now be described.

Example 1

Polyethylene teraphthalate foil is coated with a wax release layer and then an embossing layer. The embossing layer is then embossed with an optical variable image and metallised. The metallised-side is demetallised to give a partially transparent image and coated using the reverse gravure process, with a solution containing the following ingredients:

Ebecryl 1259	(UCB Chemicals)	80 parts by wt
TMPTA	(UCB Chemicals)	20 parts by wt
Ebecryl 168	(UCB Chemicals)	5 parts by wt
Ebecryl 657	(UCB Chemicals)	5 parts by wt
Darocure 1173	(Ciba Speciality Chemicals)	5 parts by wt
Benzophenone	(Aldrich Chemicals)	5 parts by wt
MEK	(Aldrich Chemicals)	40 parts by wt
Fluorad FC-430	(3M Chemicals)	0.3 parts by wt

The coating is dried and cured by the action of ultraviolet lamps to leave a hard but flexible coating of 10gsm constituting a support layer. This surface is then laminated to a glassine pre-coated with 12gsm pressure sensitive adhesive SE3293S (H B Fuller) and the foil die cut to give labels.

Example 2

Polypropylene foil is treated with an electrical corona discharge, embossed with an optical variable image and metallised. The metallised-side is coated using the meter bar process, with a solution containing the following ingredients:

Ebecryl 1259	(UCB Chemicals)	20 parts by wt
Ebecryl 160	(UCB Chemicals)	40 parts by wt
Ebecryl 168	(UCB Chemicals)	5 parts by wt
IRR 182	(UCB Chemicals)	5 parts by wt
Darocure 1173	(Ciba Speciality Chemicals)	3 parts by wt
Benzophenone	(Aldrich Chemicals)	3 parts by wt
Fluorad FC-430	(3M Chemicals)	0.3 parts by wt

The coating is dried and cured by the action of ultraviolet lamps to leave a hard but flexible support layer coating of 9gsm. This surface is then laminated to a glassine pre-coated with 15gsm pressure sensitive adhesive NA1197 (National Adhesives) and the foil die cut to give labels.

Example 3

Polyethylene teraphthalate foil is coated with a wax release layer and then an embossing layer. The embossing layer is then embossed with an optical variable image and provided with a reflection enhancing layer such as a transparent high refractive index dielectric coating or a

metallisation which is partially demetallised to give a partially transparent image. This is coated using the meter bar process, with a solution containing the following ingredients:

VMCA	(Union Carbide)	45 parts by wt
MEK	(Aldrich Chemicals)	55 parts by wt

The coating is dried to leave a hard coating of 10gsm constituting a support layer. This surface is then laminated to a glassine pre-coated with 9gsm pressure sensitive adhesive SE3293S (H B Fullers) and the foil die cut to give labels.

Example 4

Polyethylene teraphthalate foil is coated with a wax release layer and then an embossing layer. The embossing layer is then embossed with an optical variable image and provided with a reflection enhancing layer such as a transparent high refractive index dielectric coating or a metallisation which is partially demetallised to give a partially transparent image. This is coated using the reverse gravure process, with a solution containing the following ingredients:

Ebecryl 1259	(UCB Chemicals)	20 parts by wt
Ebecryl 160	(UCB Chemicals)	40 parts by wt
Ebecryl 168	(UCB Chemicals)	5 parts by wt
IRR 182	(UCB Chemicals)	5 parts by wt
Darocure 1173	(Ciba Speciality Chemicals)	6 parts by wt
Benzophenone	(Aldrich Chemicals)	3 parts by wt
Fluorad FC-430	(3M Chemicals)	0.3 parts by wt

The coating is dried and cured by the action of ultraviolet lamps to leave a hard but flexible support layer coating of 6gsm. This surface is then laminated to a glassine pre-coated with 10gsm pressure sensitive hot

melt adhesive Pressen 972 (Beardow Adams) and the foil die cut to give labels.

Example 5

Polyethylene teraphthalate foil is coated with a wax release layer and then an embossing layer. The embossing layer is then embossed with an optical variable image and provided with a reflection enhancing layer such as a transparent high refractive index dielectric coating or a metallisation which is partially demetallised to give a partially transparent image. This is coated using the meter bar process, with a solution containing the following ingredients:

Paraloid AI-63	(Rohm & Haas)	50 parts by wt
Paraloid AI-63	(Rohm & Haas)	50 parts by wt
Desmodur N75	(Bayer)	10 parts by wt
Desmodur IL	(Bayer)	10 parts by wt

The coating is dried and cured by the action of heat to leave a hard but flexible support layer coating of 6gsm. This surface is then laminated to a glassine pre-coated with 8gsm pressure sensitive adhesive SE3293S (H B Fuller) and the foil die cut to give labels.

Example 6

Polyethylene teraphthalate foil is coated with a wax release layer and then an embossing layer. The embossing layer is then embossed with an optical variable image and provided with a reflection enhancing layer such as a transparent high refractive index dielectric coating or a metallisation which is partially demetallised to give a partially transparent image. This is coated using the meter bar process with a solution of Incorez 2600 (Industrial Copolymers). The coating is dried and cured by the action of heat to leave a hard but flexible support layer coating of 6gsm. This surface is then laminated to

a glassine pre-coated with 10gsm pressure sensitive adhesive SE3293S (H B Fuller) and the foil die cut to give labels.

Labels made by these processes can be applied to a substrate, such as, for example, glass, metal, paper, plastic, wood. The carrier foil can then be removed and the optical variable image transferred to the substrate without the need for heat or substantive pressure. Surprisingly, the resultant images have improved abrasion resistance. Provided the coating materials are carefully chosen the labels are resistant to heat and many heat related processing steps for example hot printing, laser printing, hot stamping or similar actions. Such materials are extremely difficult to remove without creating irreversible damage to the image.

CLAIMS

1. A tamper evident device comprises a structure supported on a carrier and generating an optically variable effect; a support layer secured to the opposite side of the structure from the carrier; and an adhesive on the support layer for securing the device to a substrate, the adhesive comprising a material that will facilitate adhesion between the remainder of the device and the substrate at and around room temperature, the materials of the device being selected such that one or both of the optically variable effect generating structure and the substrate is damaged when an attempt is made to remove the device from the substrate to which it is adhered.

2. A device according to claim 1, wherein the support layer comprises a curable material.

3. A device according to claim 2, wherein the material is UV curable.

4. A device according to any of the preceding claims, wherein the support layer comprises a lacquer coating.

5. A device according to any of the preceding claims, wherein the adhesive is one of a pressure sensitive adhesive, a cold cure adhesive, a two pack system, or a UV curable adhesive.

6. A device according to any of the preceding claims, wherein the support layer is heat resistant.

7. A device according to claim 6, wherein the support layer is sufficiently heat resistant to allow a hot imaging process to be performed on the optical variable effect generating structure without damaging the structure.

8. A device according to any of the preceding claims, wherein the optically variable effect generating structure comprises a transmissive layer carrying a relief defining the optically variable effect and a reflection enhancing layer.

9. A device according to claim 8, wherein the reflection enhancing layer comprises a high refractive index, substantially transparent, dielectric coating.

10. A device according to claim 9, wherein the refractive index of the dielectric coating is greater than 1.7.

11. A device according to claim 8, wherein the reflection enhancing layer comprises a metal.

12. A device according to any of claims 8 to 11, wherein the reflection enhancing layer is partially provided or discontinuous so that the optically variable effect generating structure is at least partially transmissive.

13. A device according to any of the preceding claims, wherein the optically variable effect is a hologram.

14. A device according to any of the preceding claims, wherein the carrier is removable without damaging the rest of the device.

15. A device according to claim 14, further comprising a release layer between the carrier and the optically variable effect generating structure.

16. A device according to claim 14 or claim 15, wherein the carrier is formed with a tab to assist removal.

17. A method of manufacturing a tamper evidence device comprises providing an optically variable effect generating structure on a carrier; coating the side of the optically variable effect generating structure opposite to the carrier with a support layer material; hardening the support layer material; and providing an adhesive on the hardened support layer for securing the device to a substrate, the adhesive comprising a material that will facilitate adhesion between the remainder of the device and the substrate at and around room temperature, the materials of the device being selected such that one or both of the optically variable effect generating structure and the substrate is damaged when an attempt is made to remove the device from a substrate to which it is adhered.

18. A method according to claim 17, wherein the device is constructed in accordance with any of claims 1 to 16.

19. A method according to claim 17 or claim 18, wherein the support layer is coated as a liquid on the optically variable effect generating structure and thereafter hardened.

20. A method according to any of claims 17 to 19, wherein the adhesive layer is provided on a removable carrier member, the adhesive layer being provided on the support layer by bringing the adhesive layer on its carrier into contact with the support layer, the adhesive layer carrier subsequently being removed to enable the device to be adhered to a substrate.

21. A method of securing an article comprising adhering a tamper evident device according to any of claims 1 to 16 or manufactured according to any of claims 17 to 20 on the article.

22. A method according to claim 21, further comprising removing the carrier from the optically variable effect generating structure after the device has been adhered to the article.

23. A method according to claim 22, further comprising providing indicia on the exposed surface of the optically variable effect generating structure using a hot imaging process.

24. A method according to claim 23, wherein the indicia are chosen to relate to other indicia appearing on the article.

25. A method according to any of claims 21 to 24, wherein the device is at least partially transparent and is located over information appearing on the article.

26. An article which has been secured by adhering a device according to any of claims 1 to 16, manufactured according to any of claims 17 to 20, or in accordance with any of claims 21 to 25.

Fig.1.

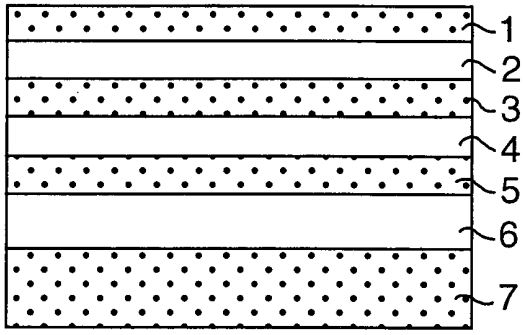


Fig.2.

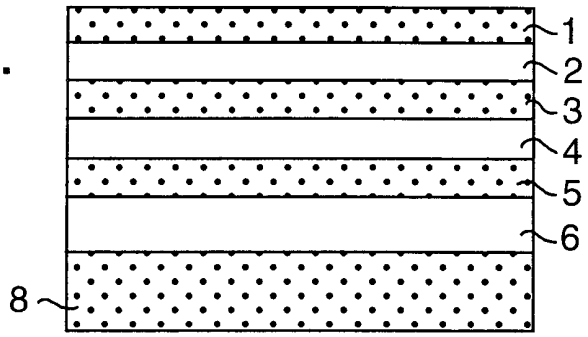


Fig.3.

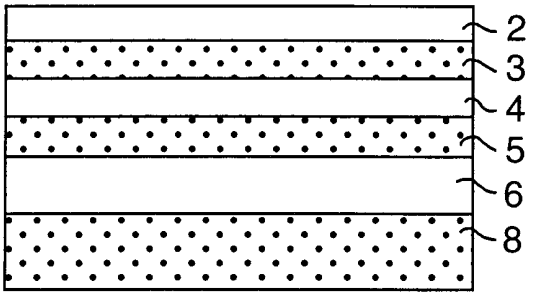


Fig.4.

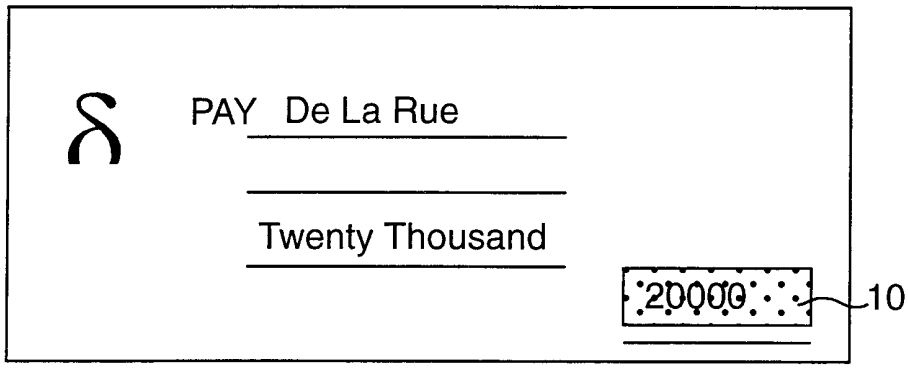
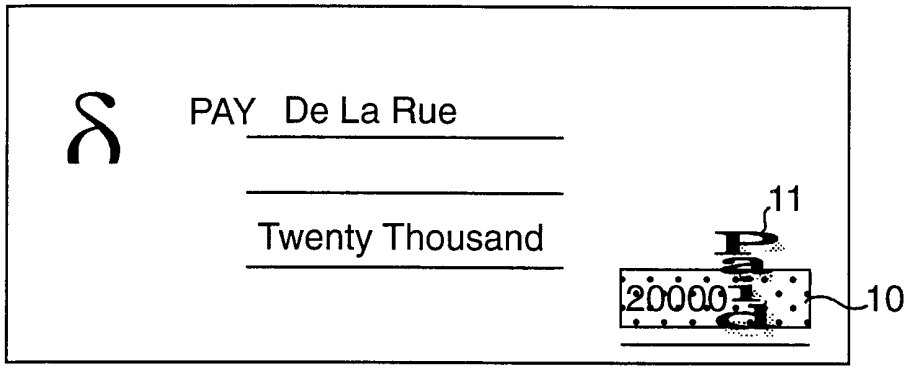


Fig.5.



INTERNATIONAL SEARCH REPORT

Internat. Application No
PCT/GB 01/00252

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G09F3/02 B42D15/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G09F G03H B42D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 243 578 A (FEDERAL PRINTERS LIMITED) 6 November 1991 (1991-11-06) page 5, line 16 - line 25 figure 1	1,5, 13-15
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 08, 30 August 1996 (1996-08-30) & JP 08 101629 A (TOPPAN PRINTING CO LTD), 16 April 1996 (1996-04-16) abstract	1,6,13
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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

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Date of the actual completion of the international search	Date of mailing of the international search report
23 March 2001	30/03/2001

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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