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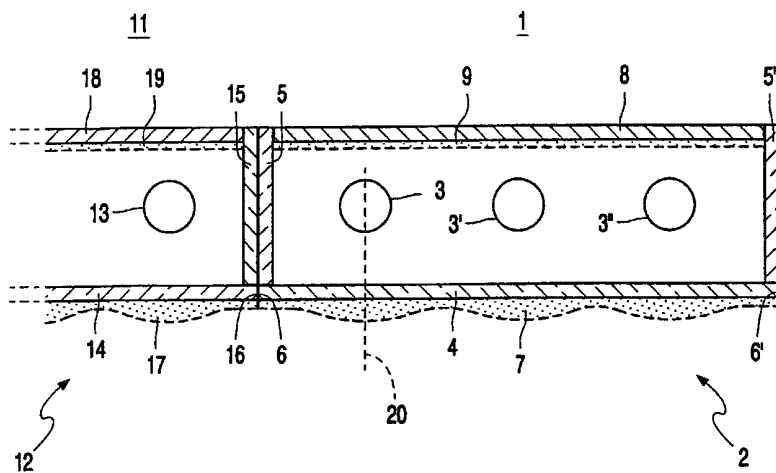
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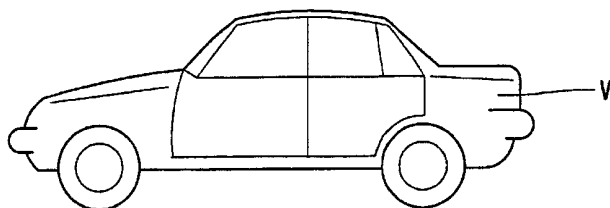
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LUMINAIRE



(57) Abstract: A system of a first luminaire (1) and a second luminaire (11) for lighting an object (V). Each luminaire has a housing (2; 12) provided with a plurality of tubular lamps (3, 3', 3''); (13). The housing (2; 12) has a light emission window (4; 14) and a side wall (5, 5'; 15) which is perpendicular to the light emission window (4; 14). In the system, the first and the second luminaire (1; 11) abut one another with their side walls (5, 5'; 15) and/or with their light emission windows (4; 14), such that an edge (6) of the light emission window (4) of the first luminaire (1) abuts an edge (16) of the light emission window (14) of the second luminaire (11). Said light emission windows (4; 14) and said side walls (5, 5'; 15) are made from an optically transparent material. Preferably, the light emission window (4; 14) is provided with a diffuser (7; 17). Preferably, said diffuser (7; 17) exhibits a variation in layer thickness, the layer thickness being greater at a location on the light emission window (4; 14) close to the tubular lamps (3, 3', 3''); (13) than at a further distance



from the tubular lamps (3, 3', 3''); (13). The object (V) is homogeneously and uniformly illuminated by said system.

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Luminaire

The invention relates to a system of a first luminaire and a second luminaire for illuminating an object.

The invention further relates to a luminaire for use in said system.

The invention further relates to a method of presenting and/or selling an object.

5 Such a system and such a luminaire are known per se. They are used inter alia in ceiling lighting and for illuminating objects such as, for example, objects in a shop window, in a shop, in an exhibition space, for example for the illumination of art objects, or in a showroom, for example for the illumination of comparatively large objects, for example vehicles. Such a system or luminaire is further used for wall illumination so as to illuminate
10 objects from the side, or as floor illumination, for example on theatrical stages, for the illumination of objects or persons. Said system and luminaire are further used as backlights for, for example, (picture) display devices such as, for example, (PA)LC displays or video walls, and as office lighting, or as a luminaire for enhancing the appearance of an object. Usually, a system as mentioned in the opening paragraph comprises a plurality of luminaires
15 mounted next to one another, often as a number of coupled squares.

 A luminaire of the type mentioned above has a major disadvantage. The luminaire has a surface with a non-homogeneous light distribution. The object is not evenly lit as a result, which is undesirable. In addition, the system of a first luminaire and a second luminaire comprises a comparatively wide band between the luminaires which is
20 comparatively dark.

The invention has for its object to counteract the above disadvantage.

According to the invention, this object is achieved with a system of a first luminaire and a second luminaire for illuminating an object,

25 wherein the first and the second luminaire each comprise a housing for accommodating at least one tubular lamp,

 which housing is provided with a light emission window for illuminating the object and a side wall which is transverse to the light emission window,

wherein the first luminaire abuts the second luminaire by its side wall and/or by its light emission window,

wherein an edge of the light emission window of the first luminaire abuts an edge of the light emission window of the second luminaire in the system of the first and the
5 second luminaire,

and wherein said light emission windows and said side wall are manufactured from an optically transparent material.

It was found that the two light emission windows in the system form a homogeneously illuminated plane during lamp operation. The expression "homogeneously
10 illuminated" in the present invention is understood to mean that the light emission window has a light distribution over the surface of the light emission window which exhibits differences in intensity which are not or substantially not observable to the human eye during operation. The expression "homogeneously illuminated" applied to the system further means that especially the edges of the respective light emission windows and transitions between mutually adjoining
15 luminaires exhibit differences in light intensity from the light emitted by the relevant light emission window as a whole which are not or substantially not perceivable. In other words, the light output of a light emission window including its edge has a dependence on the position in the light emission window which is not or substantially not observable.

Light emitted during operation by the tubular lamps reaches the light emission
20 window of the luminaire and is emitted from there in the direction of the object. Such a luminaire usually comprises a plurality of tubular lamps, for example low-pressure mercury vapor discharge lamps. These light sources are usually provided in a certain regular distribution in the housing, the tubular lamps being arranged, for example, parallel to one another. To reduce a direct visibility of the tubular lamps in the housing, each of the housings
25 of the luminaires is provided with an optically transparent light emission window manufactured, for example, from a glass or a synthetic resin which preferably scatters the light diffusely. The system is built up such that the light emission windows of mutually adjoining luminaires touch one another or at least substantially touch one another, so that a comparatively wide, comparatively dark band at the area of the abutting luminaires, as in the
30 known system, is avoided. Since the side wall of the luminaire is manufactured from an optically transparent material, light emitted during operation by the tubular lamps is partly caught by this side wall, which absorbed light is transported by means of internal reflections in the direction of the light emission window, where it is emitted again. This achieves that the edge of the light emission window of the first luminaire has a luminance which is at least

substantially equal to that of the rest of the light emission window. Given two or more luminaires which abut one another at the area of the edges of the light emission windows of the respective luminaires, a light emission window is thus obtained which is homogeneously illuminated up to and including the edge of the light emission window during operation, so that the system emits a homogeneous light. An observer will be incapable or substantially incapable of distinguishing the edges of the light emission windows of the respective luminaires on the basis of the light distribution as emitted by the system during operation.

In the known system of luminaires, the luminaires usually do not abut, so that a comparatively wide and dark band is present between the luminaires and is observed as such.

These bands achieve that the known system has a checkered appearance and that in addition the object is not homogeneously illuminated. Since the object is integrally and homogeneously illuminated owing to the measure according to the invention, an observer's attention is not drawn from the object by irregularities in the illumination of the object. The use of the system according to the invention renders it possible to illuminate objects very homogeneously and uniformly. This has particular advantages for viewing, for example, art objects in museums, or motor vehicles, for example in dealer showrooms. Particularly in the case of objects which have reflecting properties, and preferably objects having specular reflection, the absence of visible edges in a reflection of the system on the object is perceived as an advantage by a viewer. The measure according to the invention enhances the attractiveness of objects which are presented, for example, with the aim of selling the objects.

An embodiment of the system according to the invention is characterized in that the light emission window of the respective luminaire is provided with a diffusor. A diffusor achieves that the uniformity of the light intensity distribution of the light emitted by the light emission window during operation is further enhanced. A combination of a light emission window made from a material which emits the light diffusely and a diffusor provided on the light emission window renders it possible to position the tubular lamps closer to the light emission window, so that the dimensions of the luminaire will be considerably more compact than those of the known luminaire, while nevertheless a more homogeneous light distribution is realized than with the known luminaire. It is in particular possible as a result of this to reduce the depth of the housing, which is a major advantage in mounting of the system.

The inventors have come to recognize that multiple reflections in the luminaire, especially caused in the diffusor, contribute to a very homogeneous distribution of the intensity of the light emerging from the light emission window. Preferably, the diffusor has a variation in layer thickness, the layer thickness of the diffusor being chosen to be greater

immediately opposite the location where the tubular lamp is present during operation than at a further distance from the lamp. A diffuser which is comparatively thick in locations on the light emission window close to the tubular lamp and comparatively thin in locations on the light emission window comparatively far removed from the tubular lamp or lamps achieves that the uniformity of the light intensity distribution of the light emitted by the light emission window during operation is further improved. The provision of a diffuser with said layer thickness variation on the light emission window of a luminaire renders it possible to position the tubular lamps still closer to the light emission window, so that the dimensions of the luminaire are more compact than those of the known luminaire, while nevertheless a more homogeneous light distribution is realized than with the known luminaire. This renders it possible to reduce the depth of the housing considerably, which is a major advantage in mounting of the system.

Preferably, the transmission of the diffuser at the area where the layer thickness is greatest is approximately 50% of the transmission of the diffuser at the area where the layer thickness is smallest. In other words, the transmission of the diffuser on the light emission window immediately opposite the location where the tubular lamp is present is approximately 50% of the transmission of the diffuser at the area of the light emission window where the tubular lamp is at a maximum distance from the light emission window during operation. Particularly suitable materials for the diffuser are calcium halophosphate and/or calcium pyrophosphate. Such a diffuser is preferably provided as a paint to which a binder, for example a fluorine copolymer, is added.

The invention will now be described in more detail with reference to a number of embodiments and a drawing, in which

Fig. 1 shows an example of a system of two luminaires according to the invention in cross-section.

The Figure is purely diagrammatic and not drawn true to scale. Some dimensions have been particularly exaggerated for greater clarity.

Fig. 1 shows a system of a first luminaire 1 and a second luminaire 11 for illuminating an object V. The object V in Fig. 1 is a vehicle, for example an automobile. Alternative objects are art objects, for example paintings, photographs, sculptures, etc. Such objects often have a mirroring appearance.

The first and the second luminaire 1; 11 each comprise a box-shaped housing 2; 12. A plurality of tubular lamps 3, 3', 3"; 13 is provided in the housing 2; 12, for example low-pressure mercury vapor discharge lamps. In the example of Fig. 1, the luminaire 1 accommodates three TL5 discharge lamps. In an alternative embodiment, five, eight, or more lamps are provided in one luminaire, for example of the TL5 28 W type with color rendering index 84. The tubular lamps 3, 3', 3"; 13 are provided in a certain regular distribution in the housing 2; 12, such that the tubular lamps 3, 3', 3"; 13 are arranged mutually in parallel. Preferably, the distance between the side wall 5; 15 and the lamp 3; 13 placed closest to said side wall 5; 15 is at least substantially half the mutual interspacing between the respective lamps 3, 3', 3".

To reduce a direct view of the tubular lamps 3, 3', 3"; 13 in the housing 2; 12 and to achieve a homogeneous light output, each of the housings 2; 12 of the luminaires 1; 11 is provided with an optically transparent light emission window 4; 14 for illuminating the object. The housing is provided with a side wall 5, 5'; 15 transverse to the light emission window 4; 14. If so desired, the side wall 5, 5'; 15 may also be provided obliquely with respect to the light emission window 4; 14. The light emission window 4; 14 and the side wall 5, 5'; 15 are manufactured, for example, from a glass, a synthetic resin, or Perspex which scatters the light, preferably diffusely (for example so-called milk-glass).

In the system according to the invention, the first luminaire 1 abuts against the second luminaire 11 by a side wall 5, 5'; 15. In an alternative embodiment, the luminaires 1; 11 in the system abut by their light emission windows 4; 14. In that case, the side walls support the light emission window not at the edges of the light emission window, but for example, at some (short) distance from the edges of the light emission window. In a further alternative embodiment of the system, the light emission window is interrupted at the area of the side wall. In that case, the edge of the side wall is considered to form part of the light emission window in the description of this invention.

In the example of Fig. 1, both the housing 2 of the first luminaire 1 and the housing 12 of the second luminaire 11 are provided with a side wall, referenced 5 and 15, respectively, at the area where the luminaires 1; 11 abut. The invention, however, is not limited to this embodiment. Thus only one side wall may be present at the area of the abutting luminaires, in which case, for example, the side wall of the one luminaire supports the light emission windows of both luminaires. Such an embodiment may simplify the assembly of luminaires in forming the system. In the system according to the invention, an edge 6, 6' of the light emission window 4 of the first luminaire 1 at the area of the side wall 5, 5' abuts against

an edge 16 of the light emission window 14 of the second luminaire 11 at the area of the side wall 15. Furthermore, the light emission windows 4; 14 and said side wall 6, 6'; 16 are manufactured from an optically transparent material. Given such a system, the two light emission windows 4; 14 form a homogeneously illuminated surface.

5 In the example of Fig. 1, the light emission window 4; 14 is further provided with a diffuser 7; 17 which is provided on an outside of the housing 2; 12 on the light emission window 4; 14. In an alternative embodiment, the diffuser is provided on the side of the light emission window facing towards the lamp(s). In particular, the diffuser 7; 17 has a layer thickness variation, the layer thickness of the diffuser 7; 17 being chosen to be greater
10 immediately opposite the location where the tubular lamp 3, 3', 3"; 13 is present during operation. A longitudinal axis 20 transverse to the light emission window 4 is drawn in Fig. 1, extending through the center of the tubular lamp 3 and indicating the thickest region of the diffuser layer.

The provision of a diffuser 7; 17 with said layer thickness variation on the light
15 emission window of the luminaire 1; 11 renders it possible to position the tubular lamp 3, 3', 3"; 13 comparatively closely to the light emission window 4; 14 in the housing 2; 12, so that the dimensions of the luminaire 1; 11 are more compact than those of the known luminaire, while nevertheless a more homogeneous light distribution is realized than with the known luminaire. It is rendered possible in particular thereby to reduce the depth of the housing 2; 12
20 considerably, which is a major advantage in mounting of the system.

The housing 2; 12 of the luminaire 1; 11 in the system is preferably rectangular, for example square with typical dimensions of 300 mm, 600 mm, 900 mm, 1200 mm, or 1500 mm, or combinations thereof. The height of the housing 2; 12 can be comparatively small thanks to the measure according to the invention. Very suitable is a height of 30 to 70 mm for
25 the housing 2; 12, in particular a height of 35 mm. No special recessed plates need be used for ceiling mounting thanks to the possibility of a very compact construction. In fact, the luminaires are provided with interspacings equal to zero and form as it were an integral whole in the system. The components necessary for mounting are invisible. It is possible for maintenance purposes to remove the light emission window 2; 12 provided with the diffuser 7;
30 17 from the housing parallel to the longitudinal axis 20, for example for the replacement of the tubular lamps.

Preferably, the transmission of the diffuser 7; 17 at the area where the layer thickness is greatest is approximately 50% of the transmission of the diffuser 7; 17 at the area where the layer thickness is smallest. In other words, the transmission of the diffuser 7; 17 on

the light emission window 4; 14 immediately opposite the location where the tubular lamp 3, 3', 3"; 13 is present is approximately 50% of the transmission of the diffuser 7; 17 at the area of the light emission window 4; 14 where the tubular lamp 3, 3', 3"; 13 is at a maximum distance from the light emission window 4; 14 during operation. Particularly suitable materials for the diffuser 7; 17 are calcium halophosphate and/or calcium pyrophosphate. Such a diffuser is provided in the form of a paint in which a binder, for example a fluorine copolymer, for example THV, is used, as well as a solvent (for example Mibk). The advantages of the use of such a diffuser 7; 17 and of such a binder in the diffuser 7; 17 are that baking is not necessary, and that the reflection over the entire visible range and a major portion of the UV range has at least substantially the same high value. This means that this diffuser 7; 17 and these binders are particularly suitable for use in coating layers on which the light is reflected many times, because preferential absorption and resulting color differences are effectively counteracted thereby. Furthermore, other additives may have been added to the paint mixture, for example those which have improved flowing or mixing characteristics.

The light absorption of visible light of such a diffuser 7; 17 is very low, i.e. less than 3%. This renders it possible to create a large lamp distance/diffuser thickness ratio without the efficiency of the luminaire being adversely affected. In addition, a diffuser 7; 17 comprising calcium halophosphate and/or calcium pyrophosphate has substantially no color shift, i.e. such a diffuser has a comparatively low wavelength dependence.

In the example of Fig. 1, the housing 2; 12 is further provided with a rear wall 8; 18 which is provided with a reflecting coating 9; 19, which is known per se, on a side which faces the light emission window 4; 14.

It will be obvious that many variations are possible to those skilled in the art within the scope of the invention.

The scope of protection of the invention is not limited to the embodiments described. The invention resides in each new characteristic and each combination of characteristics. Reference numerals in the claims do not limit the protection scope thereof. The use of the verb "comprise" does not exclude the presence of elements other than those mentioned in the claims.

CLAIMS:

1. A system of a first luminaire (1) and a second luminaire (11) for illuminating an object,

wherein the first and the second luminaire (1; 11) each comprise a housing (2; 12) for accommodating at least one tubular lamp (3, 3', 3"; 13),

5 which housing (2; 12) is provided with a light emission window (4; 14) for illuminating the object and a side wall (5, 5'; 15) which is transverse to the light emission window,

wherein the first luminaire (1) abuts the second luminaire (11) by its side wall (5, 5'; 15) and/or by the light emission window (4; 14),

10 wherein an edge (6) of the light emission window (4) of the first luminaire (1) abuts an edge (16) of the light emission window (14) of the second luminaire (11) in the system of the first and the second luminaire (1; 11),

and wherein said light emission windows (4; 14) and said side wall (5, 5'; 15) are manufactured from an optically transparent material.

15 2. A system as claimed in claim 1, characterized in that the light emission window (4; 14) is provided with a diffusor (7; 17).

3. A system as claimed in claim 2, characterized in that the diffusor (7; 17) has a
20 layer thickness variation, such that the layer thickness of the diffusor (7; 17) is chosen to be greater immediately opposite the location where the tubular lamp (3, 3', 3"; 13) is present during operation than at a further distance from said lamp (3, 3', 3"; 13).

4. A system as claimed in claim 3, characterized in that the transmission of the
25 diffusor (7; 17) at the area where the layer thickness is greatest is approximately 50% of the transmission of the diffusor (7; 17) at the area where the layer thickness is smallest.

5. A system as claimed in claim 2, characterized in that the material of the diffusor (7; 17) is chosen from a group formed by calcium halophosphate and calcium pyrophosphate.

6. A system as claimed in claim 2, characterized in that the diffusor (7; 17) comprises a fluorine copolymer as a binder.

5 7. A system as claimed in claim 1 or 2, characterized in that the housing (2; 12) further comprises a rear wall (8; 18), and in that said rear wall (8; 18) is provided with a reflecting coating (9; 19) at a side which faces the light emission window (4; 14).

8. A luminaire suitable for use in a system as claimed in claim 1 or 2.

10

9. A method of presenting and/or selling an object, characterized in that the object is illuminated by a system as claimed in claim 1 or 2.

10. A method as claimed in claim 9, characterized in that the object exhibits
15 specular reflection.

11. A method as claimed in claim 10, characterized in that the object comprises a vehicle or an art object.

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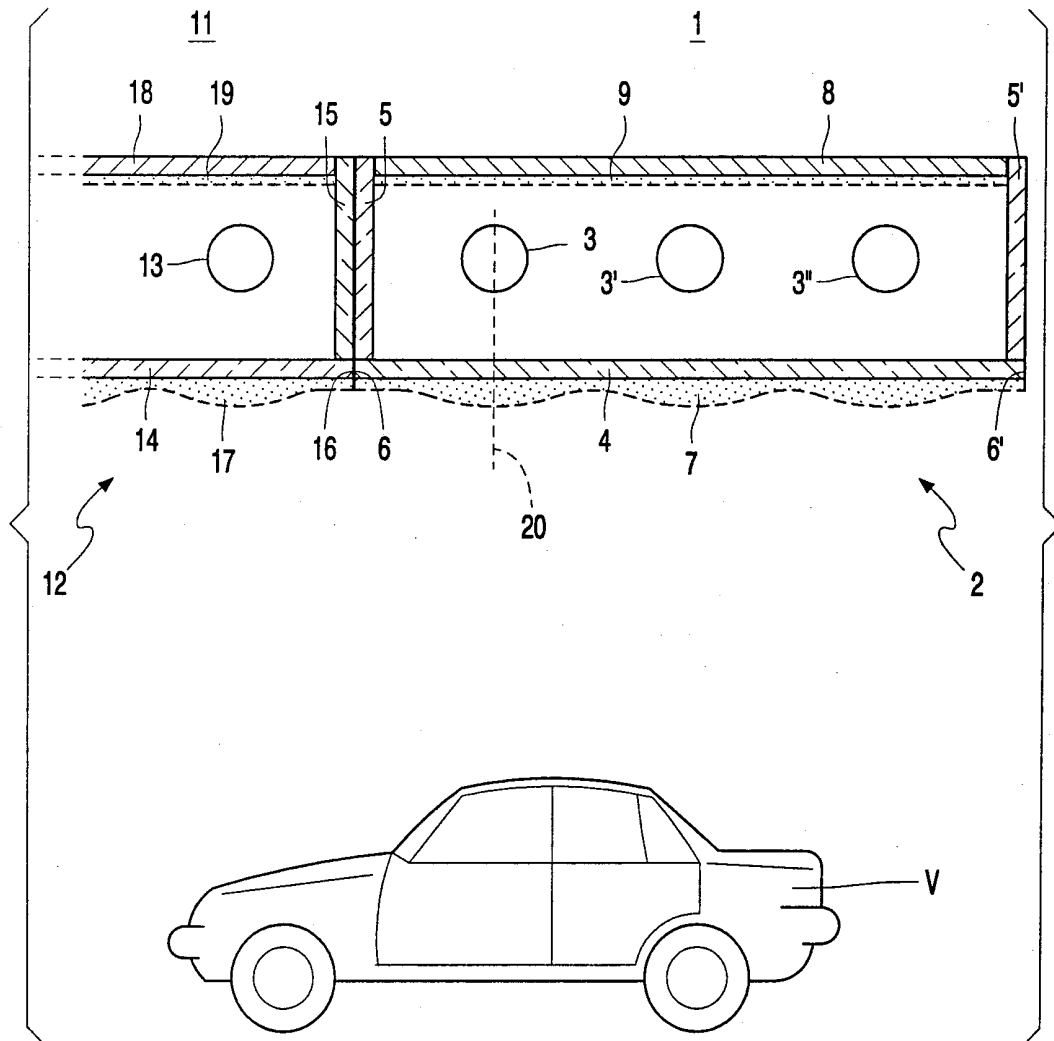


FIG. 1

INTERNATIONAL SEARCH REPORT

Internal Application No

PCT/EP 00/10609

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F21S2/00 F21W131/405

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 F21S F21V

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)

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	US 4 464 708 A (NUESSLI ARMIN ET AL) 7 August 1984 (1984-08-07) column 1, line 34 - line 37 column 2, line 23 - line 29 column 3, line 1 - line 24 figures 1-3	1,2,7-11
Y	---	3
X	US 4 631 647 A (RANNEY ROBERT) 23 December 1986 (1986-12-23) column 2, line 40 - column 3, line 23 figures 1-3	1,2,7-9
Y	---	3
Y	US 3 760 178 A (MILLER J) 18 September 1973 (1973-09-18) column 4, line 10 - line 20 figure 3	3
A	---	1,2,4
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *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

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 00/10609

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 3 655 576 A (LAYMAN HARRY D ET AL) 11 April 1972 (1972-04-11) column 1, line 11 - line 19 -----</p>	1,2,5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 00/10609

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