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**Declaration under Rule 4.17:**
— *of inventorship (Rule 4.17(iv))*

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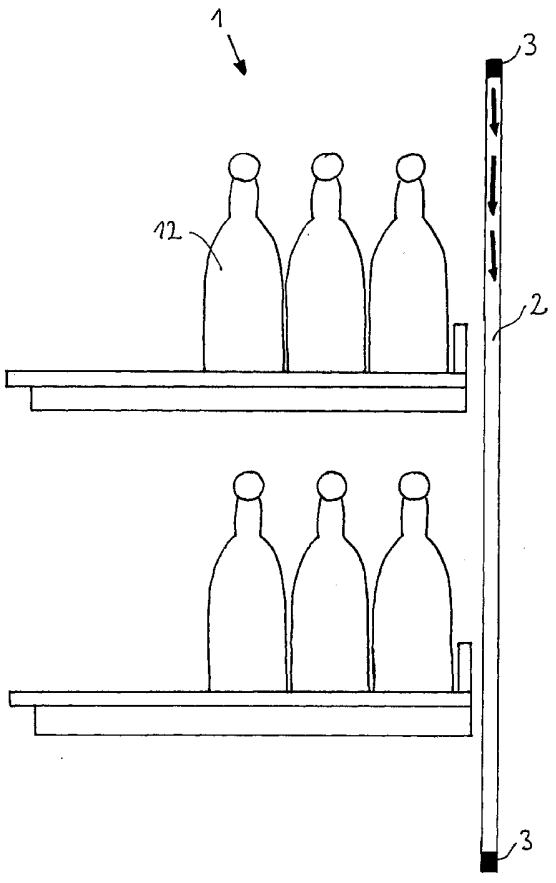
(54) **Title:** ILLUMINATED DISPLAY FOR A REFRIGERATED DISPLAY CASE




(57) **Abstract:** The invention relates to a display case (1) comprising at least one elongated transparent element (2) having a major surface, a peripheral margin of the transparent element (2) being surrounded at least partly by a frame (3), and illumination means (4) having light emitters (5) adapted to emit light. The light emitters (5) are mounted to the frame (3) in such a way that the emitted light beams propagate in angular ranges from about 60° to 90° and from about -60° to -90° to the normal to the major surface of the transparent element (2).

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# ILLUMINATED DISPLAY FOR A REFRIGERATED DISPLAY CASE

The present invention relates to a display case comprising at least one transparent element having a peripheral margin which is surrounded at least partly by a frame and comprising illumination means. Further, the invention relates to a framed transparent element suitable for a display case.

In the context of the present invention, the term display case is to include all kinds of display cases used in shops or other vending areas to display the products to be sold. There are common display cases of different shapes, e. g. stands or shelves, cabinets and chests. For example a conventional display stand with a couple of shelves may be equipped with fluorescent tubes to illuminate the products displayed.

The products are usually illuminated by substantially white light. To attract the attention of a customer it is known practice to place advertisements for the product on the surface of the display case or to place signs above the display case. Such signs are usually arranged on printed paper and sometimes on translucent material which is illuminated from behind by white light.

It is an object of the present invention to provide a display case with a new and therefor increased attractiveness for the customer.

In accordance with the present invention, this object is achieved by a display case comprising at least one elongated transparent element having a major surface, a peripheral margin of the transparent element being surrounded at least partly by a frame, and illumination means having light emitters adapted to emit light, the light emitters being mounted to the frame in such a way that the emitted light beams propagate towards the transparent element in angular ranges from about 60° to 90° and from about -60° to -90° to the normal to the major surface of the transparent element.

Said angular ranges depend on the particular material used for the transparent element. If one of the usual flat glass materials is used for example, a practical angular range may be from about 75° to 90° and from about -75° to -90° to the normal to the major surface of the transparent element. For materials having an index of refraction which is different from the index of refraction of usual flat glass materials, a different angular range might be suitable. Thus the suitable angular range is to be determined in dependency of the index of refraction of the particular transparent material used in a particular practical embodiment of the invention. The particular angular range for a particular choice of transparent material should be selected such that the light emitted from the light emitters creates a "self-shining" effect of the transparent element but does not just permeate the transparent element from one major surface to the other major surface or is not just reflected from one of the major surfaces of the transparent element. Therefore, the above-mentioned angular ranges are guide values only but should not be regarded as strict ranges for all types of transparent materials so that, depending on the particular transparent material, even an angular range beyond the above-mentioned angular ranges from about 60° to 90° and from about -60° to -90° may be possible in a particular practical embodiment to reach the effect intended by the invention.

As a result of an illumination in accordance with the invention, the transparent element itself looks like a colored shining element and has an attractive appearance itself. Examples of transparent elements are transparent doors, transparent shelves, transparent side walls or transparent top or cover walls of a display case. With the above-defined direction of the light beams there is almost no risk of glaring a customer standing in front of the display case looking at the products displayed. Because of the absence of almost any reflections, the visibility through the transparent element remains excellent. Thus, e. g. in case of a transparent door, the products displayed are clearly visible and look attractive for the customer. In case of a transparent shelve the products placed on the shelve obtain a colored shine and look also very attractive. A display case according to the present invention is able to attract special attention from the customer. The at least one transparent element of the display case is at least partly illuminated with a light with a radiation characteristic that differs from standard illumination.

Further, the invention provides a transparent element which is provided with illumination means according to the invention and is suitable to be used for a wall or door of a display case.

In an embodiment of the invention, the transparent element is plate-shaped, e.g. having the form of a conventional glass or plastic plate. The transparent element may, however, have different shapes, for example the shapes of geometric bodies having at least one convex and/or concave surface resulting in particularly attractive light radiation characteristics.

In accordance with an embodiment of the present invention the illumination means comprise fibre optic cables with light emitting ends as light emitters, a light source, coupling means for coupling the light emitted by the light source into the fibre optic cables and possibly an optical filter located somewhere in the optical path of the

light between the light source and the light emitters. The optical filter changes for example the wavelength of the light passing the filter. Therefore, a colored illumination may be achieved. Colored light is especially useful to attract the attention of customers. It can be used to create a special ambience adapted to the product displayed. For example a healthy green could be used to make vegetables to look even more green and more attractive. Another example would be to illuminate live stile products with trendy colors and to change the illumination in accordance with the ever changing trend. For example, a gas discharge lamp or a halogen lamp can be used as light source. The light is coupled into the fibre optic cable, possibly with the help of coupling means, e. g. mirrors and/or lenses. They should forward the light within a sufficiently small angle between the axis of the light beam and the axis of a corresponding fibre optic cable to feed the light into the fibre optic cable. The light emitting ends of the fibre optic cables have a very small diameter and therefore form punctiform light emitters.

In accordance with an embodiment of the present invention the illumination means comprise light emitting diodes (LEDs) as light emitters. LEDs are very suitable as illumination means. A light emitting diode is a semiconductor diode which emits light upon application of a forward voltage. Suitable semiconductor materials are in the first place III/V-seminconductors comprising elements of the third and fifth group of the periodic table of the elements. For example GaP, AlGaAs or InGaN are useful materials for light emitting diodes. The emitted wavelength depends on the choice of semiconductor material and/or on the doping with impurities of the semiconductor material. The emission of a LED is within a much smaller band of radiation compared to conventional thermal light sources, like an electric bulb, or a fluorescent tube for example. A particular advantage is also the small diameter of the light emitting surface of a LED so that it forms a quasi punctiform light source. There is available a variety of light emitting diodes which emit different light colors

and can easily be controlled by means of electric controlling means. Therefore, changes in color or intentsity of the illumination can easily be controlled.

In accordance with an embodiment of the present invention, the filter is mounted to be replaceable and/or rotatable.

In an embodiment of the invention, a holder mechanism is provided that allows to replace the optical filter by another optical filter. Thus, different colors or different brightness of the light can be displayed, for example . The radiation characteristic can change with time. This embodiment can attract special attention of the customers, e.g. if an eye-catching change of color or shifting of the tone of color is controlled, e. g. from a very dark green to a light green.

In accordance with an embodiment of the present invention the optical filter comprises at least two different areas each changing the radiation characteristic of the light in a different way. The at least two areas comprise for example a different passing wavelength or band of wavelength. Therefore the light passing the different filter areas shows different colors. In addition or alternatively, the two filter areas may differ in transparency. This means that the intensity of the passing light is different. This can be used to create simultaneously effects of brightness and shadow. Further attractive effects can be obtained by associating a first group of light emitters to a first area of the optical filter and a second group of light emitters to a second area of the optical filter so that two differently colored areas can be created within one transparent area illuminated by the light emitters.

In accordance with an embodiment of the present invention a holder mechanism is provided that allows the optical filter to move, especially to rotate. The movement can for example be a swinging, vibrating or rotating one. As holder a rod is useful

that can be rotated and/or pivoted. The filter may be elastically supported so that it can be brought into a swinging movement

A moving optical filter having for example the aforementioned at least two different areas each changing the radiation characteristic of the light in a different way is useful to create an illumination that changes with time and can create the impression of a moving pattern which is definitely useful to attract the attention of customers. In an example where a first group of ends of fibre optic cables illuminates a first area of the surface of the transparent element and a second group of ends of fibre optic cables illuminates a second area of the surface of the transparent element, the movement of the optical filter leads to a visible change in the illumination of each area of the transparent element according to the frequency of the movement. For example in case of a rotation of a filter that comprises two separated filter areas having different filter characteristics, e.g. one letting pass red light and the other letting pass green light, the frequency of change of color of the light corresponds to the rotational speed of the rotatable filter. In case of an optical filter swingingly moving and having two filter areas separated by a diameter line extending perpendicular to the swinging direction, the frequency of the change of color is that of the frequency of the vibration.

In accordance with an embodiment of the present invention the optical filter comprises different filter elements provided for different groups of fibre optic cables. The different filter elements can be provided by using two or more separated filters each related to a group of fibre optic cables. It is also possible to regard the different filter elements as sections of one optical filter each with different filter characteristics. The arrangement of different groups of fibre optic cables associated to different filter elements enables the creation of an illumination pattern comprising different areas differing in colors and/or light intensity.

In accordance with an embodiment of the present invention the display case further comprises refrigeration means to cool the space inside the display case to provide a refrigerated display case for displaying cooled, frozen or deep-frozen products. Suitable refrigeration means comprise a heat exchanger and a compressor. Usually a refrigerant is compressed and fed to the heat exchanger. It takes up heat from a second medium to which it has heat-exchanging contact by means of the heat-exchanger. The second medium can be air in direct or indirect contact with the products to be cooled. The refrigerant becomes warmer, expands and is compressed again to start the next cooling cycle. The invention is especially useful for refrigerated display cases, because it is able to create interesting illumination effects with almost no thermal energy brought inside the refrigerated display case when using LEDs or the light emitting ends of fibre optic cables as light emitters. In the latter case, as the light source(s) feeding the adjacent ends of the fibre optic cables can be located outside the refrigerated display case, they do not heat the inner space of the refrigerated display case even if heat-producing light sources are used.

In accordance with an embodiment of the present invention the at least one transparent element comprises at least one glass layer. For example display cases comprising doors, shelves or side walls having glass elements are suitable to display products in a manner likely to increase sales, because of the good visibility of the products. The glass elements are at least partly surrounded by frames. In case of a single layer glass filling the frame, the light emitters may be mounted to the frame such that they emit light beams that enter the glass sideways at an end surface of the glass. The emitted light beams are directed to propagate in angular ranges from about 60° to 90° and from about -60° to -90° to the normal to the major surface of the transparent element which means that the light path stays within the glass and the glass seems to shine. And this is the reason why no glaring of the customer occurs.

Refrigerated display cases with glass doors are common for displaying dairy products or deep-frozen products like seafood or ice-cream. For the deep-frozen products the doors should be insulated due to the greater difference in temperature between the inside of the refrigerated display case and the surrounding in the shop.

In accordance with an embodiment of the present invention the at least one transparent element comprises a two-layer insulating glass. Insulated glass comprises two parallel layers of glass arranged with a gap there between, the gap being filled with a gas. The two glass layers are connected by the frame and possibly by additional elements called spacers which bridge the distance between the two glass layers at certain locations. Spacers are especially useful for large insulated glass panels. In case of two-layered insulated glass the light emitters are mounted to the frame in such a way as well that the emitted light beams propagate in angular ranges from about 60° to 90° and from about -60° to -90° to the normal to the major surface of the two glass layers. The light beams can enter at least one of the glass layers via an end surface as described for single layered glass, but can also be emitted into the gap between the two layers with a light propagation in the described direction in this gap. This embodiment also leads to an interesting illumination effect which looks like the insulated glass would shine from inside. Fibre optic cables and LEDs are especially suitable for the use in cold environments. They show almost no emission of thermal energy at the point where they emit the light and they do not show a decrease in efficiency in cold environments as fluorescent tubes do, for example. LEDs can be mounted to the frame which holds the glass, in the same manner as described for the light emitting ends of fibre optic cables.

In accordance with an embodiment of the present invention the at least one transparent element comprises transparent plastic material. For example plexiglass can be used as transparent plastic material which leads to an interesting illumination effect.

In accordance with an embodiment of the present invention the at least one transparent element comprises a gravure. The gravure can be a logo, a slogan, a brand name or name of the product group displayed which should come to the particular attention of the customers. Illumination according to the present invention highlights the gravure by refraction. This effect can be achieved with engraved glass as well as with engraved transparent plastic material or in general with every translucent material having a refraction index other than the air surrounding the display case.

Another advantage of the present invention is that the illumination means according to the present invention can be accomplished to require low voltage only. This is an important effect under the aspect of safety for the customers and the personnel operating the display case provided with the illumination means of the invention.

Embodiments of the present invention are described in greater detail below with reference to the Figures, wherein:

Figure 1 shows a part of a display case with an illuminated single layer glass door,

Figure 2 shows a part of a display case with an illuminated shelve,

Figure 3 shows illumination means and their connection to the frame of the transparent element,

Figure 4 shows an optical filter comprising two different filter areas,

Figure 5 shows a part of an refrigerated display case with an illuminated insulated two-layer glass door and

Figure 6 shows a plate-shaped transparent element and examples of emitted light beams propagating with different angles to the normal to the major surface of the transparent element.

Figure 1 shows a part of a display case 1 with an illuminated single layer glass element 2, for example mounted in a glass door, with a frame 3. The light emitters 5 are mounted in the frame 3 such that they emit the light substantially parallel to the plane of the glass element 2 (see arrows). In the example shown in Figure 1, the light emitters 5 are mounted in the top horizontal part of the frame 3 and the direction of the emitted light beams is in essence downwards parallel to the plane of the glass element 2 or in other words perpendicular to the normal to a major surface of the glass element 2. Therefore, there is almost no risk for a customer standing for example on the right side of Figure 1 in front of the glass element 2 looking at the products 12 inside the display case 1 to be glared by the inventive illumination. The glass element 2 shows an interesting colored light effect which is likely to attract the attention of customers.

Figure 2 shows a transparent shelve 2 which is illuminated according to the invention with the light emitters 5 (see Figure 3) located in the frame 3.

Figue 3 shows an example for illumination means 4 with light emitters 5 mounted to a frame 3 and being connected to cables 6. In case of fibre optic cables 6 the light emitters 5 are simply the light emitting ends of the fibre optic cables 6. In case of light emitting diodes (LEDs) as light emitters 5, the cables 6 are electric cables

connecting the LEDs to an electrical power source and possibly to control means (not shown) controlling for example a changing illumination pattern. When LEDs emitting differently colored light are used the control means are able to control any illumination pattern and color change by means of electrical control only.

In case of use of fibre optic cables the illumination means further comprise coupling means 8 to couple the light into the fibre optic cables 6. And at least one optical filter 9 is needed if it is desired to change the radiation characteristic of the light emitted from the light source 7. The light source 7 can be a gas discharge lamp or a halogen lamp for example. The optical filter 9 is able to change the color of the light depending on the wavelength it is able to let pass, for example.

Figure 4 shows a detail of an optical filter 9 comprising two different filter areas 11a and 11b. For example area 11a is able to let pass green light and area 11b is able to let pass red light. With two different groups of fibre optic cables 6 each associated to one of the areas 11a and 11b, one part of the transparent element 2 can be illuminated with green light and the other part can be illuminated with red light. In addition, light changing effects can be obtained if the optical filter 9 is mounted for example to a pivotable and/or rotatable axle 13 which is pivoted and/or rotated.

Figure 5 shows a part of an refrigerated display case 1 with an illuminated insulated two-layer glass element 2 with a frame 3. The glass element 2 together with the frame 3 is used as an insulated glass door in this example. The light emitters 5 (not explicitly shown in Figure 5) are again mounted in the frame 3, but the optical paths of the emitted light are located between the two glass layers (see arrows) and should be in angular ranges from about 60° to 90° and from about -60° to -90° to the normal to the major surfaces of the glass layers which are substantially parallel to each other. Therefore, the insulated two-glass element 2 seems to shine with possibly colored light without any risk for the customer to be glared. All previously

described light effects can be equally obtained with two or more layered insulated glass. This is especially useful for refrigerated display cases.

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Figure 6 shows a plate-shaped transparent element and examples of emitted light beams propagating with angles of 60°, 90°, -60°, and -90° to the normal to the major surface of the transparent element.

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## CLAIMS

1. Display case (1) comprising at least one elongated transparent element (2) having a major surface, a peripheral margin of the transparent element (2) being surrounded at least partly by a frame (3), and illumination means (4) having light
325 emitters (5) adapted to emit light, the light emitters (5) being mounted to the frame (3) in such a way that the emitted light beams propagate in angular ranges from about 60° to 90° and from about -60° to -90° to the normal to the major surface of the transparent element (2).

330 2. Display case (1) according to claim 1 wherein the transparent element (2) has the shape of a plate.

3. Display case (1) according to claim 1 or 2 wherein the illumination means (4) comprise light emitting diodes (LEDs) as light emitters (5).

4. Display case (1) according to claim 1 or 2 wherein the illumination means (4) comprise fibre optic cables (6) with light emitting ends as light emitters (5), a light source (7), and coupling means (8) adapted to couple the light emitted by the light source (7) into the fibre optic cables (6).

5. Display case (1) according to any of claims 1 to 4 wherein the light emitters (5) are adapted to emit light of selectable color.

6. Display case (1) according to any of claims 1 to 5 wherein the illumination means (4) comprise an optical filter (9) filtering the light.

7. Display case (1) according to claim 6 wherein the optical filter (9) is located in the optical path of the light between the light source (7) and the light emitters (5).

8. Display case (1) according to claim 6 or 7 wherein the optical filter (9) comprises at least two different areas (11a, 11b) each changing the radiation characteristic of the light in a different way.

9. Display case (1) according to any of claims 6 to 8 wherein the optical filter (9) is mounted to be replaceable by another optical filter (9).

10. Display case (1) according to any of claims 6 to 9 wherein the optical filter (9) is mounted to be rotatable.

11. Display case (1) according to any of claims 6 to 9 wherein the optical filter (9) comprises different filter elements provided for different groups of fibre optic cables.

12. Display case (1) according to any of claims 1 to 11 further comprising refrigeration means to cool the space inside the display case (1) to provide a refrigerated display case (1).

13. Display case (1) according to any of claims 1 to 12 wherein the at least one transparent element (2) comprises at least one glass layer (2).

14.Display case (1) according to claim 13 wherein the at least one transparent element (2) comprises a two-layer insulating glass (2).

15.Display case (1) according to any of claims 1 to 12 wherein the at least one transparent element (2) comprises transparent plastic material (2).

16.Display case (1) according to any of claims 1 to 15 wherein the at least one transparent element (2) comprises a gravure.

17.Framed transparent element (2) provided with illumination means (4) as defined in any of claims 1 to 11.

18.Use of the transparent element (2) of claim 17 as a wall or door component of a display case (1) according to any of claims 1 to 16.

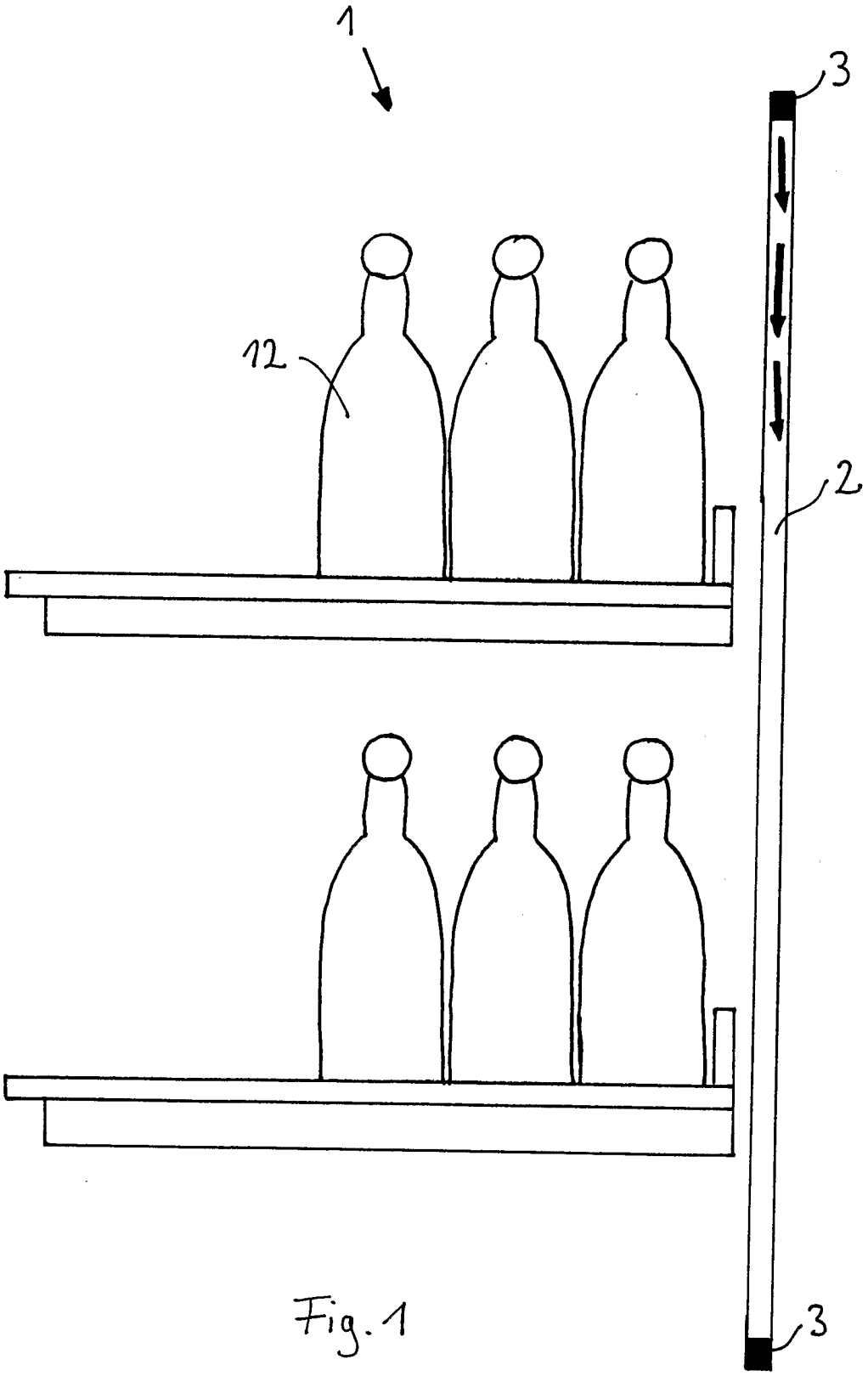


Fig. 1

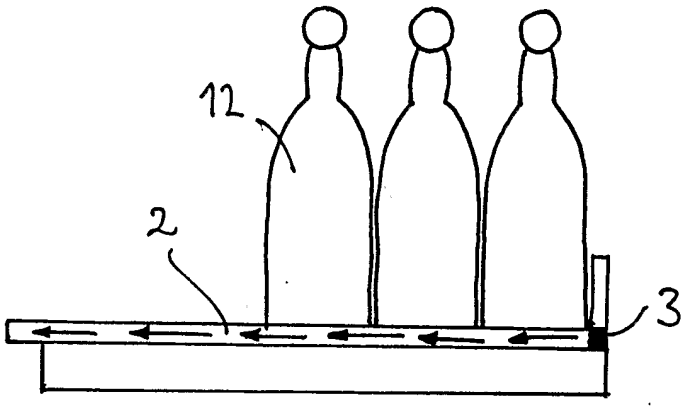


Fig. 2

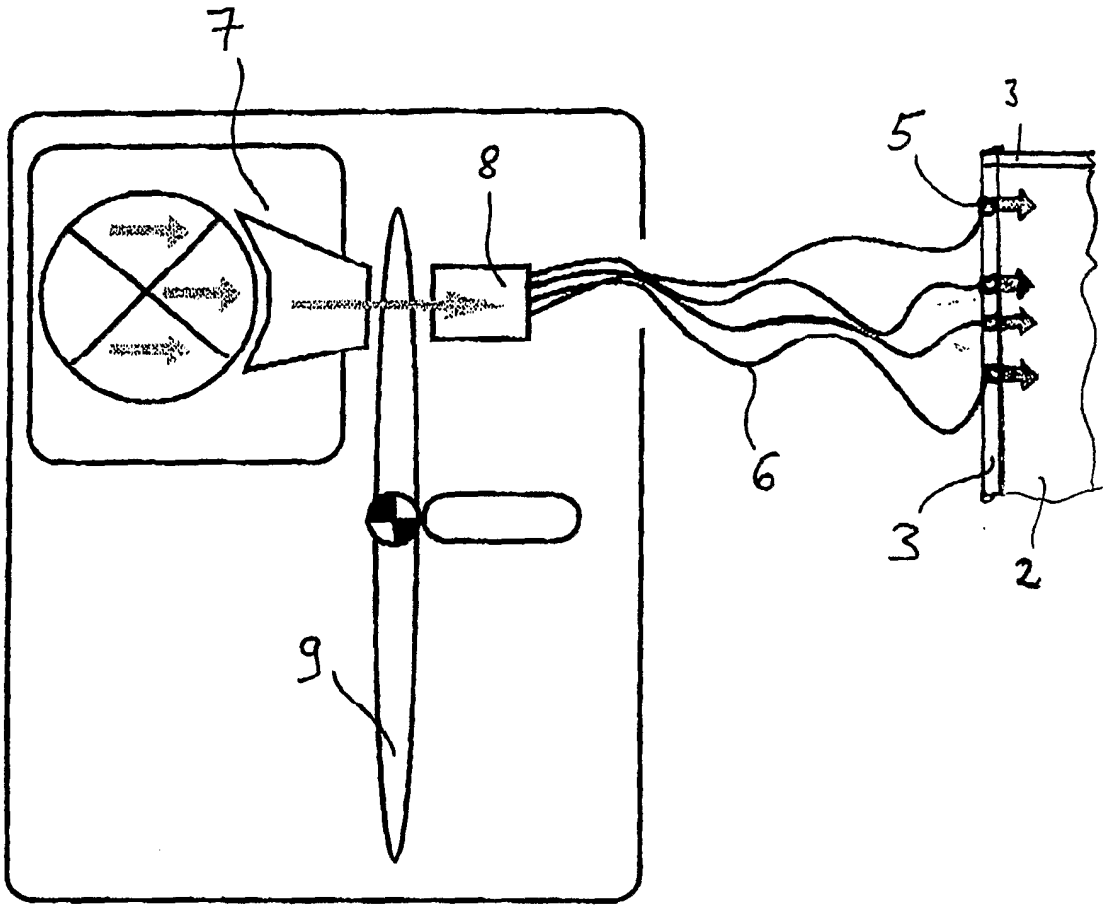


Fig. 3

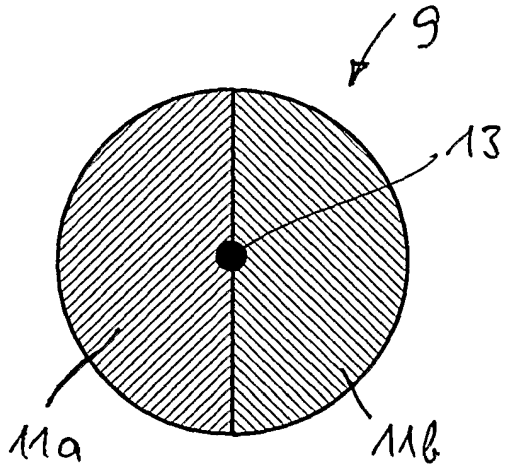


Fig. 4

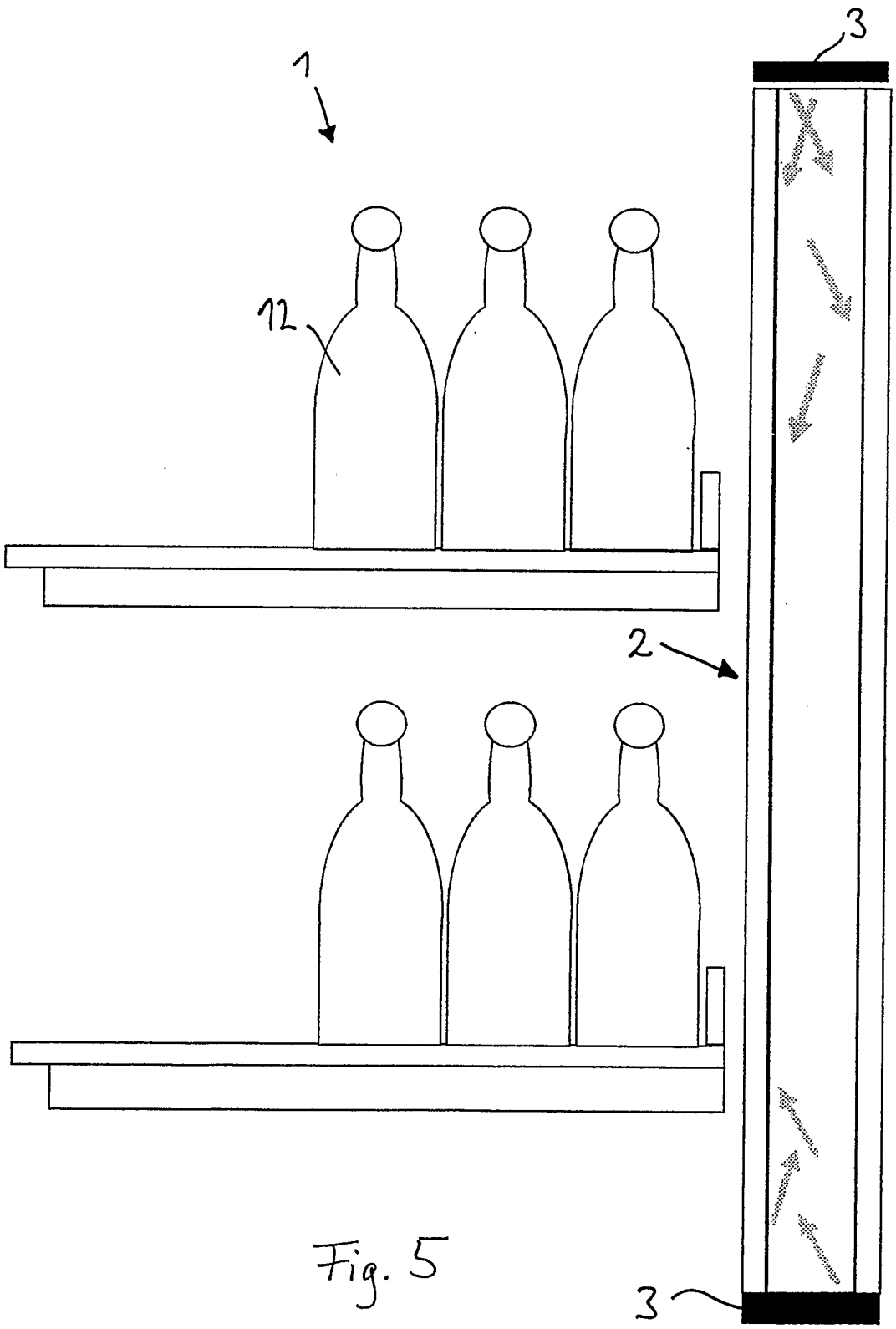


Fig. 5

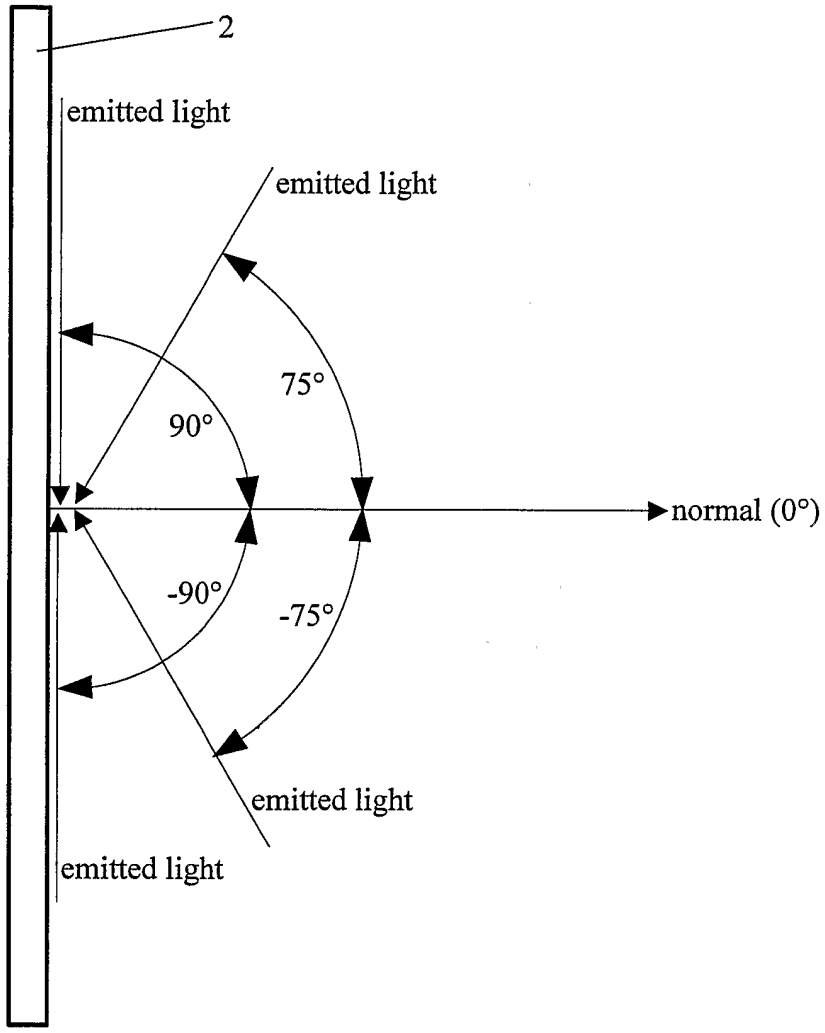
2
emitted light
emitted light
75°
90°
normal (0°)
-90°
-75°
emitted light
emitted light

FIG. 6

# INTERNATIONAL SEARCH REPORT

Interr Application No
PCT/EP2005/001574

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G09F13/18 A47F3/04

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 A47F

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, WPI Data

C. 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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| X<br>A | DE 29 46 454 A1 (EAU DE COLOGNE- & PARFUEMERIE-FABRIK GLOCKENGASSE NO. 4711 GEGENUEBER) 27 May 1981 (1981-05-27)<br>page 10, line 2 - page 18, line 17; figure 1 | 1,2, 5-11,13, 15-17<br>3,18 |
| X | DE 201 05 323 U1 (INTERLUEBKE GEBR. LUEBKE GMBH & CO. KG) 21 June 2001 (2001-06-21)<br>page 4, line 22 - page 5, line 28; figure 1 | 1-3,5, 13,15-18 |

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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| 24 October 2005 | 31/10/2005 |

| Name and mailing address of the ISA | Authorized officer |
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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Pavlov, V |

# INTERNATIONAL SEARCH REPORT

Inter... Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | abstract; figures 1,2 | 3-18 |
| Y | US 5 398 170 A (LEE ET AL)<br>14 March 1995 (1995-03-14)<br>column 7, line 22 - line 65; figure 4 | 4,6-11 |
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PCT/EP2005/001574

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