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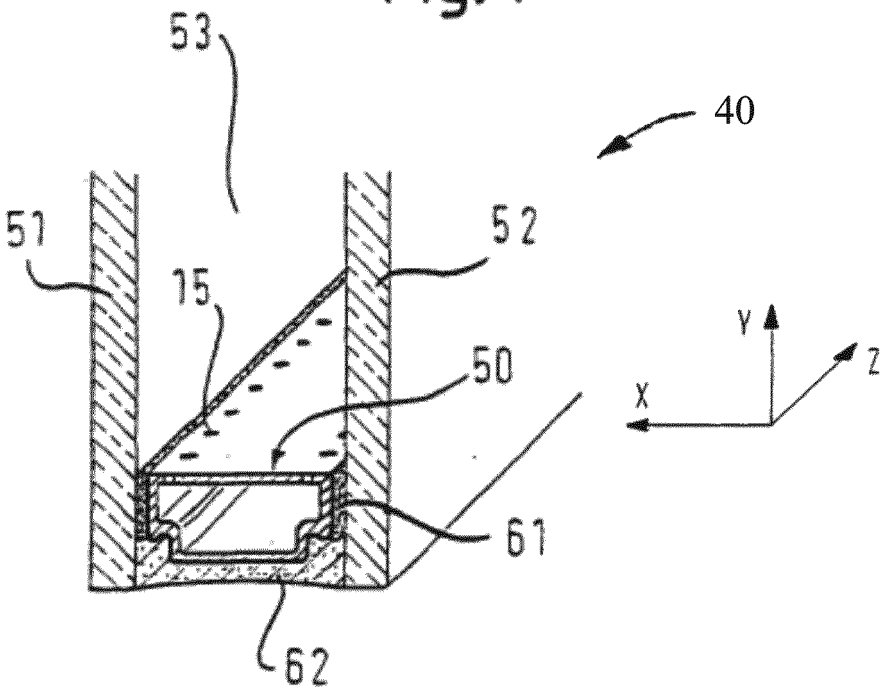
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **SELF-ILLUMINATING SPACER**

(57) A spacer for insulating glazing units (40) having at least two spaced glazing panes (51, 52) connected at their edges via the spacer (50) in a mounted state in which the spacer is mounted
at the edges to limit an interspace (53), comprising at least one self-illuminating wall adapted to face the gas filled interspace in the mounted state, wherein a major part of the self-illuminating wall is made of plastic material containing phosphorescent additives.

Fig. 1



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Description

[0001] The present invention relates to a self-illuminating spacer for insulating glass units, especially but not only suitable for insulating glass units used in emergency exits.

Background technology

[0002] DE 200 16 616 U1 describes an insulating glass unit (IGU) with a metal spacer frame, which is to be used, for example, in emergency exits, suitable especially in case of a complete failure of all (other) light sources at the emergency exits. The spacer frame of the multipane IGU is provided with a luminescing material such that the spacer frame at the edges of the panes is luminescing and afterglowing at its side facing the interior space between the panes. DE 200 16 616 U1 teaches to either provide self-illuminating foils or to coat the spacer frame with self-illuminating paint or to use a self-illuminating emaille.

[0003] DE 103 22 561 A1 discloses an IGU with a spacer frame hermetically sealing the interspace between the panes and usually filled with a rare gas. DE 103 22 561 A1 discloses three different possibilities of providing illuminating properties to the spacer frame, namely electroluminescence strips (EL), LED strips and self-illuminating strips. These long-self-illuminating strips could be phosphor pigments which are embedded in a polymer matrix and are applied with usual coating technologies.

[0004] DE 10 2011 120 845 A1 discloses the use of fluorescent material and a light source to measure the gas concentrations in the interspace of an IGU.

[0005] WO 2012/017351 A1 discloses the use of phosphorescent material in the interspace of an IGU to enable lighting at night.

[0006] GB 2 405 417 A discloses the use of phosphorescent pigments with added doping substances embedded in a synthetic foil, which is applied to a surface of an element like a door frame or window frame.

[0007] It is legally required in many countries that emergency exists are marked by a green lighting device which emits green light for at least 2 hours in case of emergency and that the device function is guaranteed for 50 years.

[0008] It is an object of the present invention to provide a technology improving the marking of emergency exits.

[0009] This object is achieved by a self-illuminating spacer for insulating glass units according to claim 1 or an IGU according to claim 3 or a window or door or facade element according to claim5.

[0010] Further developments are given in the dependent claims.

[0011] According to the present teachings, phosphorescent materials are contained in the plastic spacer body. The phosphorescent materials are not only applied to a surface of a spacer wall by coating or attaching a strip with such materials as in the prior art but are contained in the plastic material of a spacer body wall.

[0012] Therefore, the phosphorescent materials are distributed in the material of at least the major part of the self-illuminating wall and thus the longest possible lifetime of phosphorescent materials is secured. Peeling off, scratching, handling problems at the time of cutting spacers, etc. are prevented.

[0013] Moreover, the provision in at least the major part of the self-illuminating wall helps avoiding problems with other functions of a spacer like gas communication with the interspace between the glazing panes.

[0014] Accordingly, there is no need for customers to obtain additional certification related to the application of phosphorescent strips or coatings on spacer frames, and there are no problems arising from application of a phosphorescent strip or coating such as fogging of adhesive, problems with the aesthetical look, wrinkles due to bending, cracks, problems with proper cut-to-measure, perforation, etc..

[0015] The integrated solution is superior to a subsequent treatment (coating or strip application) of the spacer to provide phosphorescent properties and delivers a ready-to-use solution simplifying processes in the later handling of the spacers in manufacturing insulating glass units, door, window and facade elements.

[0016] Etching of one or more glazing panes and/or silkscreens on one or more glazing panes of an IGU allow to add communication like signs or texts visible in case of emergency or other situations suitable for or demanding communication.

[0017] Further features and advantages will become apparent from the descriptions of embodiments referring to the drawings, which show:

Fig. 1 a partial perspective cross-sectional view of an insulating glazing unit with a spacer;

Fig. 2 a side view, partially cut away, of a spacer frame bent from a spacer profile;

Fig. 3 a cross-sectional view of a spacer perpendicular to its longitudinal direction; and

Fig. 4 images of emergency exits in lighted and dark surroundings with and without self-illuminating spacers.

[0018] Herein, the following terms and definitions apply throughout the above and below description and claims. Luminescence is spontaneous emission of light by a substance not resulting from heat. Photoluminescence is light emission from any form of matter after the absorption of photons (electromagnetic radiation). Fluorescence is the spontaneous emission of light by a substance shortly after that material has absorbed photons (electromagnetic radiation). It is a form of luminescence. In most cases, the emitted light has a longer wavelength, and therefore lower energy, than the absorbed radiation. Fluores-

cent materials cease to glow nearly immediately when the radiation source stops. Phosphorescence is a type of photoluminescence related to fluorescence. Unlike fluorescence, a phosphorescent material does not immediately re-emit the radiation it absorbs. The slower time scales of the re-emission are associated with "forbidden" energy state transitions in quantum mechanics. As these transitions occur very slowly in certain materials, absorbed radiation is re-emitted at a lower intensity for up to several hours after the original excitation.

[0019] Fig. 1 shows a partial perspective view of an insulating glazing unit (IGU) 40 with a spacer 50. The IGU 40 comprises two glazing panes 51, 52 arranged parallel to each other with a predetermined distance between the same. A spacer 50 extends in a longitudinal direction z along the edges of the glazing panes 51, 52.

[0020] As shown in Fig. 2, the spacer 50 is used to form a spacer frame, e. g. by cold-bending, the spacer profile into a frame shape and connecting the ends with a linear connector 54 as know in the art. Other ways to form a spacer frame like cutting linear pieces of spacer frame parts and connecting the same via edge connectors are also possible as know in the art.

[0021] The spacer 50 is mounted at the edges of the two spaced glazing panes 51, 52. As is shown in Fig. 1, the spacer 50 comprises side walls formed as attachment bases to be adhered with the inner sides of the glazing panes 51, 52 using an adhesive material (primary sealing compound) 61, e.g., a butyl sealing compound based upon polyisobutylene. The intervening space 53 between the glazing panes is thus defined by the two glazing panes 51, 52 and the spacer profile 50. The inner side of the spacer profile 50 faces the intervening space 53 between the glazing panes 51, 52. On the (outer) side facing away from the intervening space 53 between the glazing panes in the height direction y, a mechanically stabilizing sealing material (secondary sealing compound) 62, for example based upon polysulfide, polyurethane or silicon, is introduced into the remaining, empty space between the inner sides of the window panes in order to fill the empty space. This sealing compound also protects a diffusion barrier layer provided at least on the outer side of the spacer.

[0022] The interspace 53 is usually filled with a gas having good heat insulating characteristics like a rare gas such as argon or xenon. Thus, a gas filled interspace 53 is present between the glazing panes 51, 52 and the spacer 50 in the mounted state.

[0023] As shown in Fig. 3, the spacer 50 comprises a spacer profile body 10 made by extrusion of polypropylene . The profile body 10 comprises two side walls 11, 12 that are separated by a distance in the traverse (width) direction x and that extend essentially in the height direction y. The side walls 11, 12 are connected via an inner wall 14. The one-piece diffusion barrier film 30 is formed on the outer side of the spacer which faces away from the gas filled interspace and the side walls 11, 12.

[0024] An outer wall 13 may optionally be formed on the outer side of the spacer which faces away from the gas filled interspace and the diffusion barrier film 30 may be formed on the outer wall 13 as shown in Fig. 1 and 3.

[0025] A chamber 20 is formed for accommodating hygroscopic (desiccating) material. The chamber 20 is defined in cross-sectional view perpendicular to the longitudinal direction z by on its respective lateral sides the side walls 11, 12 and on its side facing the interspace 53 by the inner wall 14. Openings 15 are formed in the inner wall 14 (see Fig. 1), so that the inner wall 14 is not formed to be diffusion-proof allowing gas exchange between the gas filled interspace 53 and the chamber 20. In addition or in the alternative, to achieve a non-diffusion-proof design, it is also possible to select the material for the entire profile body and/or the inner wall, such that the material permits an equivalent diffusion without the formation of the openings 15.

[0026] The side walls 11, 12 are formed as attachment bases for attachment to the inner sides of the glazing panes. In other words, the spacer profile is preferably adhered to the respective inner sides of the glazing panes via these attachment bases (see Fig. 1).

[0027] The plastic body 10 extending in the longitudinal direction z with the two lateral side walls 11, 12 adapted to face the glazing panes 51, 52 in the width direction x perpendicular to the longitudinal direction z comprises the inner wall 14 adapted to face the gas filled interspace 53 in the mounted state of the spacer formed such that its major part 14m is made of plastic material containing phosphorescent additives. Therefore the inner wall 14 is a self-illuminating wall.

[0028] Major part of the inner wall means in this text at least half of the inner wall in its extension in the width direction x. Containing means in this text that the phosphorescent materials are distributed in the material of the major part of the self-illuminating wall.

[0029] The phosphorescent materials can be extruded together with the plastic material of the major part of the inner wall resulting in that they are distributed in the material of the major part of the (self-illuminating) inner wall.

[0030] The phosphorescent materials can, of course, be additionally contained in other parts of the plastic body of the spacer, too, if wished or required.

[0031] Thus, an improved spacer for IGUs made of plastic material is provided with self-illuminating properties. Self-illuminating property means an illumination without external energy source such as a current supply, a battery or the like.

[0032] In test products manufactured by the applicant, the commercially available phosphorescent additive 50076 LUMILUX® Effect-MB green available from Honeywell Specialty Materials Performance Products, Seelze, Germany has been used (see https://www.honeywell-lumilux.com/product/50076-2/). It has been extruded together with the plastic material polypropylene (PP) in an amount of 20 wt% of the phosphorescent additive.

[0033] Another possible phosphorescent additive is 50077 LUMILUX® Effect-MB green. They can be used together with PP or the plastic materials SAN (Styrene acrylonitrile) or PA (Polyamide) or any other suitable plastic material, with or without additives like e.g. glass fibres, in an amount 10wt% to 60wt%.

[0034] Fig. 4 shows emergency exits. An emergency exit with the legally required green light is shown in a normal illuminated surrounding in the upper part of Fig. 4 on the left side. The same emergency exit is shown in Fig. 4 in the bottom part on the left side in a dark environment. Only the green light is clearly visible.

[0035] An emergency exit with the legally required green light and with a self-illuminated spacer according to the above teachings in the IGU of the emergency exit door is shown in a normal illuminated surrounding in the upper part of Fig. 4 on the right side. One glazing pane of the IGU is provided with an arrow-shaped etching. The arrow-shaped etching scatters the green light emitted by the self-illuminated spacer and thus improves the marking of the emergency exit. The same emergency exit is shown in Fig. 4 in the bottom part on the right side in a dark environment. It is obvious that not only the green light is clearly visible but also the self-illuminated spacer and the arrow-shaped etching.

[0036] Of course, other shapes of an etching of the glazing pane or a silk-screen (e.g. printed with a ceramic ink) could be used to add signs or texts to an emergency exit, which are illuminated by the self-illuminating spacer in a dark environment.

[0037] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. Spacer for insulating glazing units (40) having at least two spaced glazing panes (51, 52) connected at their edges via the spacer (50) in a mounted state in which the spacer is mounted at the edges to limit an interspace (53), comprising
   a plastic body (10) extending in a longitudinal direction (z) with two lateral side walls (11, 12) adapted to face the glazing panes in a width direction (x) perpendicular to the longitudinal direction (z) and at least one self-illuminating wall (14) adapted to face the gas filled interspace in the mounted state,
   wherein a major part of the self-illuminating wall (14) is made of plastic material containing phosphorescent additives.

2. Spacer according to claim 1, wherein
   at least the major part of the self-illuminating wall (14) made of plastic material and containing phosphorescent additives is made by extruding the plastic material together with the phosphorescent additives.

3. Insulating glazing unit, comprising
   at least two spaced glazing panes (51, 52) connected at their edges via a spacer (50) mounted at the edges to limit a gas filled interspace (53),
   wherein the spacer is a spacer according to claim 1 or 2.

4. Insulating glazing unit according to claim 3, wherein at least one of the glazing panes is provided with a predefined etching and/or silk screen adapted to be illuminated by phosphorescent light from the major part to provide a communication message and/or sign.

5. Window, door or facade element comprising an insulating glazing unit (40) according to any one of claims 3 or 4.

Amended claims in accordance with Rule 137(2) EPC.

1. Spacer for insulating glazing units (40) having at least two spaced glazing panes (51, 52) connected at their edges via the spacer (50) in a mounted state in which the spacer is mounted at the edges to limit an interspace (53), comprising
   an extruded plastic spacer body (10) extending in a longitudinal direction (z) with two lateral side walls (11, 12) adapted to face the glazing panes in a width direction (x) perpendicular to the longitudinal direction (z) and at least one self-illuminating inner wall (14) adapted to face the gas filled interspace in the mounted state,
   a chamber (20) formed for accommodating hygroscopic material is defined in cross-sectional view perpendicular to the longitudinal direction (z) on its respective lateral sides by the side walls (11, 12) and on its side adapted to face the interspace (53) by the inner wall (14), the inner wall (14) being formed to be non-diffusion-proof allowing gas exchange between the interspace (53) and the chamber (20), and a one-piece diffusion barrier film (30) formed on the outer side of the spacer adapted to face away from the interspace (53) and the side walls (11, 12),
   wherein phosphorescent additives are contained in the plastic spacer body such that at least a major part of the self-illuminating inner wall (14) is made of plastic material containing phosphorescent addi-

tives by extruding the plastic material together with the phosphorescent additives, major part of the inner wall meaning at least half of the inner wall in its extension in the width direction (x).

2. Spacer according to claim 1, wherein the plastic material is polypropylene or styrene acrylonitrile or polyamide.

3. Insulating glazing unit, comprising at least two spaced glazing panes (51, 52) connected at their edges via a spacer (50) mounted at the edges to limit a gas filled interspace (53), wherein the spacer is a spacer according to claim 1 or 2.

4. Insulating glazing unit according to claim 3, wherein at least one of the glazing panes is provided with a predefined etching and/or silk screen adapted to be illuminated by phosphorescent light from the major part to provide a communication message and/or sign.

5. Window, door or facade element comprising an insulating glazing unit (40) according to any one of claims 3 or 4.

Fig. 1

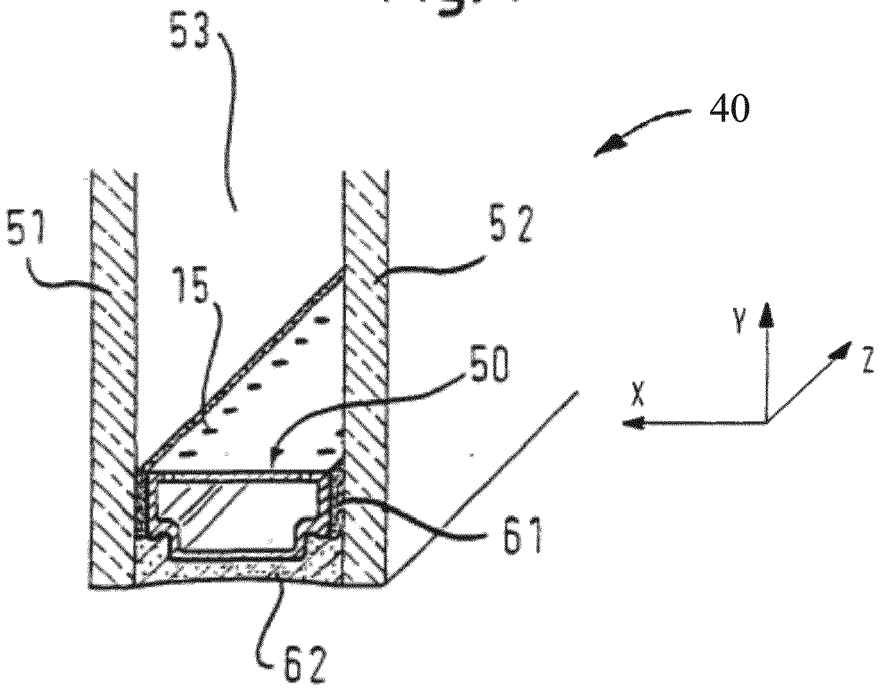

Fig. 2

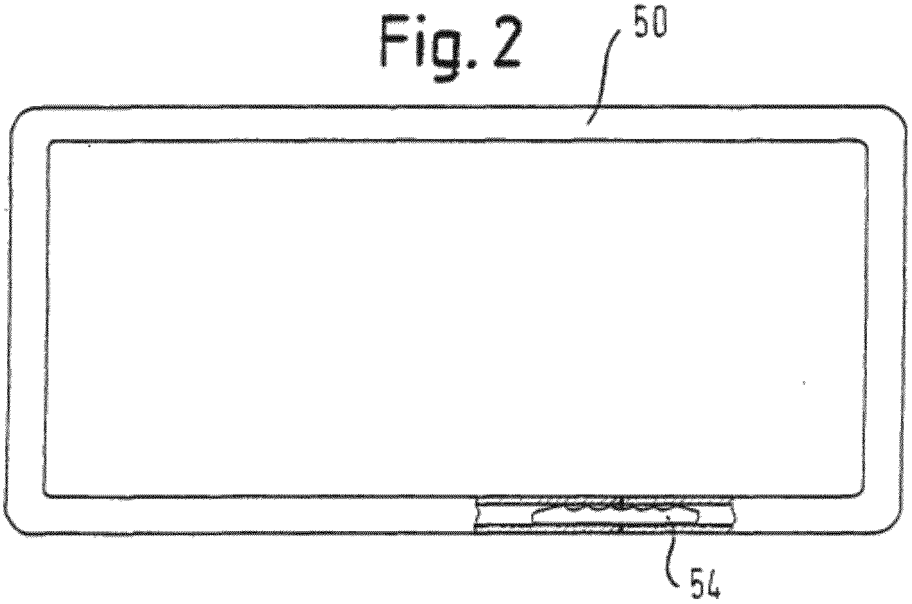

Fig. 3

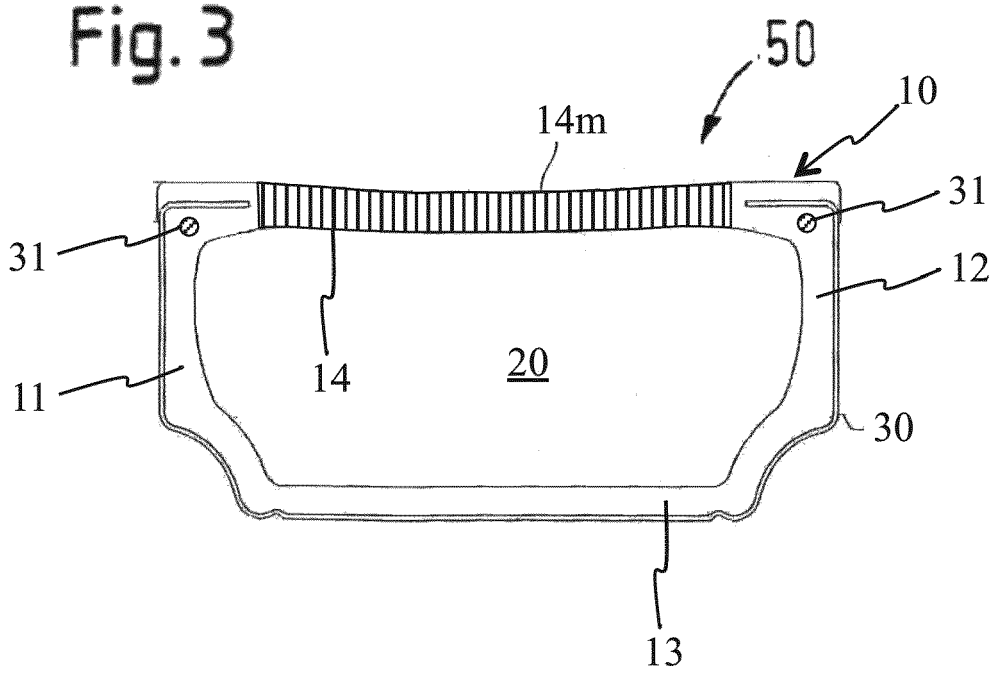

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 1457

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 April 2019	Verdonck, Benoit

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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