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(54) **AUTOMOTIVE LIGHTING DEVICE**

(57) The invention provides an automotive lighting device (1) comprising a light source (2), a housing (3) with a ventilation element (4), an outer glass (5) closing the housing (2) and an opaque element (6). The ventilation element (4) allows water vapour to pass through while preventing liquid water from entering the housing.

The opaque element (6) comprises a first portion (7) located between the ventilation element (4) and the outer glass (5), wherein the first portion (7) comprises a permeable element which allows water vapour to pass through but does not allow light to pass through.

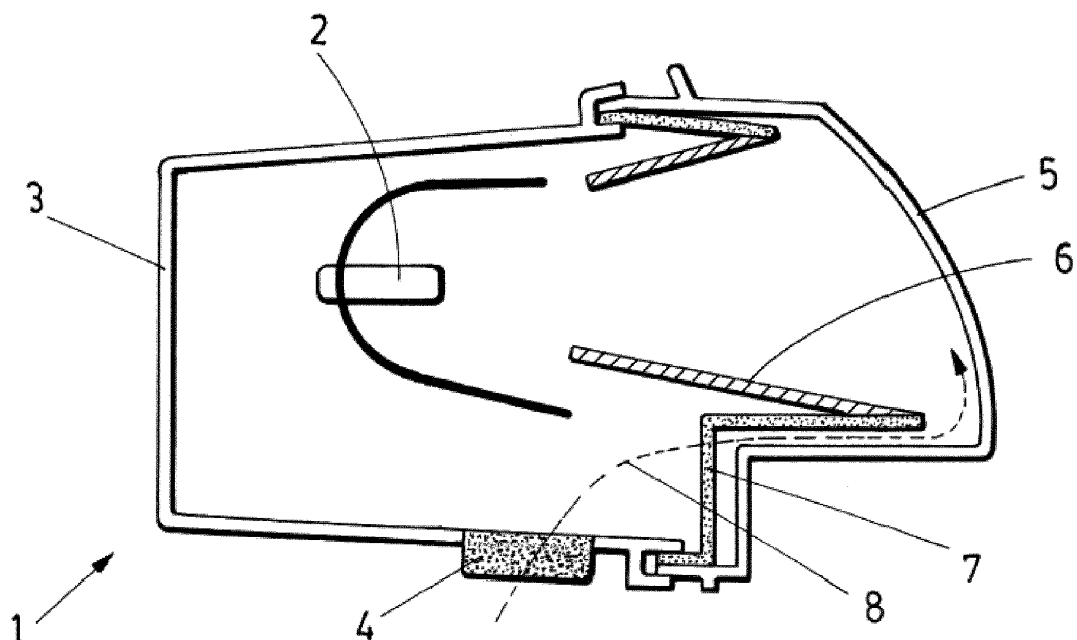


FIG. 2

Description

TECHNICAL FIELD

[0001] The present invention belongs to the field of lamps for automotive vehicles, and more specifically, to the design of headlamps to avoid fogging in the outer glass.

STATE OF THE ART

[0002] Current headlamps have to fulfil different requirements which sometimes involve contradictory design paths. One example of this is related to demisting problems.

[0003] Misting is caused when water vapour condenses on the internal surface of a glass. Micro-drops are unaesthetic and affect the light behaviour, so great efforts are put to solve this problem. However, in order to design modern and efficient lighting devices, walls of opaque materials must surround the light source, to avoid light leakage. But these opaque walls are an obstacle for a free path of dry air to reach the glass surface and avoid condensation.

[0004] Hence, the better a solution is for avoiding light leakage, the worse for avoiding glass condensation because these opaque walls create a tortuous defogging air path that will have a very low flow rate and, consequently, a very slow defogging velocity.

DESCRIPTION OF THE INVENTION

[0005] The invention provides a solution for this problem by the provision of an automotive lighting device according to claim 1. Preferred embodiments of the invention are defined in dependent claims.

[0006] Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealised or overly formal sense unless expressly so defined herein.

[0007] In this text, the term "comprises" and its derivations (such as "comprising", etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0008] In a first inventive aspect, the invention provides an automotive lighting device comprising

- a light source intended to emit light;
- a housing comprising a ventilation element, which allows water vapour to pass through while preventing liquid water from entering the housing;
- an outer glass, arranged to close the housing;
- an opaque element with a first portion located be-

tween the ventilation element and the outer glass, wherein the first portion comprises a permeable element which allows water vapour to pass through but does not allow light to pass through.

[0009] The permeable element is opaque enough to avoid light leakage, but offers an easier path for the dry flow to reach the glass and avoid misting. Hence, both problems are satisfactorily solved with a solution which is simple and inexpensive.

[0010] In some particular embodiments, the permeable element comprises a valve.

[0011] A valve is a suitable solution for a permeable material as defined in the present invention, since it allows water vapour to pass through but does not allow light to pass through.

[0012] In some particular embodiments, the permeable element comprises a porous material.

[0013] A porous material is a suitable solution for a permeable material as defined in the present invention, since it allows water vapour to pass through but does not allow light to pass through.

[0014] In some particular embodiments, the whole opaque element is made of a porous material. These embodiments include a porous material that is able to resist loads. In other embodiments, the main part of the opaque element is made of a solid material and only the second portion is made of a porous material, in order to avoid loads on this second portion.

[0015] In some particular embodiments, the first portion of the opaque element is made of plastic injection with a pore generation process. In other embodiments, the first portion of the opaque element is manufactured out of a sintering process.

[0016] These are suitable ways of obtaining a porous material from well-known manufacturing processes and inexpensive materials.

[0017] In some particular embodiments, the porous material is one of PTFE, pumice stone or a textile material.

[0018] These materials have proved to be suitable for this invention, since they provide a good pore size and good mechanical properties.

[0019] In a particular embodiment, at least a portion of the opaque element is located less than 5cm from the outer glass.

[0020] Such an arrangement helps to define a straightforward path for the dry current, and is very useful in current designs where size is growing smaller. In some embodiments, this portion of the opaque element could even touch the outer glass.

[0021] In some particular embodiments, the opaque element is a bezel. In other embodiments, the opaque element is a harness cover. These are common elements in a lighting device, and are close enough to the glass so that the porosity of the first portion has a positive impact in the path of the dry flow.

[0022] In some particular embodiments, the lighting

device further comprises a deflector arranged to direct an airflow from the ventilation element to the first portion of the opaque element.

[0023] This deflector makes still easier the path of the dry flow from the ventilation element comprised in the housing and the glass which is intended to be demisted.

[0024] In some particular embodiments, the first portion has a hydrophobic or super-hydrophobic surface treatment.

[0025] These treatments are useful since, otherwise, the pores would become a humidity store, and the dry current would become a wet current when crossing the porous material, thus losing the demisting properties.

[0026] In some particular embodiments, the internal face of the outer glass has an anti-mist surface treatment.

[0027] This anti-mist treatment is also helpful to cooperate with the dry current in achieving the demisting of the glass surface.

[0028] In some particular embodiments, the light source is a solid-state light source.

[0029] The term "solid state" refers to light emitted by solid-state electroluminescence, which uses semiconductors to convert electricity into light. Compared to incandescent lighting, solid state lighting creates visible light with reduced heat generation and less energy dissipation. The typically small mass of a solid-state electronic lighting device provides for greater resistance to shock and vibration compared to brittle glass tubes/bulbs and long, thin filament wires. They also eliminate filament evaporation, potentially increasing the life span of the illumination device. Some examples of these types of lighting comprise semiconductor light-emitting diodes (LEDs), organic light-emitting diodes (OLED), or polymer light-emitting diodes (PLED) as sources of illumination rather than electrical filaments, plasma or gas.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

Figure 1 shows a scheme of an automotive lighting device according to the state of the art.

Figure 2 shows a scheme of a particular embodiment of an automotive lighting device according to the invention.

Figure 3 shows a scheme of a different embodiment of an automotive lighting device according to the invention.

Figure 4 shows a lighting device according to a particular embodiment of the invention installed in an automotive vehicle.

DETAILED DESCRIPTION OF THE INVENTION

[0031] The example embodiments are described in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternate forms and should not be construed as limited to the examples set forth herein.

[0032] Accordingly, while embodiment can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included. Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate.

[0033] Figure 1 shows a scheme of an automotive lighting device 101 according to the state of the art. This lighting device comprises the following elements:

- a light source 102 intended to emit light;
- a housing 103 comprising a ventilation element 104, configured to allow water vapour to pass through but does not allow liquid water to enter the housing;
- an outer glass 105, arranged to close the housing 103;
- an opaque element 106 located between the light source 102 and the outer glass 105, intended to avoid light leakage.

[0034] In this lighting device 101 the dry path which comes from the ventilation element 104 follows a tortuous path 107 from this ventilation element until reaching the outer glass 105.

[0035] Figure 2 shows an automotive lighting device 1 according to the invention. This lighting device 1 comprises

- a solid-state light source, such as a LED 2 intended to emit light;
- a housing 3 comprising a ventilation element 4, configured to allow water vapour to pass through but does not allow liquid water to enter the housing;
- an outer glass 5, arranged to close the housing;
- an opaque element 6 with a first portion 7 located between the light source 2 and the outer glass 5, wherein the first portion 7 is made of a porous material which allows water vapour to pass through but does not allow light to pass through.

[0036] In the particular embodiment shown in this figure, the opaque element 6 is a bezel, which is located between 1cm and 5cm from the outer glass.

[0037] This bezel 6 comprises a first portion 7 which is made of a porous material. The location of this first portion 7 is optimum to provide the dry current the fastest path 8 to reach the outer glass. As may be seen from the comparison of Figures 1 and 2, the path 8 of the lighting device of the invention is much more straightforward than the path 107 followed by the dry flow in the lighting devices of the state of the art.

[0038] The bezel 6 is made of a plastic injection material, where the first portion 7 is subject to a pore formation process. The rest of the bezel keeps its original structure, so that it may resist loads, while the first portion is made porous to provide the advantageous feature to the lighting device. Further, the porous material has a hydrophobic surface treatment, to avoid humidity being stored in the pores.

[0039] Figure 3 shows an even more efficient lighting device 1 according to the invention. This embodiment comprises all the elements of the embodiment shown in the preceding figure and also comprises a deflector 9 arranged to direct the dry flow from the ventilation element 4 to the first portion 7 of the opaque element 6. This deflector is arranged in contact with a zone of the housing which is close to the ventilation element, and limits the path for the dry flow so that it reaches the first portion 7 sooner.

[0040] In this embodiment, the first portion 7 of the opaque element 6 is smaller, since the deflector 9 directs the flow towards the particular first portion, and the rest of the bezel does not receive the dry flow. As a consequence, there is no need to arrange such a big first portion as in the preceding example. This has a positive outcome in the mechanical properties of the final bezel, since the porous materials have, in general, poorer mechanical properties than solid materials.

[0041] Figure 4 shows a lighting device 1 according to the invention installed in an automotive vehicle 100.

[0042] This automotive vehicle 100 will have their headlamps easily demisted without using particular and expensive active elements. There is no need to force any current, since the particularly advantageous structure of the lighting device 1 according to the invention is enough to cause demisting in a faster way than in the headlamps which are known in the state of the art.

[0043] The bezel 6 is usually seen, but the first portion is not seen in this figure. Since solid plastic materials are aesthetically preferred to porous materials, this feature turns out to be advantageous.

Claims

1. Automotive lighting device (1) comprising
a light source (2) intended to emit light;

a housing (3) comprising a ventilation element (4), which allows water vapour to pass through while preventing liquid water from entering the housing;

an outer glass (5), arranged to close the housing (2);

an opaque element (6) with a first portion (7) located between the ventilation element (4) and the outer glass (5), wherein the first portion (7) comprises a permeable element which allows water vapour to pass through but does not allow light to pass through.

2. Automotive lighting device (1) according to claim 1, wherein the permeable element comprises a valve.

3. Automotive lighting device (1) according to any of the preceding claims, wherein the permeable element comprises a porous material.

4. Automotive lighting device (1) according to claim 3, wherein the whole opaque element is made of a porous material.

5. Automotive lighting device (1) according to any of claims 3 or 4, wherein the first portion of the opaque element is made of plastic injection with a pore generation process.

6. Automotive lighting device (1) according to any of claims 3 or 4, wherein the first portion of the opaque element is manufactured out of a sintering process.

7. Automotive lighting device (1) according to any of claims 3 to 6, wherein the porous material is one of PTFE, pumice stone or a textile material.

8. Automotive lighting device (1) according to any of the preceding claims, wherein at least a portion of the opaque element is located less than 5cm from the outer glass.

9. Automotive lighting device (1) according to any of the preceding claims, wherein the opaque element is a bezel.

10. Automotive lighting device (1) according to any of the preceding claims, wherein the opaque element is a harness cover.

11. Automotive lighting device (1) according to any of the preceding claims, wherein the lighting device further comprises a deflector arranged to direct an airflow from the ventilation element to the first portion of the opaque element.

12. Automotive lighting device (1) according to any of the preceding claims, wherein the first portion has a

hydrophobic or super-hydrophobic surface treatment.

13. Automotive lighting device (1) according to any of the preceding claims, wherein the internal face of the outer glass has an anti-mist surface treatment. 5
14. Automotive lighting device (1) according to any of the preceding claims, wherein the light source is a solid-state light source. 10

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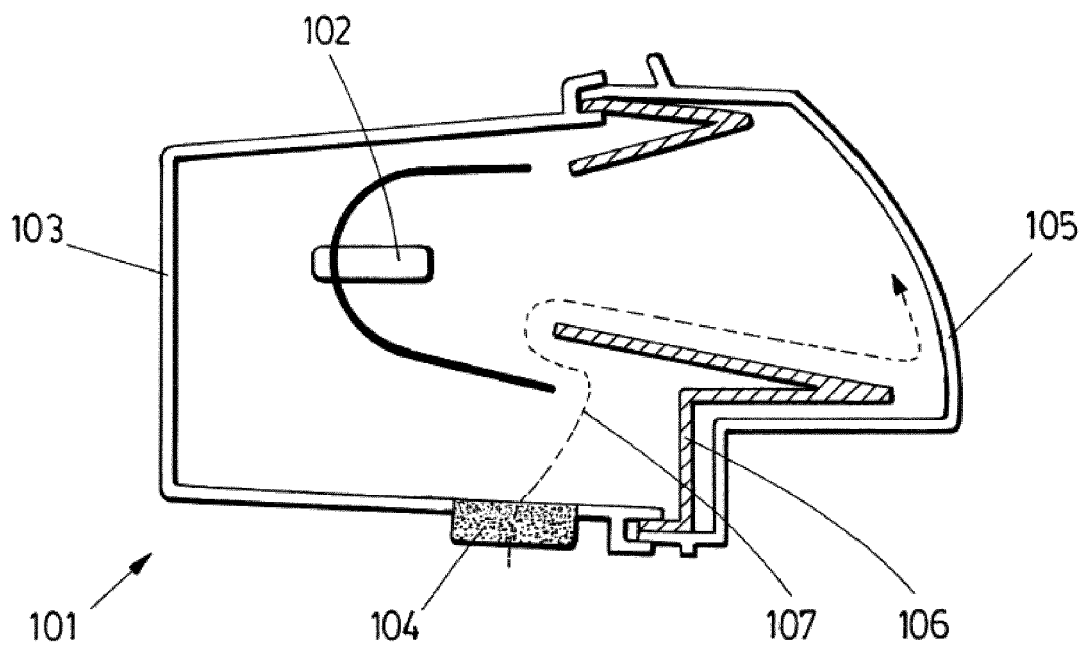


FIG.1

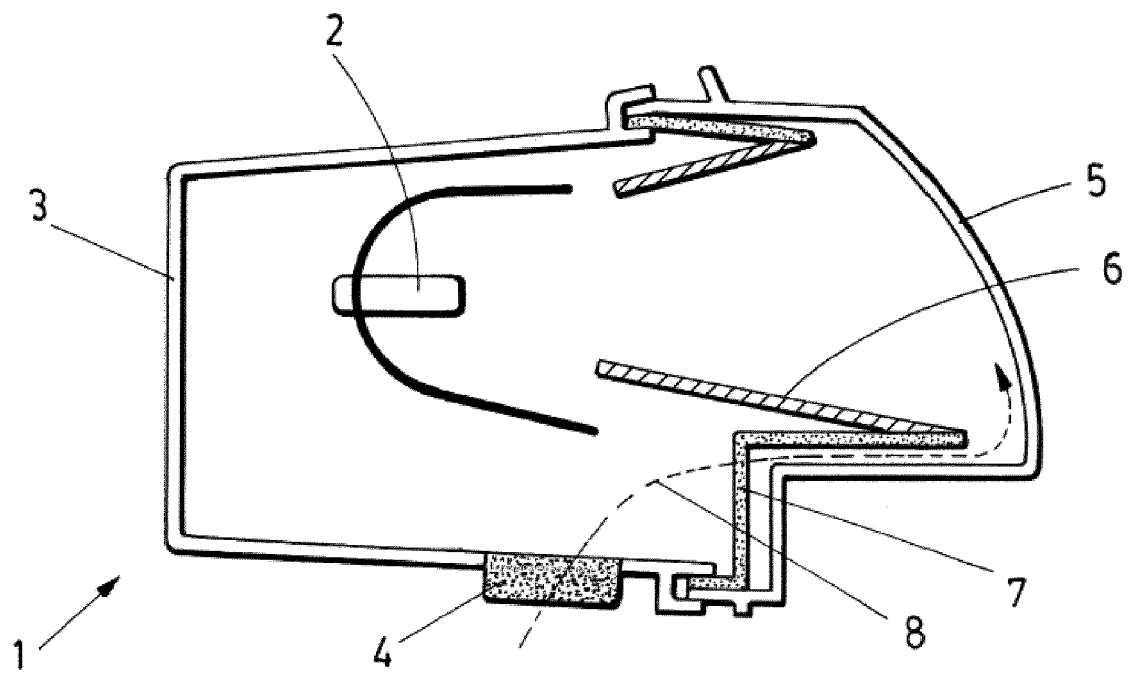


FIG.2

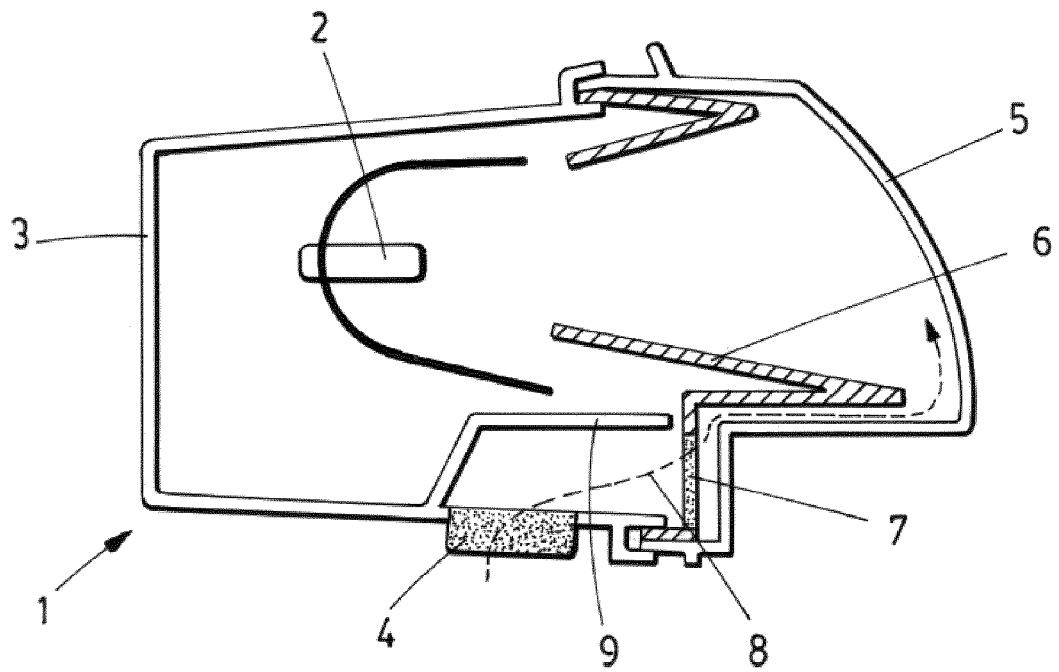


FIG.3

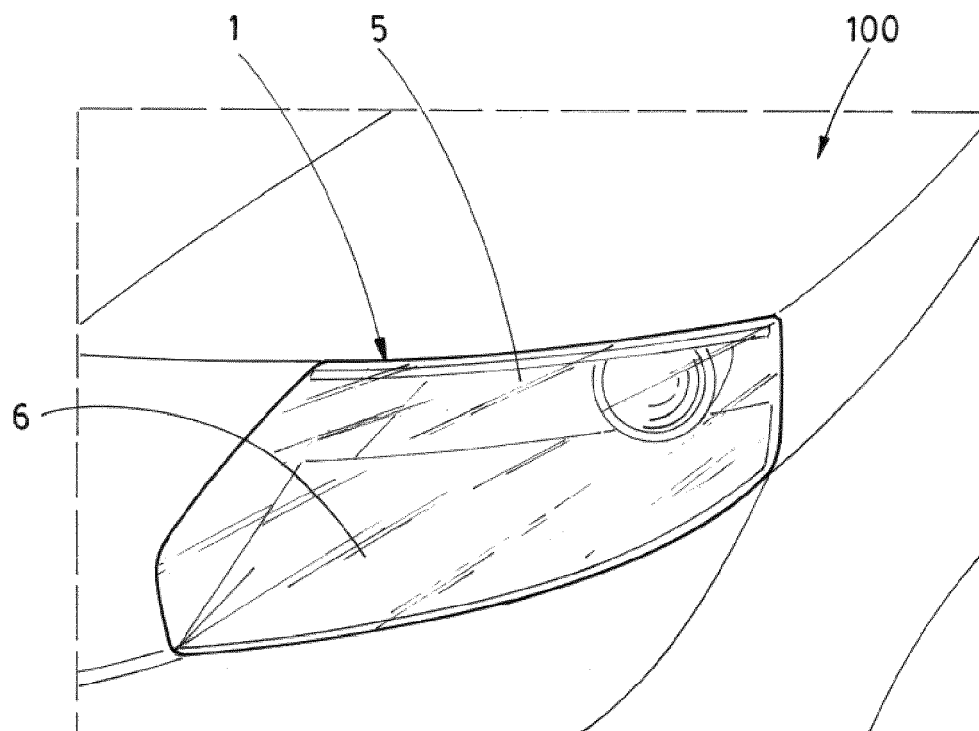


FIG.4



EUROPEAN SEARCH REPORT

Application Number
EP 18 38 2421

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F21S
Place of search		Date of completion of the search	Examiner
Munich		20 November 2018	Schulz, Andreas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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