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(71) Applicants:
• **SCHOTT Flat Glass CR, s.r.o.**
757 01 Valasské Mezirící (CZ)
• **Schott VTF**
(Societe Par Actions Simplifiee)
57870 Troisfontaines (FR)

(72) Inventors:
• **Rafaj, Martin**
75501 Vsetin (CZ)
• **Blaha, Martin**
75301 Hranice (CZ)
• **Kukulis, Jaroslav**
75661 Roznov pod Radhostem (CZ)
• **Kolheb, Benoît**
57445 Reding (FR)
• **Chevrier, Laurent**
57870 Hartzviller (FR)
• **Placek, Jaroslav**
74267 Zenklava (CZ)

(74) Representative: **Ullrich & Naumann PartG mbB**
Schneidmühlstrasse 21
69115 Heidelberg (DE)

(54) INSULATING GLASS UNIT AND CHILLER OR FREEZER DEVICE

(57) An insulating glass unit (1) for a chiller or a freezer device, comprising a transparent outer pane (2), a transparent inner pane (3) and at least one active heating element (7, 7'), wherein said transparent inner pane (3) and said transparent outer pane (2) are spaced apart from each other by at least one spacer element (5, 5'), is characterized in that a circumferential edge section (8) of the transparent outer pane (2) is defined as being the section of said transparent outer pane (2) positioned between an outer edge (9) of said transparent outer pane (2) up to an inner edge (10) of said spacer element (5, 5'), wherein said active heating element (7, 7') is arranged on or adjacent to said circumferential edge section (8) of said transparent outer pane (2) and extends not more than 5 cm towards the center of the transparent outer pane (2), as measured from an inner edge (10) of said spacer element (5, 5'). Further, a chiller or freezer device is described.

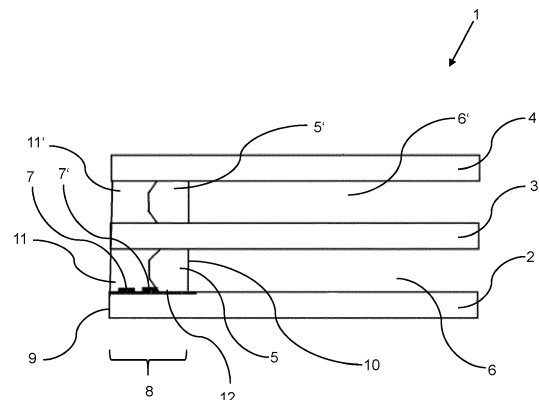


Fig. 1

Description

[0001] The present invention relates to an insulating glass unit for a chiller or a freezer device, comprising a transparent outer pane, a transparent inner pane and at least one active heating element, wherein said transparent inner pane and said transparent outer pane are spaced apart from each other by at least one spacer element.

[0002] Further, the present invention relates to a chiller or freezer device.

[0003] Especially in supermarkets and convenient stores chiller or freezer devices are used for presenting cooled or frozen goods, therefore comprise an insulating glass unit having a transparent area through which the goods are visible. The insulating glass unit serves to insulate the inside of the device against the warm ambient air. A problem of the known insulating glass units is that when the temperature of the outer pane facing the warm ambient shop atmosphere is below the dew point humidity from the ambient air will condensate at the outer pane (so-called static condensation). Therefore, thermal bridges between the outer pane and the cold inside of the device should be avoided for keeping the temperature of the outer pane above the dew point.

[0004] Several solutions for this problem are known in the state of the art. European patent specification EP 1 626 940 B1 describes a condensation-preventing heating glass comprising a heatable layer. A disadvantage of this heating glass is that the power consumption is very high and that only the center of the door is heated but not the electrically insulating circumferential edge.

[0005] Embodiments of the present invention therefore address the problem of improving and further developing an insulation glass unit such that condensation is prevented by utilizing simple technical means and with lower power consumption.

[0006] In an embodiment, the present invention provides an insulating glass unit for a chiller or a freezer device, comprising a transparent outer pane, a transparent inner pane and at least one active heating element, wherein said transparent inner pane and said transparent outer pane are spaced apart from each other by at least one spacer element, characterized in that a circumferential edge section of the transparent outer pane is defined as being the section of said transparent outer pane positioned between an outer edge of said transparent outer pane up to an inner edge of said spacer element, wherein said active heating element is arranged on or adjacent to said circumferential edge section of said transparent outer pane and extends not more than 5 cm towards the center of the outer pane, as measured from the inner edge of said spacer element.

[0007] In a further embodiment, the present invention provides a chiller or freezer device comprising a door and/or a sidewall having an insulating glass unit according to any one of claims 1 to 16.

[0008] It is noted, that even though an insulating glass

unit is disclosed, the transparent outer pane and/or the transparent inner pane do not necessarily consist of glass but can consist of any other material, for example polymer. According to another embodiment, the insulating glass unit can comprise at least one further transparent pane, i.e. the invention is not limited to two-pane insulating glass units. Additionally or alternatively, the space between the transparent panes can be filled with air, specific gases like argon or krypton or gas mixtures or may be evacuated.

[0009] The term "outer pane" refers in particular in the claims, preferably in the description to the transparent pane of the insulating glass unit that is outside of the refrigerated compartment of the chiller or freezer device.

[0010] The term "inner pane" refers in particular in the claims, preferably in the description to the transparent pane of the insulating glass unit that is facing the cold inside of the chiller or freezer device.

[0011] The term "outer edge" of the transparent pane refers in particular in the claims, preferably in the description to the upper and lower horizontal edges and the vertical side edges of the transparent pane.

[0012] The term "inner edge" of the spacer element refers in particular in the claims, preferably in the description to the edges of the spacer element facing the center part of the insulating glass unit.

[0013] It has been realized that with regard to condensation the critical part of the outer pane is the edge due to cold bridges existing in this area. It has been further realized that the center of the outer pane does not have to be actively heated for preventing condensation on the outer transparent pane. By arranging a circumferential active heating element, that does not extend more than 5 cm towards the center of the pane, the temperature of the outer pane can be kept above the dew point whereas less power consumption is needed compared to also actively heating the inner part of the outer transparent pane. A skilled person understands that the active heating element can be positioned directly onto the surface of the outer pane or indirectly, i.e. further elements can be arranged between the surface of said outer pane and the active heating element, as long as the active heating element is arranged on or adjacent to the circumferential edge section.

[0014] The active heating element converts electrical energy into heat because electric current passing through the active heating element encounters resistance, which results in heating of the active heating element. In a preferred embodiment, said circumferential active heating element is exclusively arranged on said circumferential edge section. This has the advantage that the actively heated area is further minimized, which leads to less power consumption, whereas condensation on the outer transparent pane is prevented.

[0015] According to a further embodiment, said circumferential active heating element is defined by at least one electrical conductive area. Defining said active heating element by at least one electrical conductive area is

advantageous since such a construction is easy to achieve and the heating of the outer transparent pane can be varied by changing the voltage and/or the current of the active heating element, for example if the dew point shifts because of a shift in the air humidity and/or a shift in the ambient temperature.

[0016] In a preferred embodiment, said circumferential active heating element is arranged directly or indirectly on the surface of said transparent outer pane facing said transparent inner pane. An advantage of this feature is that the active heating element is encapsulated by the outer transparent pane and the inner transparent pane. Therefore, one cannot inadvertently touch the active heating element, which might be electrically live. Furthermore, the active heating element is protected from being damaged.

[0017] According to a further embodiment, said circumferential active heating element is arranged at least partly between said transparent outer pane and said spacer element. Since the spacer element acts like a cold bridge, the active heating element is arranged at the critical area that has to be heated for avoiding moisture condensation at the transparent outer pane.

[0018] In a preferred embodiment, said circumferential active heating element comprises a layer of an electrical conductive material. A layer of such a material is easy to manufacture, for example by screen printing. A further advantage is that the layer can be applied easily in all different kinds of geometries. Thereby the active heating element can be formed in such a way that areas being critical for condensation can be heated.

[0019] In a preferred embodiment, said circumferential active heating element comprises a low-emission layer, preferably comprising a metal or a metal oxide, for example indium tin oxide. An advantage of a low-emission layer is that it is transparent such that the active heating element does not block a person's view through the transparent outer pane. Hence, the active heating element does not effect the product presentation which is especially important for chiller or freezer devices being used in supermarkets or convenient stores.

[0020] According to a further embodiment, a low-emission coating being electrically isolated from the circumferential active heating element is arranged on a center part of said transparent outer pane. The low-emission coating, which is not electrically live, serves to reduce the emissivity of the insulating glass unit, which leads to a better thermal insulation of the inside of the chiller or freezer device.

[0021] In a preferred embodiment, said circumferential active heating element comprises a conductive printed layer, preferably comprising silver and/or gold and/or tin or similar materials with low electrical resistance. A printed layer is advantageous because it is easy to manufacture different geometries and thicknesses. Preferably, the active heating element is applied by screen printing.

[0022] According to a further embodiment, said spacer element comprises glass or polymer, preferably

polymethylmethacrylat or polyacryl. One of the advantageous of these materials is that they have a low thermal conductivity and can be transparent. Hence, the temperature of the transparent outer pane is less dependent on the temperature inside of the chiller or freezer device and does not have to be heated that much.

[0023] In a preferred embodiment, said spacer element is either a hollow profile containing a desiccant or a non-hollow foam spacer with embedded desiccant. A hollow profile containing a desiccant has the advantage that it is lightweight and can be used for electrical isolating the circumferential active heating element. A non-hollow foam spacer is advantageous because it has an extremely reduced thermal conductivity. Preferably, a metallic foil is attached to the non-hollow foam spacer for providing a vapor barrier for the embedded desiccant. In this case an electrical insulation has to be arranged between the circumferential active heating element and the non-hollow foam spacer. The electrical insulation can be an adhesive tape or a layer comprising a non-electrical conductive adhesive.

[0024] According to a further embodiment, a sealing is arranged between said at least one spacer element and the edges of said transparent outer pane and said transparent inner pane. If the space between the transparent outer pane and the transparent inner pane is gas-filled the sealing prevents the gas from leaving this space. Furthermore, the sealing can be used for electrically insulating the circumferential active heating element.

[0025] According to a further embodiment, at least one section of said circumferential active heating element has a different heating power, preferably said section is arranged at a lower horizontal edge of said transparent outer pane and has a higher heating power. The term "heating power" describes the heat emitted per (circumferential) length, i.e. watt/meter. Since the temperature is not constant over the entire outer surface of the transparent outer pane, the heating power is preferably adjusted accordingly. Usually, the lower horizontal edge of the transparent outer pane is colder than the other parts of the circumferential edge section. Therefore, it is advantageous to arrange a section having a higher heating power at the lower horizontal edge of the transparent outer pane. For example, the heating power at the upper horizontal section may be 10 watt/meter, at the lower horizontal section 20 watt/meter and at the vertical sections the heating power may be continuously or in increments increasing from the upper edge to the lower edge from 10 to 20 watt/meter, especially when the device is mounted to the cabinet and connected to an external power supply.

[0026] In a preferred embodiment, said at least one section comprising said different heating power is defined by an decreased thickness and/or an decreased width of said circumferential active heating element. Decreasing the thickness and/or the width leads to an increased electrical resistance of the active heating element such that the heating power is increased in this section. Es-

pecially if the active heating element is applied via printing, for example screen printing, the width and/or thickness can be varied easily. Alternatively said at least one section comprising said different heating power can be defined by a material comprising an increased electrical resistance.

[0027] According to a further embodiment, at least one contacting element is arranged for electrically contacting said circumferential active heating element. Preferably, the contacting element is a connection pad connected to the active heating element via soldering or gluing.

[0028] In a preferred embodiment, a surface of said transparent outer pane facing said transparent inner pane comprises a print and said circumferential active heating element is at least partly arranged on said print. The print can serve to cover the active heating element such that a person standing in front of the insulating glass unit does not see the active heating elements such that an appealing design is achieved.

[0029] The present disclosure further describes a method for the manufacture of an insulating glass unit according to any one of claims 1 to 16 comprising the following steps:

- arranging an active heating element on or adjacent to an edge section of said transparent outer pane, wherein said active heating element extends not more than 5 cm towards the center of said transparent outer pane,
- arranging a transparent inner pane spaced apart from said transparent outer pane with at least one spacer element being located between said transparent outer pane and said transparent inner pane.

[0030] Further, a low-emission coating covering said transparent outer pane can be partly removed, preferably laser-etched, for arranging said circumferential active heating element. Alternatively said active heating element is printed, preferably screen-printed, onto said transparent outer pane.

[0031] There are several ways how to design and further develop the teaching of the present invention in an advantageous way. To this end, it is to be referred to the patent claims subordinate to patent claim 1 on the one hand and to the following explanation of preferred examples of embodiments of the invention, illustrated by the drawing on the other hand. In connection with the explanation of the preferred embodiments of the invention by the aid of the drawing, generally preferred embodiments and further developments of the teaching will be explained. In the drawing

Fig. 1 shows a part of a cross-sectional view of an insulating glass unit according to an embodiment of the present invention,

Fig. 2 shows a rear view of a transparent outer pane of the insulating glass unit according to fig. 1,

Fig. 3 shows a part of a cross-sectional view of an insulating glass unit according to another embodiment of the present invention,

5 Fig. 4 shows a rear view of a transparent outer pane of the insulating glass unit according to fig. 3,

Fig. 5 shows a part of a cross-sectional view of an insulating glass unit according to an embodiment of the present invention, and

10 Fig. 6 shows a front view of a transparent outer pane of an insulating glass unit.

15 **[0032]** Fig. 1 and 2 show different views of an embodiment of the present invention. It is noted that Fig. 1 shows only a part of the insulating glass unit 1. The insulating glass unit 1 comprises a transparent outer pane 2 and a transparent inner pane 3. In this embodiment, a third transparent pane 4 is arranged. A skilled person understands that the insulating glass unit 1 can only comprise the transparent outer pane 2 and the transparent inner pane 3. The inner pane 3 and the outer pane 2 are spaced apart from each other by a spacer element 5. A further spacer element 5' is positioned between the third pane 4 and the inner pane 3. The spacer elements 5, 5' can comprise a desiccant and/or a sealing.

[0033] The space 6 between the outer pane 2 and the inner pane 3 as well as the space 6' between the inner pane 3 and the third pane 4 can be filled with a gas or can be evacuated.

[0034] Fig. 1 further shows two active heating elements 7, 7'. Preferably, the heating elements 7, 7' are printed onto the outer pane 2, more preferably screen-printed. 35 The active heating elements 7, 7' are arranged on a circumferential edge section 8 of the surface of the outer pane 2 facing the inner pane 3. The circumferential edge section 8 is defined as being the section of the outer pane 2 positioned between the outer edge 9 of the transparent outer pane and the inner edge 10 of the spacer element 5. In this embodiment the active heating elements 7, 7' are arranged exclusively on the edge section 8. According to the invention, at least one of the heating elements 7, 7' could be positioned such that it extends not more 40 the 5 cm towards the center of the outer pane 2.

[0035] Each of the circumferential active heating elements 7, 7' is a layer of an electrical conductive material such that the heating elements 7, 7' heat up when an electrical current is running through them. In this embodiment the heating elements 7, 7' are respectively formed as a line even though the heating elements 7, 7' can have a different geometry. Since the lower horizontal edge 17 of the transparent outer pane 2 is usually colder than the other areas of the transparent outer pane 2, the heating elements 7, 7' may have a higher heating power in this section.

[0036] The insulating glass unit 1 further comprises sealings 11, 11' and a print 12. The print 12 is arranged

on the surface of the outer pane 2 facing the inner pane 3. Alternatively the print 12 can be applied to the surface of the outer pane 2 facing the ambient room. Fig. 2 shows that the print 12 is arranged frame-like over the outer pane 2 and serves to block a person's view onto the active heating elements 7, 7', the sealing 11, 11' and the spacer elements 5, 5' such that an appealing design of the insulating glass unit 1 is achieved.

[0037] Fig. 3 and 4 show different views of a further embodiment of the present invention. It is noted that Fig. 3 shows only a part of the insulating glass unit 1. The insulating glass unit 1 comprises a transparent outer pane 2, a transparent inner pane 3 and a transparent third pane 4. The outer pane 2 and the inner pane 3 are spaced apart from each other by a spacer element 5. Further, the inner pane 3 and the third pane 4 are spaced apart by a spacer element 5. Preferably, the spacer elements 5, 5' are transparent and consist for example of glass or plastics. The space 6 between the outer pane 2 and the inner pane 3 as well as the space 6' between the inner pane 3 and the third pane 4 can be filled with a gas or can be evacuated.

[0038] According to Fig. 3 two active heating elements 7, 7' are positioned on the circumferential edge section 8 on the surface of the outer pane 2 facing the inner pane 3. Preferably, the heating elements 7, 7' are printed, for example screen-printed, onto the outer pane 2 and/or are transparent. Since the lower horizontal edge 17 of the transparent outer pane 2 is usually colder than the other areas of the transparent outer pane 2, the heating elements 7, 7' may have a higher heating power in this section.

[0039] Contrary to the embodiment shown in Figs. 1 and 2 the embodiment depicted in Fig. 3 and 4 comprises a print 12 only in the upper and lower horizontal region. If the active heating elements 7, 7' and the spacer elements 5, 5' are transparent, the insulating glass unit 1 comprises vertical transparent areas 13 and horizontal non-transparent areas 14 defined by the print 12.

[0040] Fig. 5 shows a further embodiment of the present invention. Fig. 5 shows only a part of an insulating glass unit 1. The insulating glass unit 1 comprises a transparent outer pane 2 and a transparent inner pane 3, whereas it is possible that a third pane is arranged. The transparent outer pane 2 extends over the transparent inner pane 3 such that a so-called step design is realized. Of course, the transparent outer pane 2 and the transparent inner pane 3 could be flush with each other. The transparent inner pane 3 and the transparent outer pane 2 are spaced apart from each other by a spacer element 5.

[0041] Further, an active heating element 7 is arranged adjacent to the circumferential edge section 8 of said transparent outer pane 2 such that it does not extend more than 5 cm towards the center of the transparent outer pane 2, as measured from the inner edge of the spacer element 5. At least one further active heating element could be arranged on or adjacent to the circum-

ferential edge section 8.

[0042] Without being considered limiting with respect to the embodiment shown, Fig. 6 serves to illustrate the circumferential edge section 8 of a transparent outer pane 2. The circumferential edge section 8 is defined as being the section of the transparent outer pane 2 positioned between an outer edge 9 of the outer pane 2 and the inner edge 10 of the spacer element 5. Furthermore, the dotted line 15 depicts the area over which the active heating element 7, 7' might extend towards the center of the transparent outer pane 2. Hence, the distance 16 between the dotted line 15 and inner edge 10 of the spacer element 10 is at most 5 cm. Therefore, the active heating element could be arranged anywhere between the dotted line 15 and the outer edge 9 directly or indirectly on the transparent outer pane 2. In some embodiments, the active heating element is arranged on the circumferential edge section 8 (i.e. between the outer edge 9 of the transparent outer pane 2 and the inner edge 10 of the spacer element 5) or adjacent to the circumferential edge section 8 (i.e. between the inner edge 10 of the spacer element 5 and the dotted line 15) or such as to extend from the circumferential edge section 8 into the section between the inner edge 10 of the spacer element 5 and the dotted line 15.

[0043] Many modifications and other embodiments of the invention set forth herein will come to mind to the one skilled in the art to which the invention pertains having the benefit of the teachings presented in the foregoing description and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

List of reference signs

[0044]

1	insulating glass unit
2	transparent outer pane
3	transparent inner pane
4	third pane
5, 5'	spacer element
6, 6'	space
7, 7'	heating element
8	circumferential edge section
9	outer edge (outer pane)
10	inner edge (spacer element)
11, 11'	sealing
12	print
13	vertical transparent area
14	horizontal non-transparent area
15	dotted line
16	distance

17 lower horizontal edge

Claims

1. Insulating glass unit (1) for a chiller or a freezer device, comprising a transparent outer pane (2), a transparent inner pane (3) and at least one active heating element (7, 7'), wherein said transparent inner pane (3) and said transparent outer pane (2) are spaced apart from each other by at least one spacer element (5, 5'),
characterized in that a circumferential edge section (8) of the transparent outer pane (2) is defined as being the section of said transparent outer pane (2) positioned between an outer edge (9) of said transparent outer pane (2) up to an inner edge (10) of said spacer element (5, 5'), wherein said active heating element (7, 7') is arranged on or adjacent to said circumferential edge section (8) of said transparent outer pane (2) and extends not more than 5 cm towards the center of the transparent outer pane (2), as measured from an inner edge (10) of said spacer element (5, 5').
2. Insulating glass unit (1) according to claim 1, wherein said circumferential active heating element (7, 7') is exclusively arranged on said circumferential edge section (8).
3. Insulating glass unit (1) according to claim 1 or claim 2, wherein said circumferential active heating element (7, 7') is defined by at least one electrical conductive area.
4. Insulating glass unit (1) according to any one of claims 1 to 3, wherein said circumferential active heating element (7, 7') is arranged directly or indirectly on the surface of said transparent outer pane (2) facing said transparent inner pane (3).
5. Insulating glass unit (1) according to any one of claims 1 to 4, wherein said circumferential active heating element (7, 7') is arranged at least partly between said transparent outer pane (2) and said spacer element (5, 5').
6. Insulating glass unit (1) according to any one of claims 1 to 5, wherein said circumferential active heating element (7, 7') comprises a layer of an electrical conductive material.
7. Insulating glass unit (1) according to any one of claims 1 to 6, wherein said circumferential active heating element (7, 7') comprises a low-emission layer, preferably comprising a metal or a metal oxide, for example indium tin oxide.
8. Insulating glass unit (1) according to any one of claims 1 to 7, wherein a low-emission coating being electrically isolated from the circumferential active heating element (7, 7') is arranged on a center part of said transparent outer pane (2).
9. Insulating glass unit (1) according to any one of claims 1 to 6 or 8, wherein said circumferential active heating element (7, 7') comprises a conductive printed layer, preferably comprising silver and/or gold and/or copper and/or tin.
10. Insulating glass unit (1) according to any one of claims 1 to 9, wherein said spacer element (5, 5') comprises glass or polymer, preferably polymethylmethacrylat, polyacryl or polycarbonate.
11. Insulating glass unit (1) according to any one of claims 1 to 10, wherein said spacer element (5, 5') is either a hollow profile containing a desiccant or a non-hollow foam spacer with embedded desiccant.
12. Insulating glass unit (1) according to any one of claims 1 to 11, wherein a sealing (11, 11') is arranged between said at least one spacer element (5, 5') and the outer edge (9) of said transparent outer pane (2).
13. Insulating glass unit (1) according to any one of claims 1 to 12, wherein at least one section of said circumferential active heating element (7, 7') has a different heating power, preferably said section is arranged at a lower horizontal edge (17) of said transparent outer pane (2) and has a higher heating power.
14. Insulating glass unit (1) according to claim 13, wherein said at least one section comprising said different heating power is defined by an decreased thickness and/or an decreased width of said circumferential active heating element (7, 7').
15. Insulating glass unit (1) according to any one of claims 1 to 14, wherein at least one contacting element is arranged for electrically contacting said circumferential active heating element (7, 7').
16. Insulating glass unit (1) according to any one of claims 1 to 15, wherein a surface of said transparent outer pane (2) facing said transparent inner pane (3) comprises a print (12) and wherein said circumferential active heating element (7, 7') is at least partly arranged on said print (12).
17. Chiller or freezer device comprising a door and/or a sidewall having an insulating glass unit (1) according to any one of claims 1 to 16.

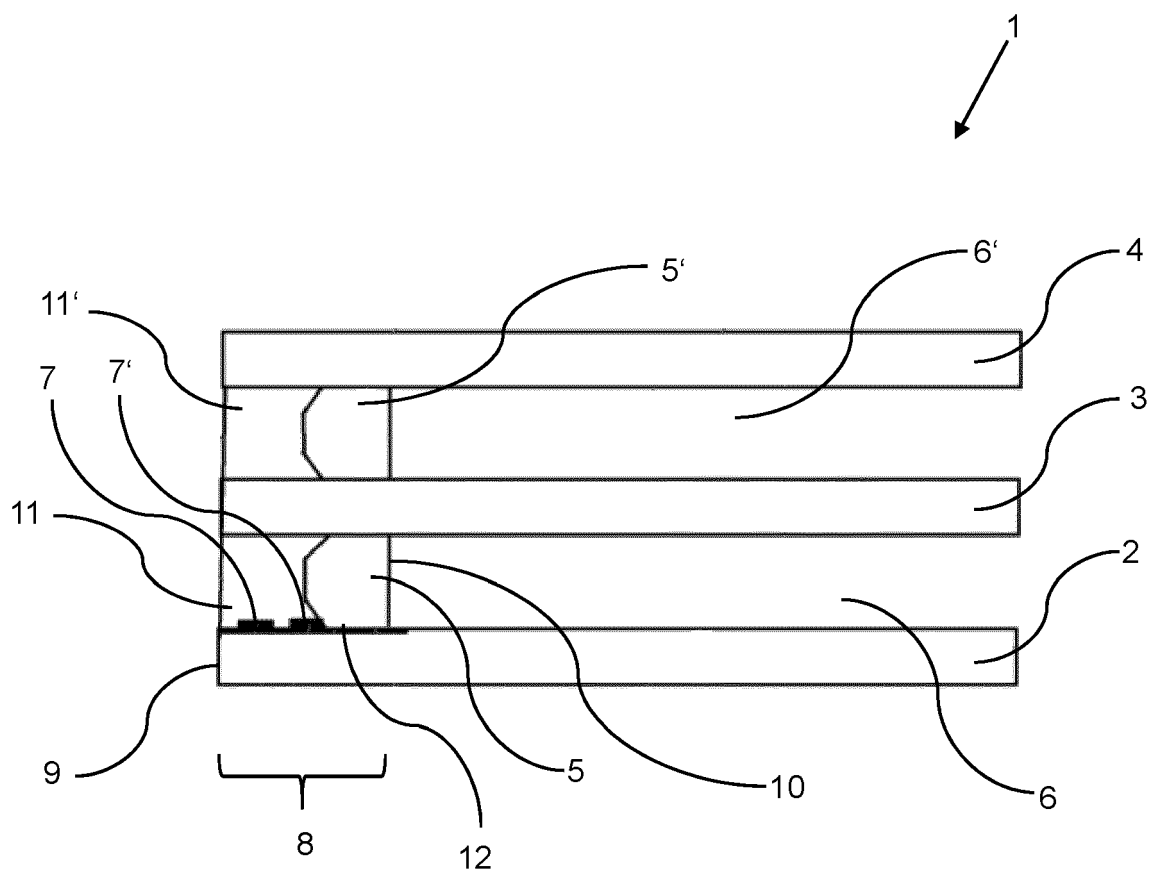


Fig. 1

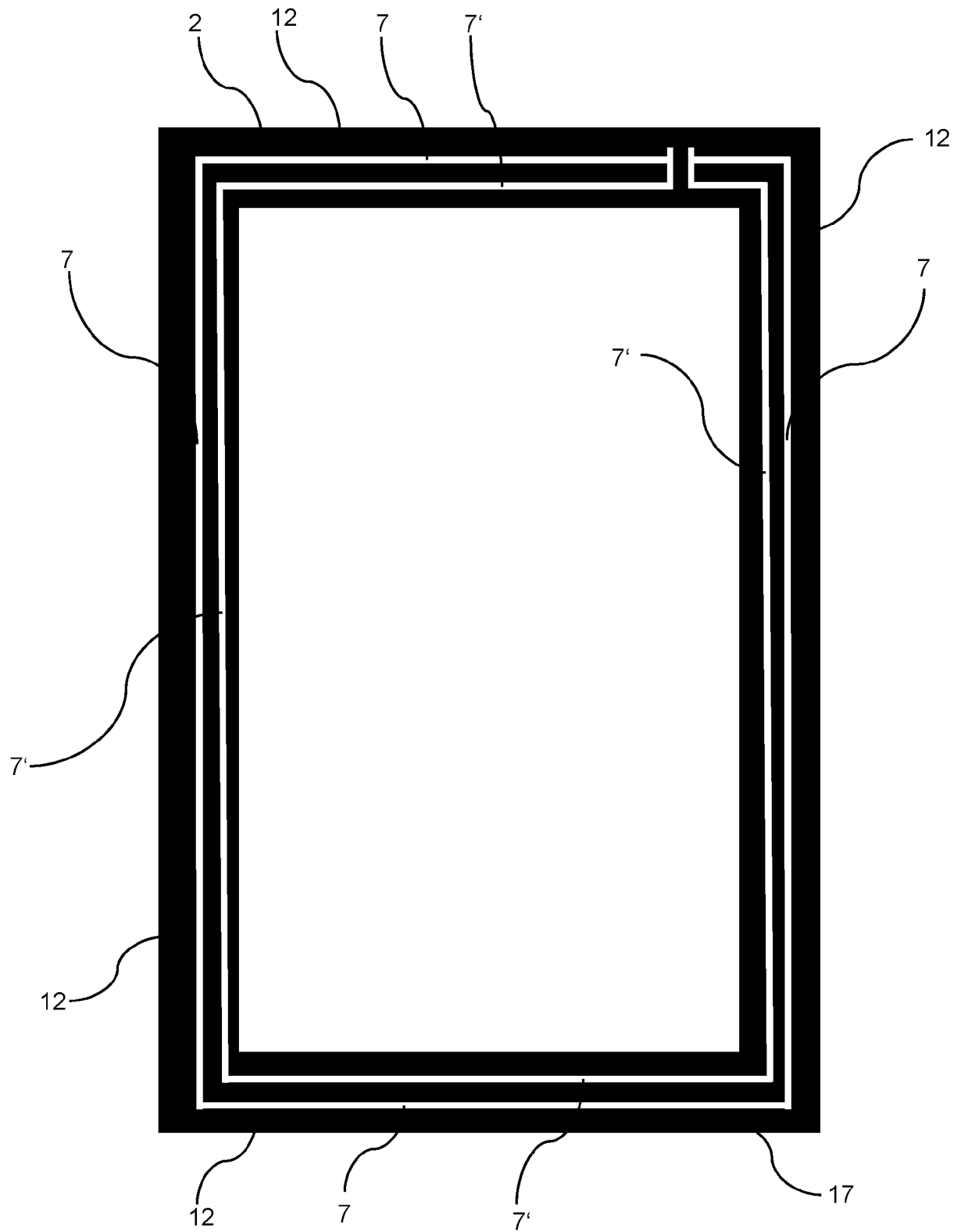


Fig. 2

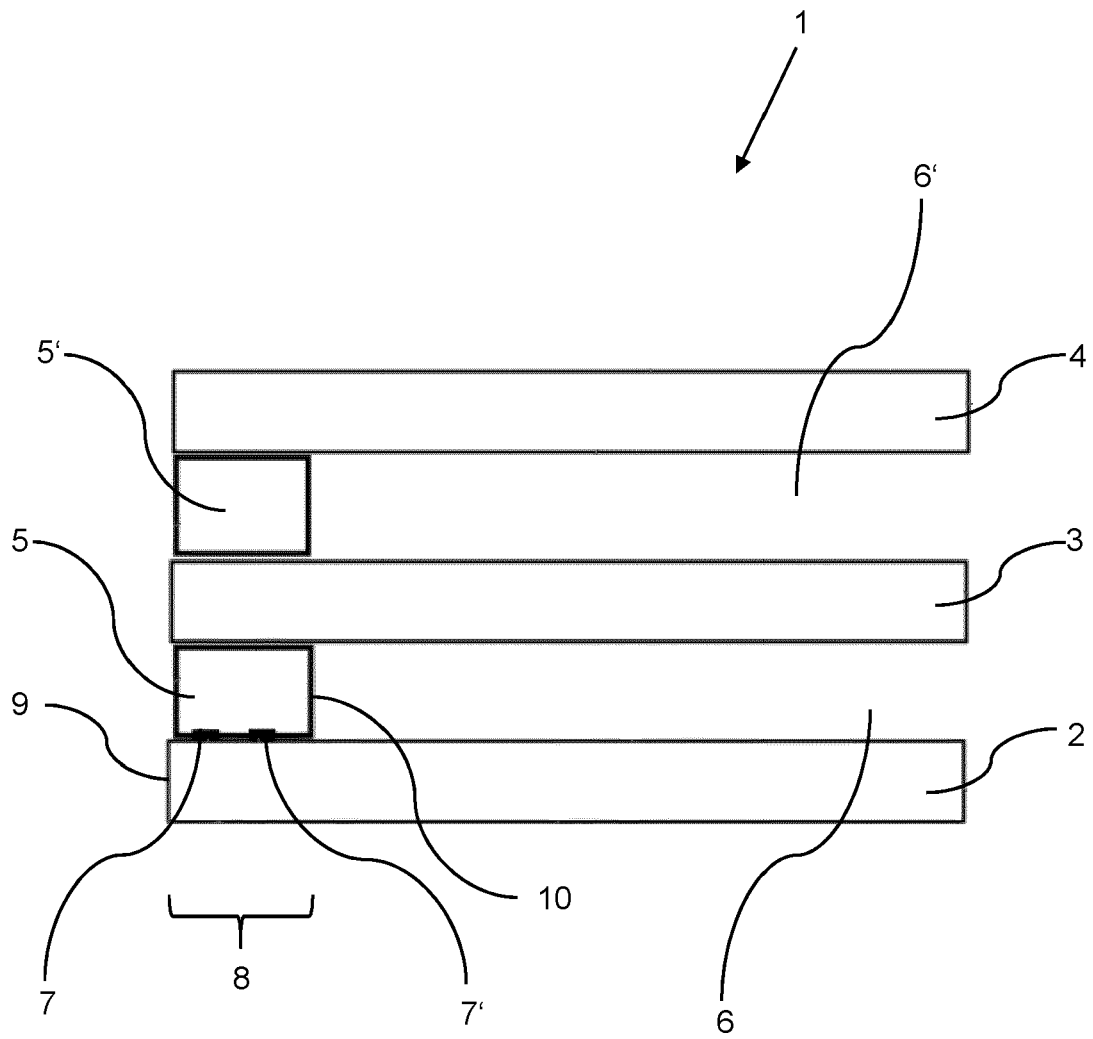


Fig. 3

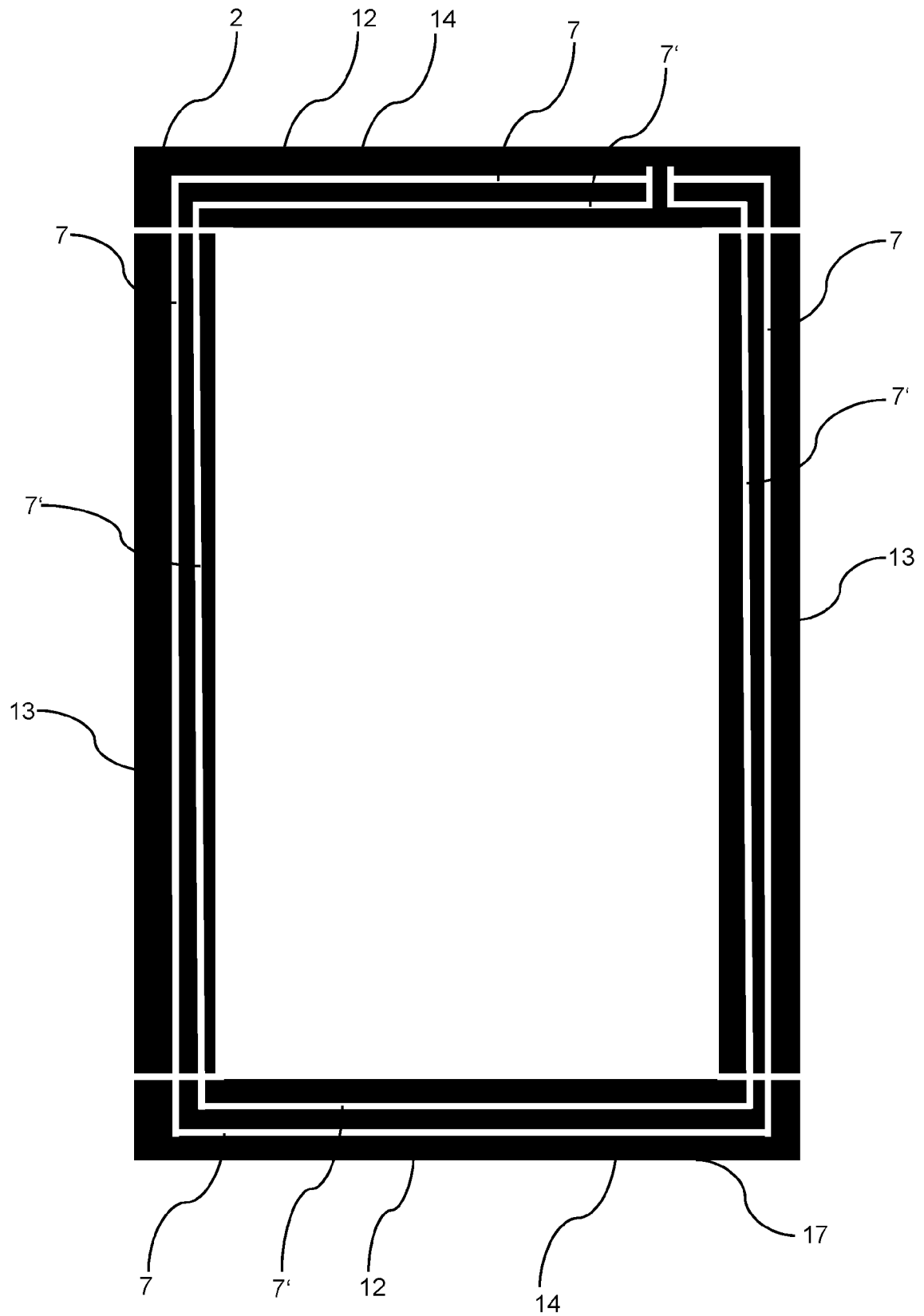


Fig. 4

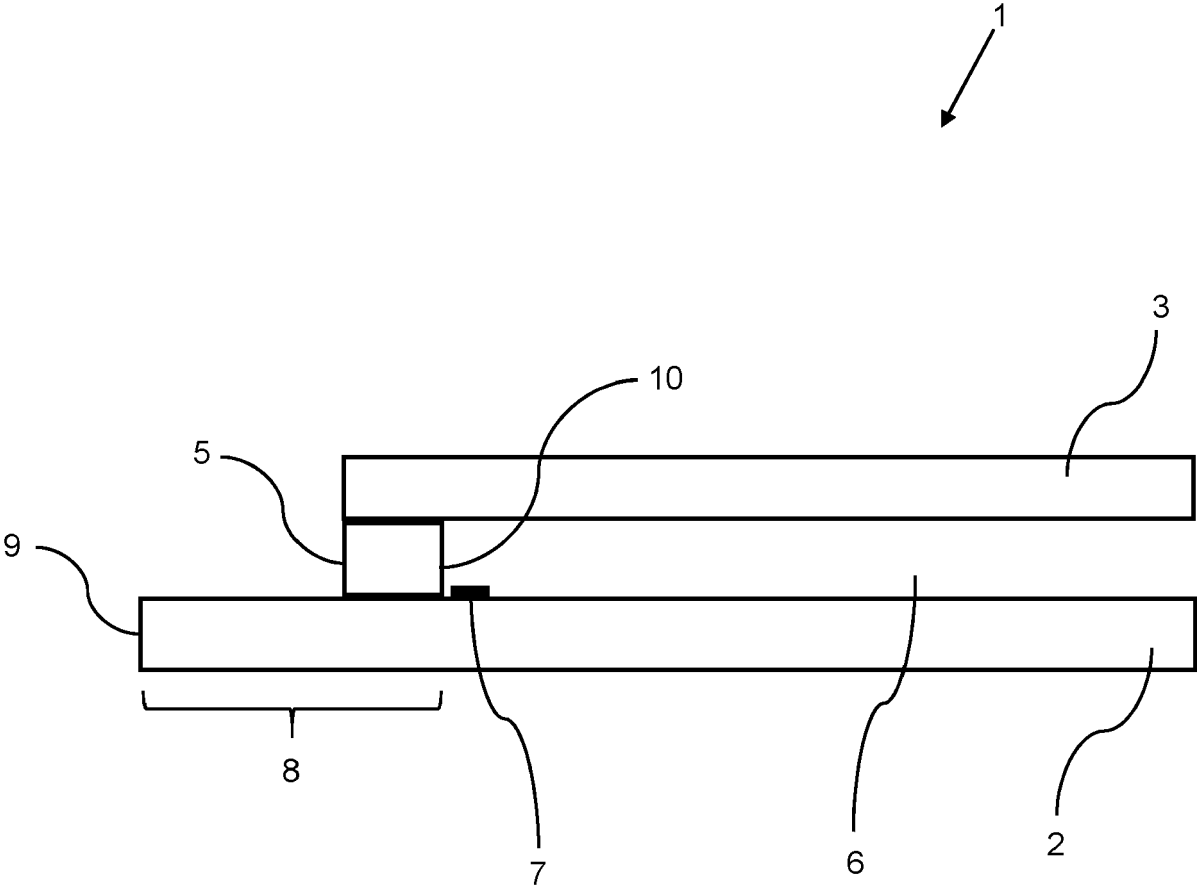


Fig. 5

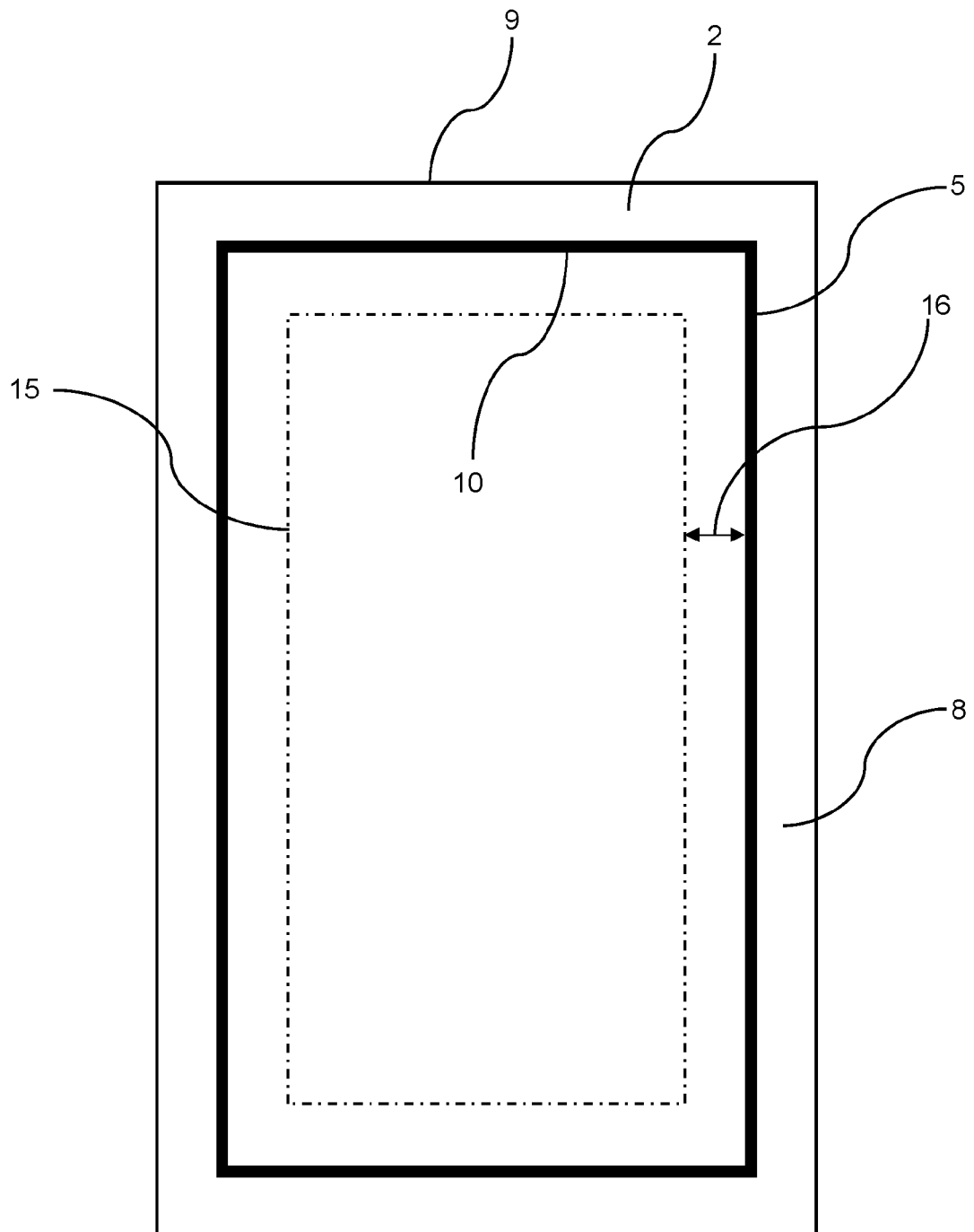


Fig. 6



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 19 0224

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			H05B F25D A47F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 January 2021	Examiner Aubry, Sandrine
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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