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(54) **WINDOW**

(57) A window (1) is provided with a transparent or semitransparent panel (16) and with a frame (10), which comprises framework elements (11,12) arranged so as to form the perimeter of an opening closed by the panel (16); the framework elements define a seat (33), which is engaged by a perimetral edge portion (22) of the panel (16) and is defined by a bottom surface (36) and two shoulders (38,39), coupled to respective faces of the perimetral edge portion (22); the framework elements (11,12) comprise foamed polymer material defining the bottom surface (36), which is fixed to the perimetral edge portion (22) by means of an adhesive sealant which fills the gap between the bottom surface (36) and the perimetral edge portion (22).

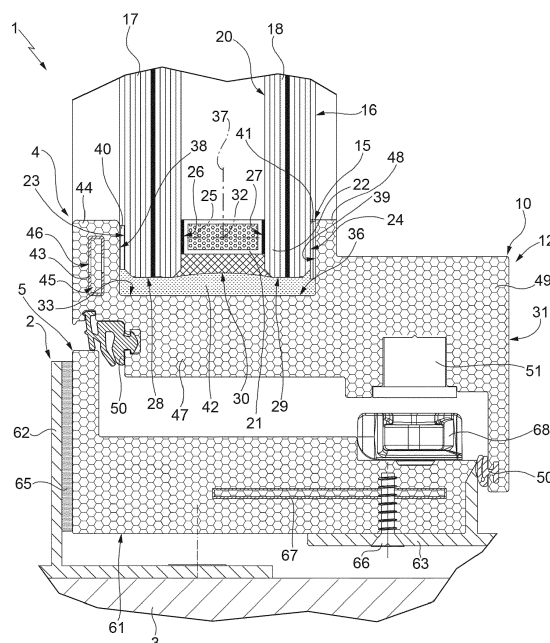


FIG. 2

DescriptionCROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102019000003263 filed on 06/03/2019.

TECHNICAL FIELD

[0002] The present invention relates to a window, of the openable or fixed type.

BACKGROUND ART

[0003] Currently, there are very restrictive design limitations for the windows regarding energy heat loss and, in particular, regarding thermal transmittance, both in the components of the window fixtures (i.e. the fixed part of the windows) and in the components of the sash (i.e. the moving part).

[0004] As the heat shield function cannot be left to the glass of the window alone, the need is felt to improve the known solutions so that the frames that form the fixtures and the sash of the windows are highly performing in terms of thermal insulation and structurally, and so that they are preferably eco-sustainable and economically competitive.

SUBJECT OF THE INVENTION

[0005] The aim of the present invention is to produce a window that allows to fulfil the above requirement in a simple and inexpensive way.

[0006] According to the present invention, a window is provided, as defined in claim 1.

[0007] According to the present invention, in addition, a method for producing a window, according to claim 12, and a method for assembling a window, according to claims 13 and 14, are provided.

[0008] With the present invention, light window systems are obtained where the sections that form the perimeter frame have foamed material provided with still air cells. In particular, the sections of the new window systems, according to the present invention, are produced with specific moulds, thanks to which reinforcement elements, hinges, outer finishing shells, etc. can be embedded in the foamed material. These sections, which are mounted as "glass enclosing" sections in the workshop, they perform not so much a function of structural elements (left to the double-glazed unit inside the perimeter frame), but an insulating function and a function of filling joints in the gaps between the double-glazed unit and the moving and closing hardware. Therefore, the stiffness of the double-glazed unit (and not that of the foamed sections) as a load-bearing element is advantageously used: in other words, it is as if the window moves without any perimeter frame, given the function of mere filling of

the empty gaps assigned to the sections.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will now be described with reference to the attached drawings, which show some non-limiting exemplary embodiments, and wherein:

- Figure 1 is a front view which shows, in a simplified manner, a preferred embodiment of the window according to the present invention;
- Figure 2 is a section according to the line II-II of Figure 1;
- Figures 3 to 5 are similar to Figure 2 and illustrate further embodiments of the window according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] In Figure 1, the reference number 1 denotes a window comprising an outer framework 2, connected in a fixed position to a building support structure, for example to a wall 3 (Figure 2); and a leaf 4, which engages an opening 5 defined by the framework 2 and is coupled in a movable manner to the framework 2 to open and close said opening 5. For example, the leaf 4 is coupled to the framework 2 by means of hinges, not illustrated, so as to rotate around a vertical axis along an upright of the framework 2. However, it is evident that the present invention also applies to fixed, non-openable, windows and to windows in which the opening technique is different from the one mentioned above by way of example (e.g. bottom-hinged windows).

[0011] The leaf 4 comprises a frame 10 formed by framework elements arranged in series and defined by two vertical uprights 11 and by two horizontal crosspieces 12. The ends 13 of the crosspieces 12 are fixed to the ends 14 of the uprights 11 in a known manner, not described in detail, so as to form a quadrangular perimeter and define an opening 15 inside the frame 10.

[0012] The leaf 4 comprises, furthermore, a transparent (or semi-transparent) panel, denoted by the reference number 16, which permanently closes the opening 15 and comprises at least two sheets of glass. According to an alternative, the glass could be replaced by a different transparent material, for example by PMMA (sometimes also referred to as "acrylic glass").

[0013] In the example shown in Figure 2, the panel 16 comprises two sheets 17 and 18, which are defined for example by a multilayer glass, and are parallel and spaced so as to form an air space or gap 20 between one another, whereby the panel 16 defines a so-called "double-glazed unit" or "double-glass". The air space 20 is isolated from the outer environment by means of a spacer element 21 arranged between the sheets 17 and 18 along a perimetral edge portion 22 of the panel 16. At the portion 22, the sheets 17 and 18 are delimited by:

- respective faces 23 and 24, which face the outside of the panel 16 and are orthogonal to a direction 25;
- respective faces 26 and 27, which are parallel to the faces 23 and 24 and are sealingly coupled to the spacer element 21, so as to maintain a vacuum condition in the air space 20; and
- respective edges or end faces 28 and 29, which are transverse to the faces 23, 24, 26 and 27 and, preferably, are arranged in positions substantially coplanar one with the other and with an outer face 30 of the spacer element 21.

[0014] In particular, the face 23 is facing, in use, towards the outside of the building in which the window 1 is mounted, while the face 24 is facing towards an internal environment of said building.

[0015] Figure 2 shows the cross-section of one of the crosspieces 12, but the same characteristics can also be applied to the other crosspiece 12 and/or to the uprights 11. The crosspiece 12 comprises at least one section element 31, which extends along a direction 32, orthogonal to the plane of the section of Figure 2, preferably along the entire length of the crosspiece 12, that is, from one end 13 to the other. The crosspiece 12 has a seat 33, which is parallel to the direction 32, is engaged by the portion 22 of the panel 16 and is defined by:

- a bottom surface 36, which faces the faces 28, 29 and 30, along a direction 37 orthogonal to the directions 25 and 32, and is spaced from the faces 28, 29 and 30;
- two shoulder surfaces 38 and 39, which are orthogonal to the direction 25, are transverse to the bottom surface 36, and are coupled to the faces 23 and 24, respectively, (directly resting on, or by means of a spacer element or a gasket, or by means of a layer of adhesive sealant 40, or by means of a double-sided adhesive tape 41).

[0016] It is therefore evident that the seat 33 has a U-shape, and the surfaces 38 and 39 form a jaw in which the portion 22 is held.

[0017] The section element 31 comprises a foamed polymer material, formed in one piece. Preferably, said material is defined by foamed polystyrene, also known by the abbreviation EPS. By way of example, the material known by the commercial name Airpop (registered trademark), formed by 98% of still air, can be used.

[0018] According to an aspect of the present invention, the seat 33 is defined, at least in part, by the foamed material of the section element 31. In other words, at least the bottom surface 36 is defined by said foamed material. In the embodiment of Figure 2, the surfaces 38 and 39 are also defined by the foamed material and are connected to the bottom surface 36. The shape of the section element 31, in particular the shape of the seat 33, are obtained directly by moulding, and not by cutting starting from a block of foamed material.

[0019] According to a further aspect of the present invention, at least part of the gap present between the bottom surface 36 and the portion 22 is filled with adhesive sealing material, which is preferably in the form of a continuous strip 42 and directly connects the faces 28, 29 and 30 to the bottom surface 36. In particular, this material is a structural adhesive sealant (that is, the adhesive sealant is able to create an elastic but mechanically integral bond between the panel 16 and the foamed material of the section element 31).

[0020] In particular, said material must be chosen from those available that are suitable for gluing glass and foamed material.

[0021] Preferably, the gap present between the bottom surface 36 and the faces 28, 29 and 30 is completely filled with the adhesive sealing material.

[0022] During the assembly of the window 1, the adhesive sealant, designed to form the strip 42, is injected into an empty gap between the bottom surface 36 and the portion 22 of the panel 16, after having positioned the portion 22 in the seat 33. Alternatively, the adhesive sealant, suitable to form the strip 42, is deposited or spread on the bottom surface 36, in a still melted condition, and subsequently the portion 22 of the panel 16 is inserted in the seat 33 so as to rest against said adhesive sealant. In both procedures, the adhesive sealant polymerizes and, by consolidating, firmly attaches to the foamed material of the bottom surface 36, to the faces 28 and 29 of the sheets 17 and 18 and to the face 30 of the spacer element 21. Thanks to this fixing process, the adhesive sealant of the strip 42 allows the bearing and support characteristics of the door 4 to be transferred to the panel 16.

[0023] Preferably, the section element 31 comprises at least one core or stiffening insert 43, at least a part of which is embedded in the foamed material.

[0024] In the embodiment of Figure 2, the section element 31 is defined by foamed material and by one or more inserts or cores 43, embedded in the foamed material, without further additional elements. In particular, the insert 43 is completely embedded in an end portion 44 of the section element 31, which defines the surface 38 and, therefore, in use, is arranged on the outer side of the building where the window 1 is mounted. In particular, the insert 43 is defined by an elongated element, parallel to the direction 32, for example a tubular element, such as to define an inner cavity 45; the core 43 can comprise a plurality of holes 46, due to which the foamed material, during the moulding, at least partially fills the cavity 45. More in detail, during the production of the section element 31, the insert 43 is arranged in a fixed position in a mould, and the foamed material is overmoulded on said insert 43. Preferably, the insert 43 is a metallic material, but could be in different materials, however having a stiffness greater than that of the moulded foamed material.

[0025] In particular, the section element 31 comprises:

- a base portion 47, defining the bottom surface 36;
- the aforementioned portion 44, which protrudes from an end of the portion 47, parallel to the direction 37;
- an appendage 48, which protrudes from the portion 47 parallel to the direction 37 and defines the shoulder surface 39; and
- an end portion 49, defining an extension of the portion 47 parallel to direction 25, on the same side of the appendage 48, i.e. towards the inside of the building.

[0026] The crosspiece 12 comprises, furthermore, a plurality of gaskets 50 and possibly one or more components 51 defined by mechanisms, sensors or metal closing elements. The gaskets 50 and the components 51 are brought into fixed positions by the section element 31 and, in particular, are snap-fitted or pressure coupled to retaining seats and/or retaining teeth, defined by the foamed material. As an alternative or in combination with this type of fitting/coupling, the gaskets 50 and/or the components 51 are glued to the section element 31. According to an alternative not illustrated, the components 51 are fixed by screws, screwed into threaded seats of inserts embedded in the foamed material.

[0027] When the leaf 4 is closed, the gaskets 50 abut against the outer framework 2. The crosspieces and the uprights of the framework 2 comprise respective section elements 61 which have a structure and materials similar to those of the section elements 31. Specifically, the foamed material of the section elements 61 is carried by at least one bracket, for example by two brackets 62 and 63 defined by extruded aluminium elements and fixed to the wall 3 by means of screws or plugs. The fixing between the extruded elements 62,63 and the section element 61 is obtained by means of a layer of glue 65 and/or by means of screws 66 (screwed into one or more inserts 67, embedded in the foamed material of the section element 61). Even the section elements 61 can carry one or more components 68 (and/or gaskets not illustrated), in a similar way as described above for the components 51.

[0028] Figures 3 to 5 relate to other embodiments. The parts that form the frame 10 and the framework 2 have been denoted, where possible, by the same reference numbers used for the corresponding parts shown in Figure 2, but followed respectively by the reference letters "a", "b" and "c".

[0029] In the embodiment of Figure 3, the end portion 44 of Figure 2 is absent, and is replaced by a pressing element 71 which is distinct from the section element 31a and defines the surface 38a, which is coupled to the face 23 by means of a gasket 72, preferably carried in a fixed position by the pressing element 71. The pressing element 71 extends along the entire length of the section element 31a and of the panel 16 and, for example, is defined by an extruded aluminium element. The pressing element 71 is fixed to the portion 47a by means of screws 73, screwed into threaded seats obtained in an insert 43a

embedded in the foamed material of the portion 47a. By acting on the screws 73 it is possible to bring the pressing element 71 closer to the portion 47a parallel to the direction 25 and therefore compress the gasket 72 against the face 23.

[0030] In the embodiment of Figure 4, the panel 16 comprises two air spaces 20; the portion 44b is externally covered with a half-shell 81, which is preferably defined by an extruded aluminium element; the portion 49b is also covered by a half-shell 83, preferably in aluminium, comprising an appendage 48b, which defines the surface 39b and carries, in a fixed position, a gasket 85 arranged resting against the face 24. According to an alternative not illustrated, the gasket 85 is absent, and the appendage 48b is after on the face 24 or fixed by means of an adhesive sealant.

[0031] The half-shells 81 and 83 are fixed to the foamed material of the section element 31b, for example by gluing or, preferably, by over-moulding of said foamed material during the production of the crosspiece 12b.

[0032] The half-shells 81 and 83 essentially have an aesthetic function and can be produced with a metallic material other than aluminium or with a plastic material, for example in PVC. In the specific case, they also perform a support function for the gaskets 50b.

[0033] Likewise, the foamed material of the section element 61b is also covered by an outer half-shell 87 and an inner half-shell 89, having functions and structure similar to the half-shells 81 and 83. Furthermore, in this example, the section element 61b is placed directly on the wall 3 and fixed by means of screws, without brackets.

[0034] In the embodiment of Figure 5, half-shells 81c, 87c and 89c similar to the corresponding half-shells 81, 87 and 89 of Figure 4 are provided, even if they preferably have a box-shaped structure so as to delimit inner channels parallel to the direction 32. The portion 49c is covered by a half-shell 83c which, unlike the half-shell 83 of Figure 4, does not define the surface 39c of the seat 33c. This surface 39c is defined by a pressing element 71c distinct from the section element 31c and coupled to the face 24 by means of a gasket 72c resting on a shoulder of the pressing element 71c. The pressing element 71c is substantially L-shaped, it is fixed to the portion 49c by means of screws 73c, screwed into an insert 43c embedded in the foamed material of the portion 49c, and is covered by a wall 90 which is snap-fitted or pressure coupled to the pressing element 71c.

[0035] Thanks to the foamed material of the section elements 31, 31a,31b,31c, an innovative section is obtained where the thermal insulation function is integrated directly into the structure of the sash, i.e. it is integrated into the section of the frame 10.

[0036] In the frame 10, the use of materials that have hitherto characterized the production of sashes, such as metals like aluminium, and which are not suitable for the thermal insulation performance required by the market and/or regulations, is extremely limited. Furthermore, in the frame 10, the use of PVC is also extremely limited,

which is widely used today, but is difficult to dispose of.

[0037] At the same time, the frame 10 is integrated with the panel 16, i.e. with the double-glazed unit, with a belt gluing defined by the strip 42, made of structural adhesive. As mentioned above, in this way, the frame 10 no longer has to carry out a load-bearing function, so it is possible to reduce the width of the cross-section of the frame 10, with the advantage of a larger glass surface and a minimum visual impact regarding the frame 10 itself. In this way, it is possible to exploit the best thermal insulation performance for each of the two components (frame 10 and panel 16) of the window 1. In other words, by expanding the dimensions of the double-glazed unit defined by the panel 16 full advantage of its performance is exploited from a thermal point of view.

[0038] The frame 10 is, in essence, only a "glass enclosing" element that surrounds and protects the perimeter of the panel 16 (i.e. the portion 22), but does not perform the primary structural function, which instead is delegated to the glass of the panel 16. The frame 10 is limited to guaranteeing air and water seal and housing and/or carrying the closing and safety mechanisms and the gaskets.

[0039] The material chosen to form the seat 33, 33a, 33b and 33c is then extremely insulating (it has a thermal conductivity of about 0.032 W/(m·K)). In particular, during forming it expands 50 times compared to the original volume and traps still air, while remaining resistant and rigid. In other words, the chosen material combines strength and lightness, in addition to being recyclable.

[0040] At the same time, it is possible to provide different surface finishes, in particular on the aforementioned half-shells, which can be easily applied on the actual foamed material and, preferably, can be integrated directly during the moulding of the frame 10, i.e. by overprinting said foamed material.

[0041] It is also evident that the window 1, not only is highly performing from the point of view of thermal insulation, but is also very advantageous on an economic level.

[0042] Finally, it is clear from the foregoing that, modifications and variations can be made to the window 1 described with reference to the attached Figures, which do not go beyond the scope of the present invention, as defined in the attached claims.

[0043] In particular, the shape and dimensions of the cross-section of the section elements which form the frame 10 and/or the framework 2 could be different from what is illustrated by way of example. Instead of the panel 16, a transparent or semi-transparent panel could be provided having different structure and/or number of sheets. Furthermore, the foamed material could be different from the one described, for example defined by foamed polymers with fire resistant or flame-retardant properties.

Claims

1. A window (1) comprising:

- a transparent or semi-transparent panel (16) comprising a perimetral edge portion (22) and
- a frame (10), which comprises a plurality of framework elements (11, 12) arranged so as to form the perimeter of an opening (15) closed by said panel (16);

said framework elements defining a seat (33), which is engaged by said perimetral edge portion (22) and is defined by:

- a bottom surface (36) spaced from said perimetral edge portion (22) by a gap, and
- a first and a second shoulder (38,39) transverse to said bottom surface (36) and coupled directly or indirectly to respective lateral faces (23,24) of said perimetral edge portion (22);

said framework elements (11,12) comprising respective section elements (31) comprising foamed polymer material which defines at least said bottom surface (36); said panel (16) comprising:

- two sheets (17,18), parallel to and spaced from one another so as to form an air space (20) between one another, and
- a spacer element (21) arranged between said sheets (17,18) along said perimetral edge portion (22);

said gap being defined, on one side, by said bottom surface (36) and, on the other side, by respective end faces (28,29) of the sheets (17,18) and by an outer face (30) of said spacer element (21)

characterized in that said gap, at least partly, is engaged by an adhesive sealant which fixes the foamed polymer material of said bottom surface (36) directly to said end faces (28,29) and outer face (30).

2. The window according to claim 1, **characterized in that** said foamed polymer material is foamed polystyrene.

3. The window according to claim 1 or 2, **characterized in that** said adhesive sealant is a structural adhesive sealant.

4. The window according to anyone of the preceding claims, **characterized in that** said section elements (31) comprise respective stiffening cores (42) at least partly embedded in said foamed polymer material.

5. The window according to any one of the preceding claims, **characterized in that** each section element

(31) comprises a single piece of foamed polymer material; said bottom surface (36) and said first shoulder being defined by said piece of foamed polymer material.

6. The window according to claim 5, **characterized in that** said second shoulder is defined by metallic elements (71; 71c) fixed to said section elements.

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- inserting the perimetral edge portion (22) into said seat (33) so as to rest against the adhesive sealant;

7. The window according to claim 6, **characterized in that** said metallic elements (71; 71c) are fixed to said section elements by screws, which are screwed into at least one insert embedded in said foamed polymer material.

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after such a rest, the adhesive sealant consolidates and firmly attaches, on one side, to the foamed material of the bottom surface (36) and, on the other side, to said end faces (28,29) and outer face (30).

8. The window according to claim 6 or 7, **characterized by** comprising a gasket (72; 72c) interposed between said second shoulder and the corresponding lateral face of said perimetral edge portion (22).

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9. The window according to any one of the claims 5 to 8, **characterized by** comprising an adhesive (40, 41) which couples said first shoulder to the corresponding lateral face of said perimetral edge portion (22).

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10. The window according to claim 5, **characterized in that** said second shoulder is also defined by said piece of foamed polymer material.

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11. The window according to any one of the preceding claims, **characterized in that** said gap is completely engaged by said adhesive sealant.

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12. A method for producing a window according to any one of the preceding claims, **characterized in that** the shape of the said seat (33) in each of said section element (31) is obtained by moulding the foamed polymer material.

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13. A method for assembling a window according to claim 11, **characterized by** comprising the steps of:

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- positioning said perimetral edge portion (22) in said seat (33) ;
- after the positioning step, injecting the adhesive sealant into said gap;

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after said injection, the adhesive sealant consolidates and firmly attaches, on one side, to the foamed material of the bottom surface (36) and, on the other side, to said end faces (28,29) and outer face (30).

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14. A method for assembling a window according to claim 11, **characterized by** comprising the steps of:

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- depositing or spreading the adhesive sealant, in a melted condition, on said bottom surface (36), and subsequently

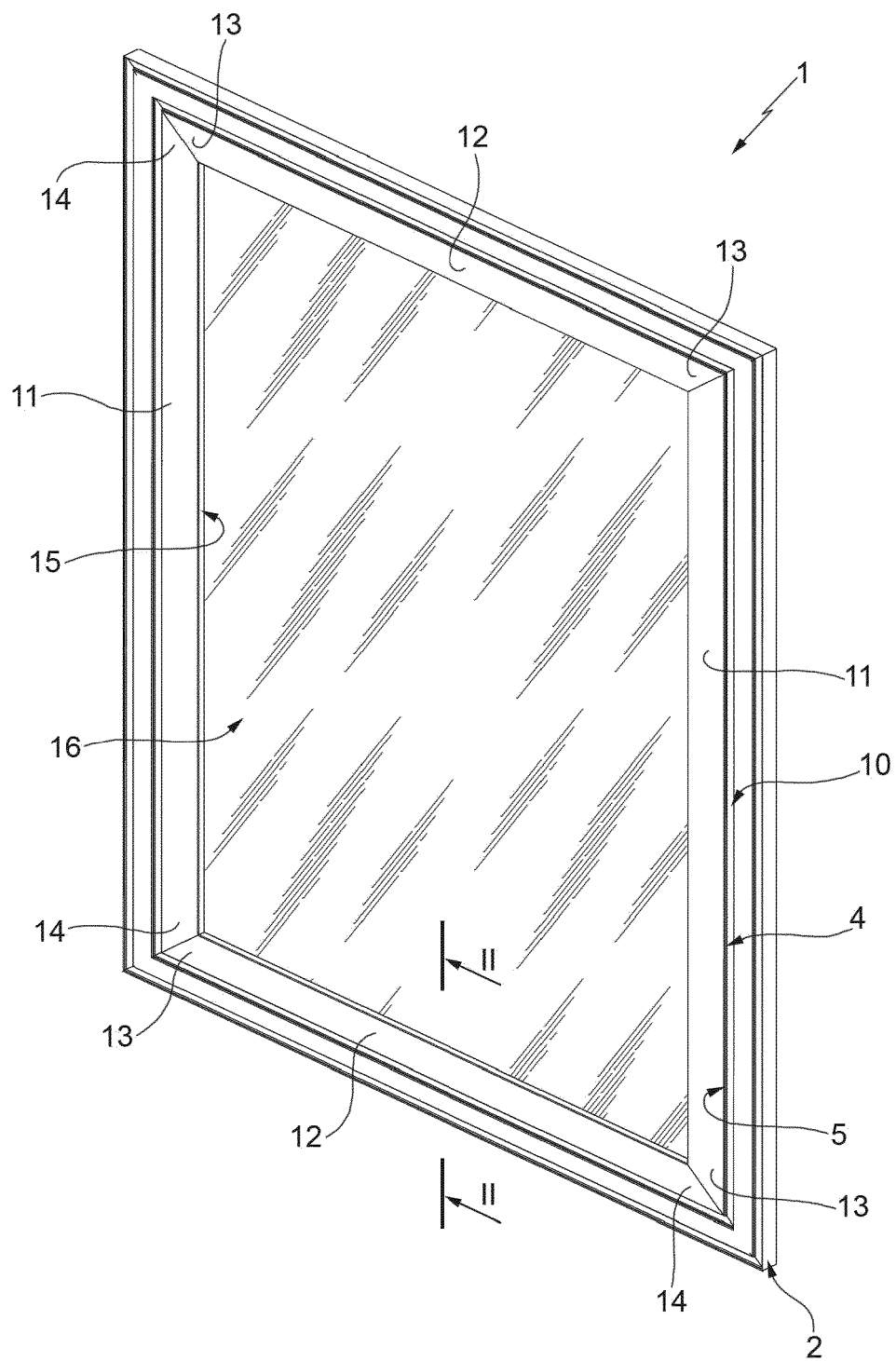
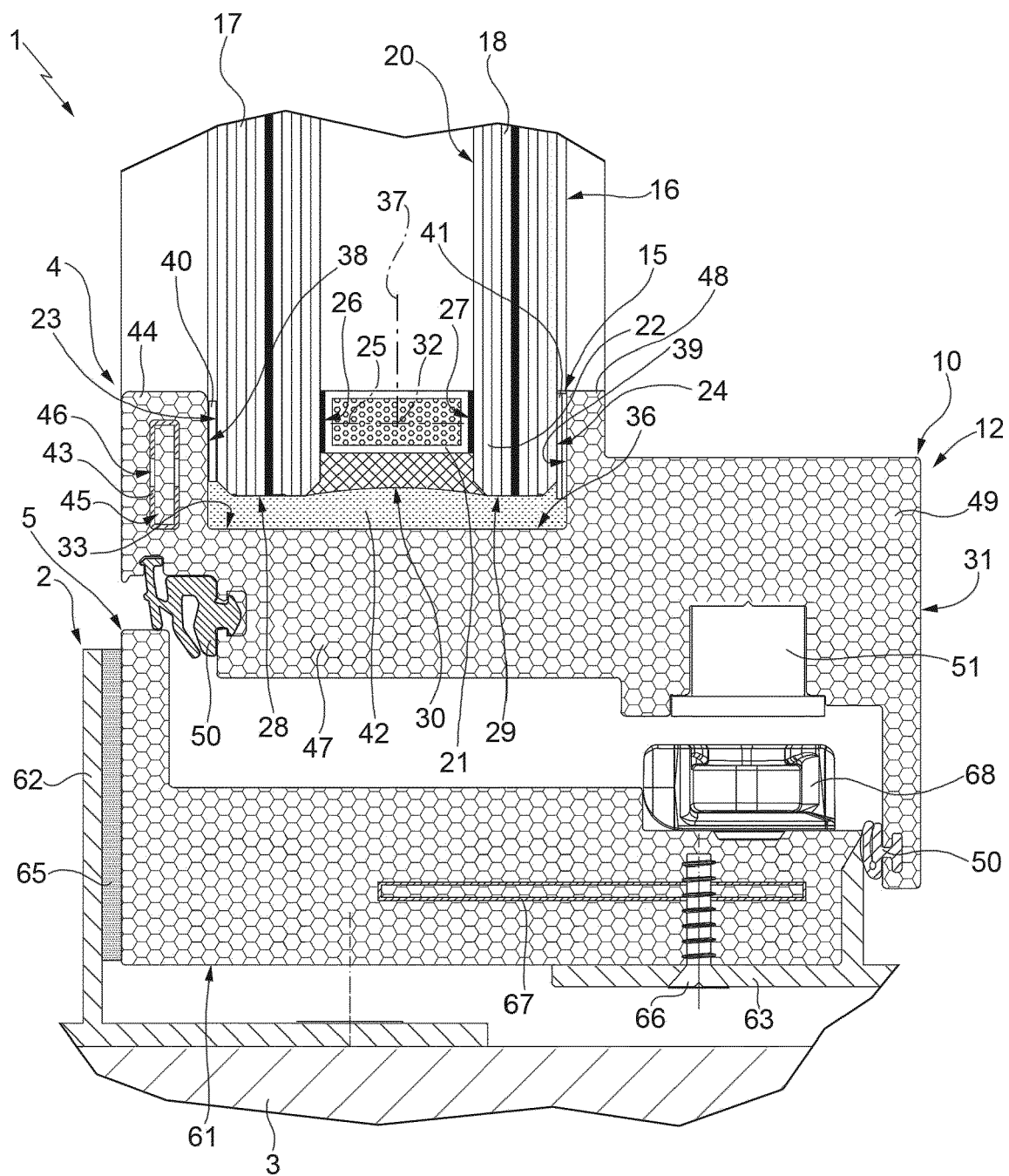


FIG. 1

**FIG. 2**

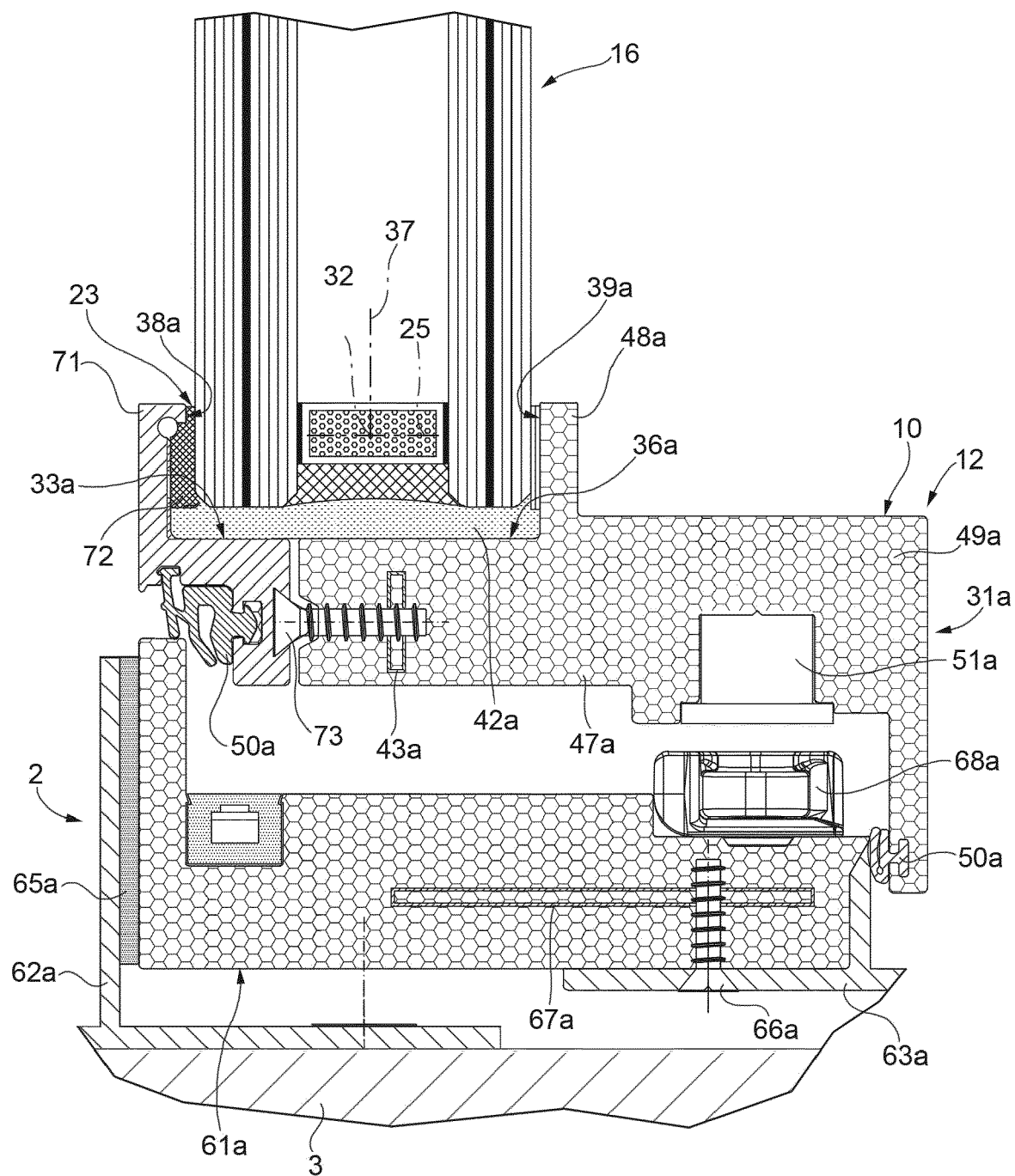


FIG. 3

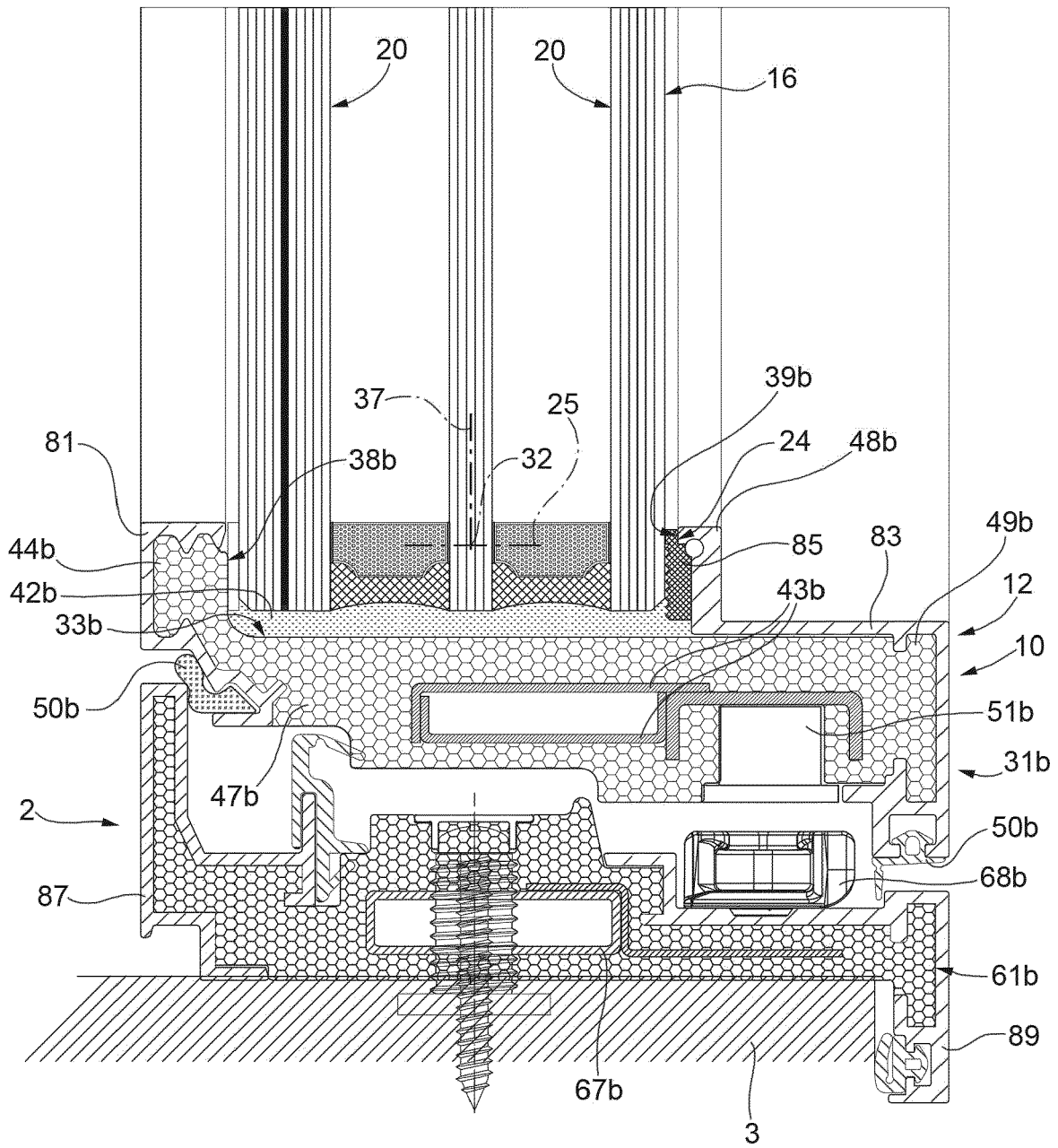


FIG. 4

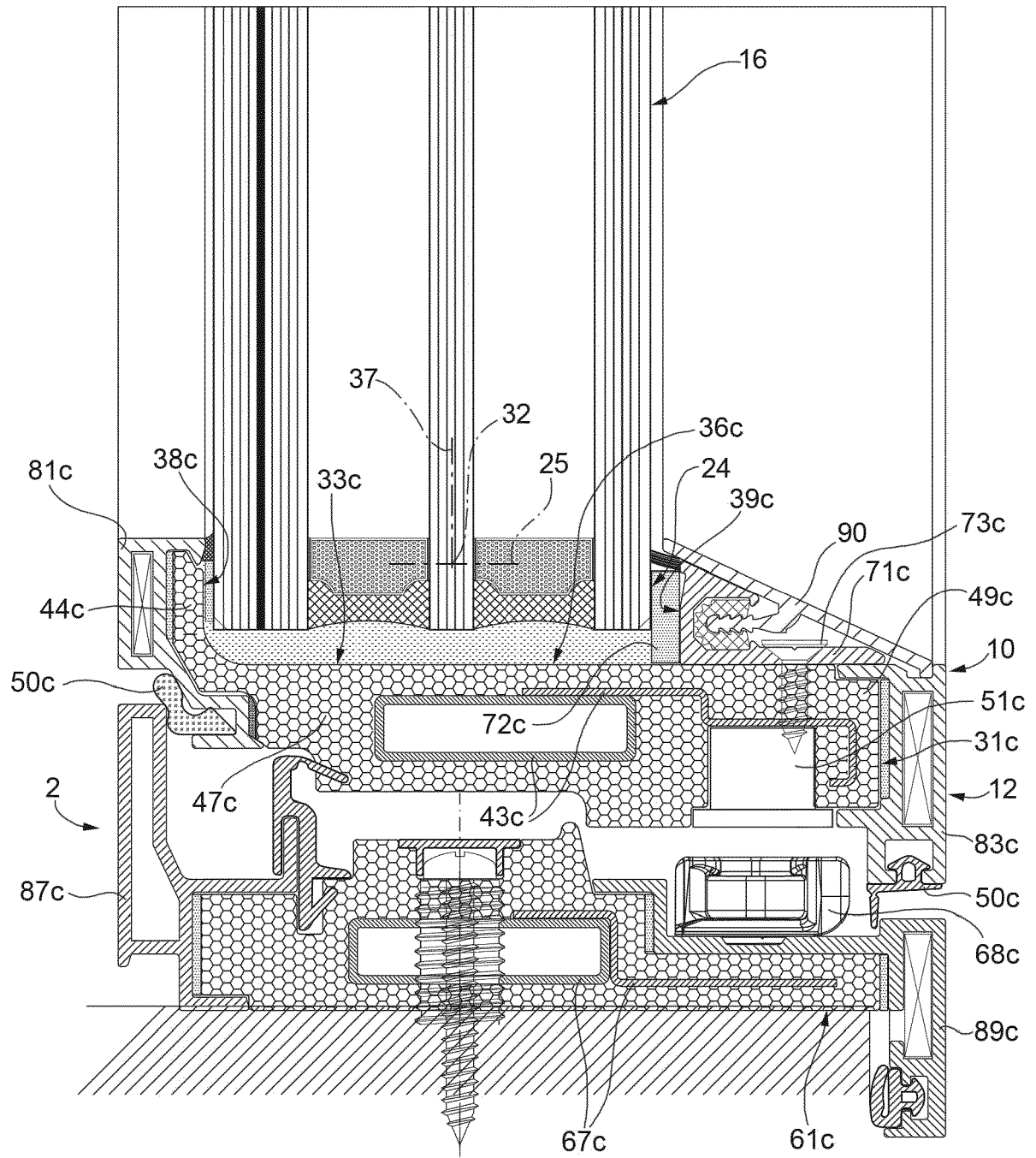


FIG. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 16 1644

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 July 2020	Examiner Verdonck, Benoit
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 16 1644

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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