(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 905 934 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.04.2008 Bulletin 2008/14

(51) Int Cl.:
E06B 3/56 *(2006.01)* ***E04B 2/88*** *(2006.01)*

(21) Application number: **07114126.1**

(22) Date of filing: **09.08.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **21.09.2006 IT PD20060352**

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(54) **Module for a glass curtain wall**

(57) A glass curtain wall module, comprising: a glass pane (11); supporting bodies (12), which are arranged along at least two mutually opposite edges of the glass pane (11) and at the inner face of the glass pane (11), the supporting bodies (12) being fixed to the glass pane (11) by interposing structural adhesive material (14); elements (18) for fixing the supporting bodies (12) of the glass pane (11) to a supporting structure; means (21) for rotational articulation, which are adapted to couple the fixing elements (18) to the supporting bodies (12) of the glass pane (11).

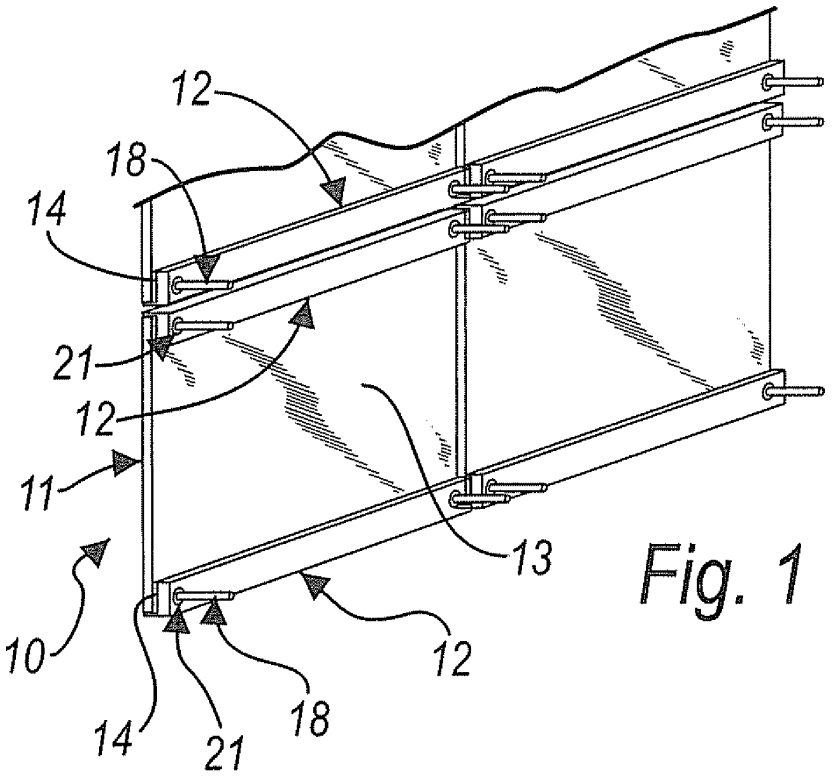

Fig. 1

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Description

[0001] The present invention relates to a glass curtain wall module.

[0002] As is known, glass curtain walls consist in the external cladding of a building and are constituted by modules which comprise glass panes which are fixed in various manners to a supporting structure.

[0003] The supporting structure is typically formed by metallic structural beams, which form a plurality of mutually parallel vertical uprights; brackets, for example of the cross-shaped type, are fixed to the uprights.

[0004] Such brackets have a number of supporting arms (generally four), each for contiguous portions of distinct glass panes, such as typically the corner regions.

[0005] At the cantilever ends of the supporting arms there are portions with through holes, in which there are corresponding threaded pins which support, at one end, means for spot connection to a corresponding portion of a glass pane.

[0006] Such spot connection means are constituted for example by a pad which is inserted and locked in a through hole formed in the glass pane; such pad can be of the fixed or articulated type.

[0007] Each glass pane with the spot connection means and the corresponding fixing pins applied thereto constitutes in practice a module of the glass curtain wall.

[0008] As is known, hanging or suspended glass curtain walls are typically subject to movements caused by static settling of the face and by the loads caused by wind and snow.

[0009] These movements give rise to conditions of elastic deformation on the glass panes that compose the glass curtain walls.

[0010] As mentioned, the spot connection means retain the corner regions of the glass panes that compose the glass curtain walls: such retention is performed at a through hole, which as is known is a feature which weakens the pane.

[0011] Such weak points can be particularly dangerous in the case of very high loads applied to the glass curtain walls (for example much stronger than average gusts of wind): in such situations, the glass panes in fact might be damaged at the locking holes, leading in an extreme case to the separation of the panes.

[0012] The aim of the present invention is to solve the above mentioned drawbacks linked to the strength of the fixing of modules of glass curtain walls to corresponding supporting structures.

[0013] Within this aim, an object of the present invention is to provide a glass curtain wall module which withstands the intense loads applied thereto, including dynamic ones, and at the same time is easy to fix to the corresponding supporting structure.

[0014] Another object of the present invention is to provide a glass curtain wall module which is constructively simple.

[0015] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a glass curtain wall module, characterized in that it comprises:

- a glass pane,
- supporting bodies which are arranged along at least two mutually opposite sides of said glass pane and at the inner face of said glass pane, said supporting bodies being fixed to said glass pane by interposing structural adhesive material, each supporting body being extended substantially along the entire length of the respective side of the glass pane,
- elements for fixing said supporting bodies of the glass pane to a supporting structure, said fixing elements being arranged at the ends of said supporting bodies, substantially in the corner regions of the glass pane,
- means for rotational articulation, which are adapted to couple said fixing elements to said supporting bodies of the glass pane.

[0016] Further characteristics and advantages of the invention will become better apparent from the following detailed description of some preferred but not exclusive embodiments thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a perspective rear view of a portion of a glass curtain wall which uses modules according to the invention;
Figure 2 is a sectional detail view of an element for fixing the module of Figure 1 to a supporting structure;
Figure 3 is a view of a second embodiment of the module of Figure 2 regarding the manner in which the module is fixed to a fixing structure;
Figure 4 is a view of a third embodiment of the module of Figure 2 regarding the manner in which the module is fixed to a fixing structure;
Figure 5 is a view of a bracket for fixing to a supporting structure for four contiguous corner portions of respective modules of the type shown in the preceding figures;
Figure 6 is a view of a fourth embodiment of the module of Figure 2 regarding the manner in which the module is fixed to a fixing structure;
Figure 7 is a view of a bracket for fixing to a supporting structure for four contiguous corner portions of respective modules of the type shown in Figure 6;
Figures 8, 9 and 10 are views of three additional embodiments of the glass curtain wall module according to the invention.

[0017] It is noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

[0018] With reference to Figures 1 and 2, a first embodiment of a glass curtain wall module according to the

invention is generally designated by the reference numeral 10.

[0019] In particular, Figure 1 illustrates schematically four contiguous modules at their corner regions.

[0020] Each glass curtain wall module 10 comprises a glass pane 11, in this embodiment a double-glazing pane (but it is possible to use equivalently a monolithic pane), supported along all of its upper and lower sides by two respective supporting bodies 12.

[0021] Each supporting body 12 is fixed to the internal face 13 of the glass pane 11 by interposing structural adhesive material, generally designated by the reference numeral 14; said structural adhesive material is preferably of the type used in fixing systems known by the French acronym VEC (Vitrages Extérieurs Collés), and is preferably of the silicone type (variations may include, for example, structural adhesive material of the polyurethane and/or epoxy type).

[0022] In practice, each supporting body 12 is a metallic profiled element which is longitudinally extended and runs along the entire length of the respective side of the glass pane 11 and has a flat face 15 for adhesion to said glass pane.

[0023] Moreover, each supporting body 12 has a longitudinal rib 16, which is perpendicular to the flat face 15 and abuts against the respectively upper or lower edge of the glass pane 11, thus facilitating the placement of the supporting bodies with respect to said glass pane.

[0024] To fix the supporting bodies 12 to a supporting structure, such as for example to a metallic upright, not shown in the figures, by means of a bracket 17, there are fixing elements 18 which are arranged at the corner regions of the glass pane 11.

[0025] In particular, the fixing elements 18 (two for each supporting body 12) are constituted by threaded rods, which are rigidly coupled at one end to the supporting bodies 12 and are arranged in through holes which are provided in a plate 19 which forms the bracket 17 and are locked thereto by means of a coupling with two nuts 20 which clamp the plate 19 from opposite sides.

[0026] Figure 5 shows the bracket 17; the through holes of the plate 19 may also be slots (shown schematically in broken lines) to allow adjustment of the position of the modules.

[0027] The fixing elements 18 are rigidly coupled to the supporting bodies 12 by means of rotary articulation means 21.

[0028] The rotary articulation means 21 are constituted, in this first embodiment, by a spherical joint for each fixing element 18.

[0029] In particular, the spherical joint has a spherical head 22, which is formed at the end of the corresponding fixing element 18 and is arranged in a complementarily shaped seat 23 formed inside a corresponding end region of the corresponding supporting body 12.

[0030] The complementarily shaped seat 23 has a first substantially hemispherical part 23a, which is formed within the thickness of the supporting body 12, and a second part 23b, which is formed on the end face of a ring 24 for retaining the spherical head 22 in its seat; the ring 24 is screwed into a corresponding cylindrical receptacle, which is formed in the face of the supporting body 12 that lies opposite the face on which the structural adhesive material is provided.

[0031] The ring 24 is provided axially with a through hole 25 for the passage of the threaded rod which constitutes the corresponding fixing element 18; at the portion of the through hole 25 which relates to the end face of the ring 24 there is the second part 23b of the seat 23.

[0032] Figure 3 illustrates a second embodiment of the module described above.

[0033] In this embodiment, each supporting body, now designated by the reference numeral 112, is constituted in practice by a single metallic bar which has a quadrangular cross-section, to the end regions of which respective blocks 131 (only one is shown in Figure 3) are fixed by way of fixing means 130.

[0034] Similar seats 123 for the spherical heads 122 of the fixing elements 118 are formed in the blocks 131 and, as in the preceding example, are constituted by a first substantially hemispherical part 123a, which is obtained within the thickness of the corresponding block 131, and a second part 123b, which is formed on the end face of the ring 124 for retaining the spherical head 122 in its seat.

[0035] In particular, in this embodiment, the fixing means 130 are constituted by a threaded pin-like portion 133, which is screwed into a corresponding complementarily shaped hole 135 formed in the supporting body 112.

[0036] The axis of the pin-like portion 133 passes through the center of rotation of the spherical joint of the fixing element 118; in this example, each block 131 is cylindrical, with an axis which coincides with the axis of the pin-like portion 133 and with a diameter which is substantially equal to the width of the bar that constitutes the supporting body 112.

[0037] A portion 134a of an L-shaped element 134 is locked in a sandwich fashion between the blocks 131 and the metallic bar that constitutes the supporting body 112, and its perpendicular portion constitutes the longitudinal rib 116 (which is perpendicular to the flat face 115 of the supporting body 112 on which the structural adhesive material is provided), which acts as abutment for the glass pane 111.

[0038] The portion 134a of the L-shaped element 134 which is locked in a sandwich fashion has a through hole to allow the passage of the threaded pin-like portion 133.

[0039] Figure 4 illustrates a third embodiment of the module described above.

[0040] In this embodiment also, each supporting body, now designated by the reference numeral 212, is constituted in practice by a single metallic bar which has a quadrangular cross-section and at the end regions of which respective blocks 231 (only one is shown in Figure 4) are fixed by way of fixing means 230.

[0041] In this example, the block 231 is a parallelepi-

ped and the fixing means 230 are constituted by screws 233 which pass through said block and grip the supporting body 212.

[0042] Figure 6 illustrates a fourth embodiment of the glass curtain wall module.

[0043] In this embodiment also, according to the same inventive concept, the fixing elements, now designated by the reference numeral 318, are rigidly coupled to the supporting bodies 312 by way of rotary articulation means 321.

[0044] The fixing elements are constituted by horizontal pins 350 which lie parallel to the flat extension of the glass panes 311 and protrude from a bracket 317 (shown in Figure 7) which is fixed to a supporting structure (not shown in the figures).

[0045] As can be seen in Figure 7, two pairs of pins 350, related to the coupling of the contiguous corner regions of four modules, protrude from the bracket 317, from opposite sides of a central plate 319; the upper pins retain the upper modules (for example the module of Figure 6) while the lower pins retain the lower modules.

[0046] In practice, the rotary articulation means 321 are constituted, in this embodiment, by an articulation about a single axis of rotation, in this example a substantially horizontal axis of rotation.

[0047] Each supporting body 312 is constituted in practice by a single metallic bar which has a quadrangular cross-section and to the end regions of which respective blocks 331 (only one is shown in Figure 6) are fixed by way of fixing means 330 (such as for example screws).

[0048] A seat 323 is provided in each block 331 and is open downward to rotationally accommodate the corresponding pin 350; in practice, the modules hang from the pins 350 by means of the blocks 331.

[0049] A portion 334a of an L-shaped element 134 is locked in a sandwich fashion between the blocks 331 and the metallic bar that constitutes the supporting body 312, and its perpendicular portion constitutes the longitudinal rib 316 (which is perpendicular to the flat face 315 of the supporting body 312 on which the structural adhesive material 314 is provided), which acts as abutment for the glass pane 311.

[0050] It is evident that the supporting bodies 12 can be fixed not only along the lower and upper sides of the glass pane 11 but also only along their vertical sides; Figure 8 is a schematic rear head-on view of a module with supporting bodies 412 which are arranged along the mutually opposite vertical sides of the glass pane 411.

[0051] Figure 9 is a schematic rear head-on view of a module in which the supporting bodies 512 form a perimetric frame 512a (which is monolithic or constituted by mutually rigidly coupled elements) for the glass pane 511.

[0052] Figure 10 illustrates another embodiment, which relates in particular to the example of Figure 4.

[0053] This embodiment has the same structure as the example of Figure 4, but provides for the addition of a contrast plate 201, which locks in a sandwich fashion the glass pane 211 against the supporting body 212.

[0054] The contrast plate 201 in practice has a first flat portion 202, which is parallel to the flat face 215 of the supporting body 212, and a second flat portion 203, which is parallel to the longitudinal rib 216, so as to form in practice an L-shaped configuration together with the first flat portion 202, which protrudes up to the block 231; the second flat portion 203 is fixed to the block 231 (but it can be fixed, as an alternative, for example also to the metallic bar that composes the supporting body 212) for example by means of screws 204.

[0055] In practice it has been found that the invention thus described achieves the intended aim and objects.

[0056] In particular, the present invention provides a structural glass curtain wall module which is particularly resistant to the loads to which it is subjected.

[0057] This has been achieved by combining a rotary retention for the panes (which leads to lower tension peaks in the retention regions with respect to those generated with rigid retentions) with the fact that said retention is provided without forming holes in the panes and therefore without creating weak points, as instead occurs with the spot retentions that are currently used.

[0058] Moreover, the particular structure of the module allows installation of the panes to be extremely simple.

[0059] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0060] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0061] The disclosures in Italian Patent Application No. PD2006A000352 from which this application claims priority are incorporated herein by reference.

[0062] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A glass curtain wall module, **characterized in that** it comprises:

   - a glass pane (11, 111, 211, 311, 411, 511),
   - supporting bodies (12, 112, 212, 312, 412, 512) which are arranged along at least two mutually opposite sides of said glass pane (11, 111, 211, 311, 411, 511) and at the inner face of said glass pane (11, 111, 211, 311, 411, 511), said supporting bodies (12, 112, 212, 312, 412, 512) being fixed to said glass pane (11, 111, 211, 311,

411, 511) by interposing structural adhesive material (14), each supporting body (12, 112, 212, 312, 412, 512) being extended substantially along the entire length of the respective side of the glass pane (11, 111, 211, 311, 411, 511),
- elements (18, 118, 218, 318) for fixing said supporting bodies (12, 112, 212, 312, 412, 512) of the glass pane (11, 111, 211, 311, 411, 511) to a supporting structure, said fixing elements (18, 118, 218, 318) being arranged at the ends of said supporting bodies (12, 112, 212, 312, 412, 512), substantially in the corner regions of the glass pane (11, 111, 211, 311, 411, 511),
- means (21, 321) for rotational articulation, which are adapted to couple said fixing elements (18, 118, 218, 318) to said supporting bodies (12, 112, 212, 312, 412, 512) of the glass pane (11, 111, 211, 311, 411, 511).

2. The glass curtain wall module according to claim 1, **characterized in that** said rotary articulation means (21, 321) comprise a spherical articulation for each of said fixing elements (18).

3. The glass curtain wall module according to claim 2, **characterized in that** each of said fixing elements (18) is constituted by a threaded rod and said spherical articulation has a spherical head (22) which is formed at the end of the corresponding said fixing element (18), said spherical head (22) being arranged in a complementarily shaped seat (23) which is formed at the end region of the corresponding said supporting body (12).

4. The glass curtain wall module according to claim 3, **characterized in that** said complementarily shaped seat (23, 123) has a first substantially hemispherical part (23a, 123a) and a second part (23b, 123b) which is formed on the end face of a ring (24, 124) for retaining said spherical head (22, 122) in its seat, said ring (24, 124) being provided axially with a through hole (25, 125) for the passage of the threaded rod which constitutes the corresponding fixing element (18, 118), said second part (23b, 123b) of the seat (23, 123) being formed at the portion of said through hole (25, 125) related to the end face of said ring (24, 124).

5. The glass curtain wall module according to claim 4, **characterized in that** said first part (23a) is formed within the thickness of said supporting body (12), said ring (24) being screwed into a corresponding cylindrical receptacle which is formed in the face of said supporting body (12) which lies opposite the face on which said structural adhesive material (14) is provided.

6. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** said rotary articulation means (321) comprise an articulation about a single axis of rotation.

7. The glass curtain wall module according to claim 6, **characterized in that** said single axis of rotation is substantially horizontal.

8. The glass curtain wall module according to claim 7, **characterized in that** said fixing elements (318) comprise horizontal pins (350) which are parallel to the flat extension of said glass pane (311) and are fixed to a bracket (317), which in turn is fixed to a supporting structure, said rotary articulation means (321) comprising a seat (323), which is rigidly coupled to the corresponding said supporting body (312) and is open downward, for rotationally accommodating the corresponding said pin (350).

9. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** each said supporting body (112, 212, 312) is constituted by a metallic bar which has a quadrangular cross-section, to the end regions of which respective blocks (131, 231, 331) are fixed by way of fixing means (130, 230, 330), said fixing elements (18, 118, 218, 318) being fixed to said blocks by way of said rotary articulation means (21, 321).

10. The glass curtain wall module according to claims 4 and 9, **characterized in that** said seats (123) for said spherical heads (122) of the fixing elements (118, 218) are formed in said blocks (131, 231), said seats (123) being constituted by a first substantially hemispherical part (123a), which is formed within the thickness of the corresponding said block (131), and a second part (123b) which is formed on the end face of the ring (124) for retaining the spherical head (122) in its seat.

11. The glass curtain wall module according to claim 10, **characterized in that** said blocks (131) are cylindrical and said fixing means (130) comprise a threaded pin-shaped portion (133) which is screwed into a corresponding complementarily shaped hole (135) which is formed in the corresponding said supporting body (112), the axis of said pin-shaped portion (133) passing through the center of rotation of the spherical joint of the corresponding said fixing element (118).

12. The glass curtain wall module according to claim 10, **characterized in that** said blocks (231) are parallelepipedal and said fixing means (230) comprise at least one screw (233) which passes through the respective block (231) and engages said supporting body (212).

13. The glass curtain wall module according to claims 8

and 9, **characterized in that** a said seat (323) is provided on each of said blocks (331) and is open downward for the corresponding said horizontal pin (350), which constitutes an element (318) for fixing to the supporting structure.

14. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** a longitudinal rib (16, 116, 316) is rigidly coupled to each supporting body (12, 112, 212, 312) and is perpendicular to the flat face (15, 315) of said supporting body on which said structural adhesive material (14) is arranged, said rib being adapted to abut against the respective edge of said glass pane (11, 111, 211, 311).

15. The glass curtain wall module according to claims 9 and 14, **characterized in that** said longitudinal rib (16, 116, 316) is constituted by a portion of an L-shaped element (134), the opposite portion of which (134a, 334a) is locked in a sandwich fashion between said blocks (131, 331) and the metallic bar that constitutes the supporting body (112, 312).

16. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** said supporting bodies (12) are fixed along the lower and upper sides of said glass pane (11) or along the vertical sides of said glass pane (411).

17. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** said supporting bodies (512) form a perimetric frame (512a) for said glass pane (511).

18. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** it comprises a contrast plate (201) which locks in a sandwich fashion said glass pane (211) against said supporting body (212).

19. The glass curtain wall module according to claim 18, **characterized in that** said contrast plate (201) has a first flat portion (202), which is parallel to the flat face (215) of said supporting body (212), and a second flat portion (203), which is parallel to the longitudinal rib (216) which extends up to the supporting body (212), said second flat portion (203) being fixed to the supporting body (212).

20. The glass curtain wall module according to claim 19, **characterized in that** said second flat portion (203) is fixed to said block (231).

21. The glass curtain wall module according to one or more of the preceding claims, **characterized in that** said structural adhesive material is of the type used in fixing systems known by the French acronym VEC (Vitrages Extérieurs Collés).

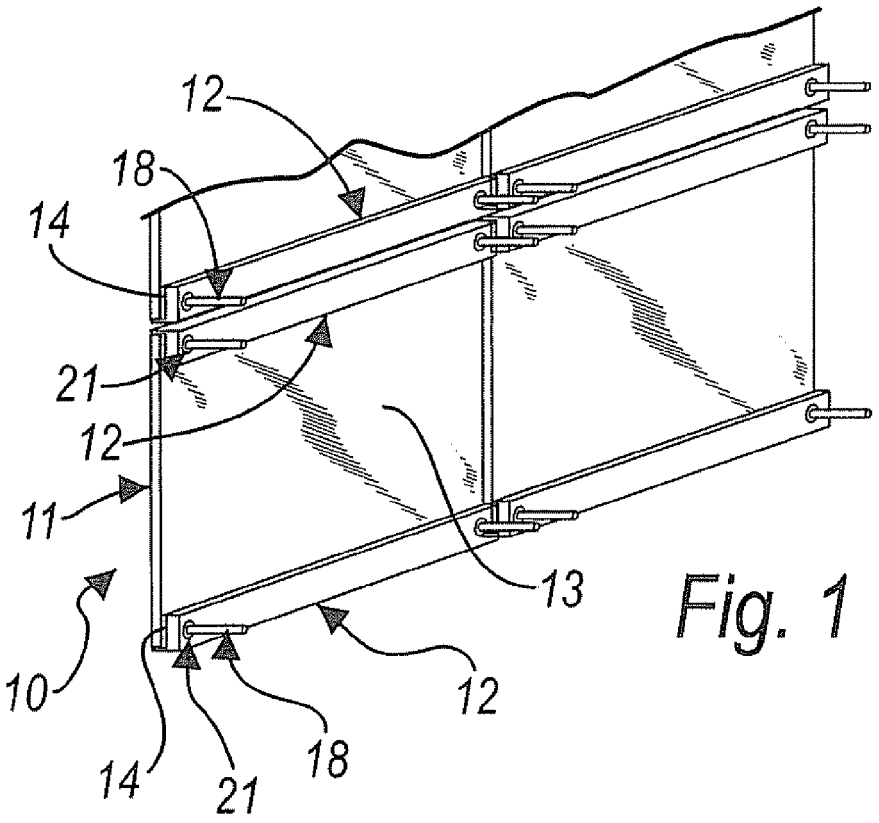
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Fig. 1

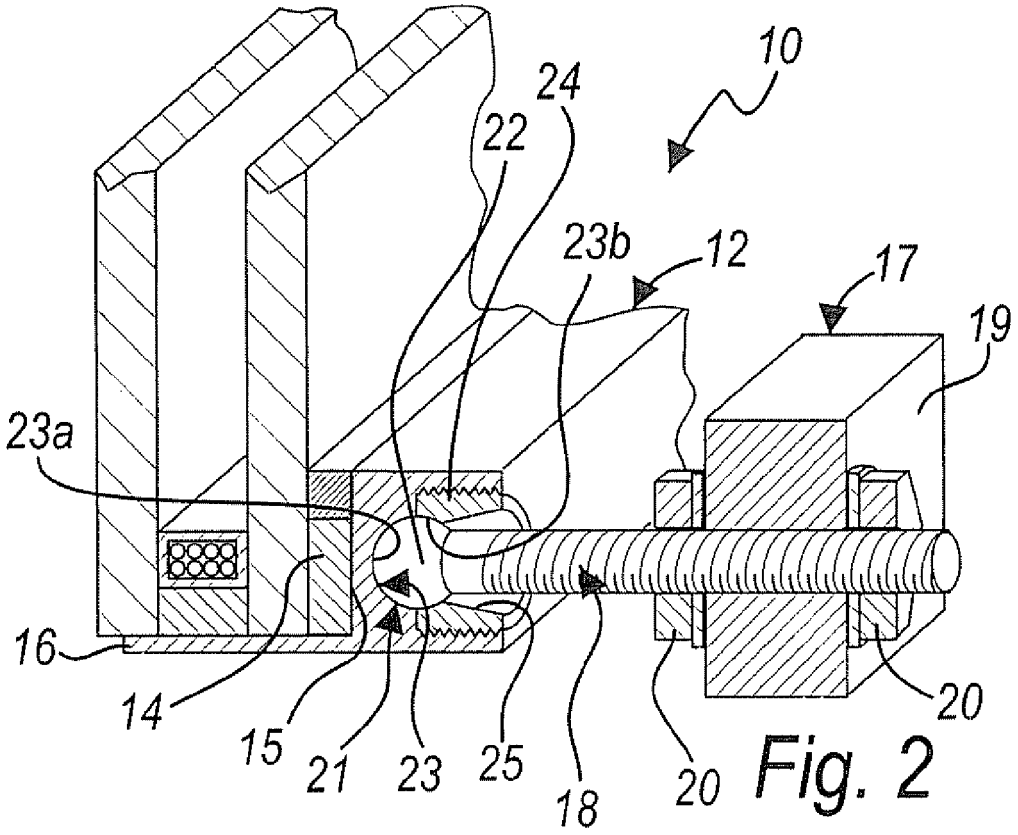
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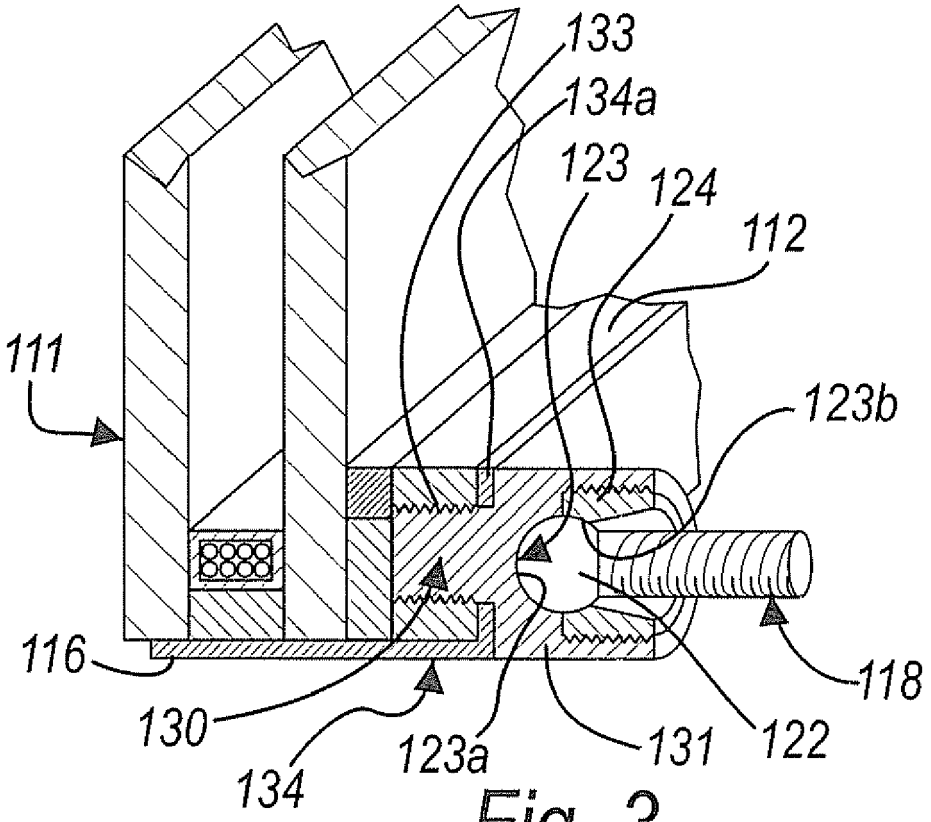
Fig. 2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134a
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111
123b
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123a
131
122

Fig. 3

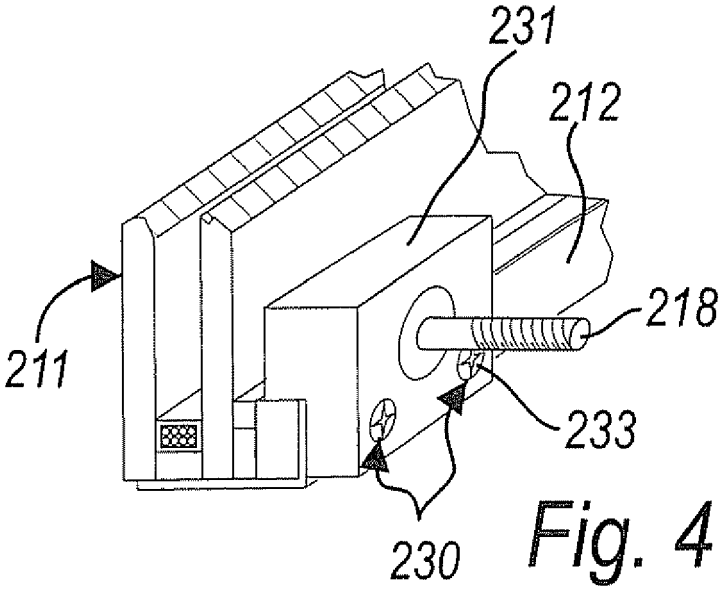
231
212
218
211
233
230

Fig. 4

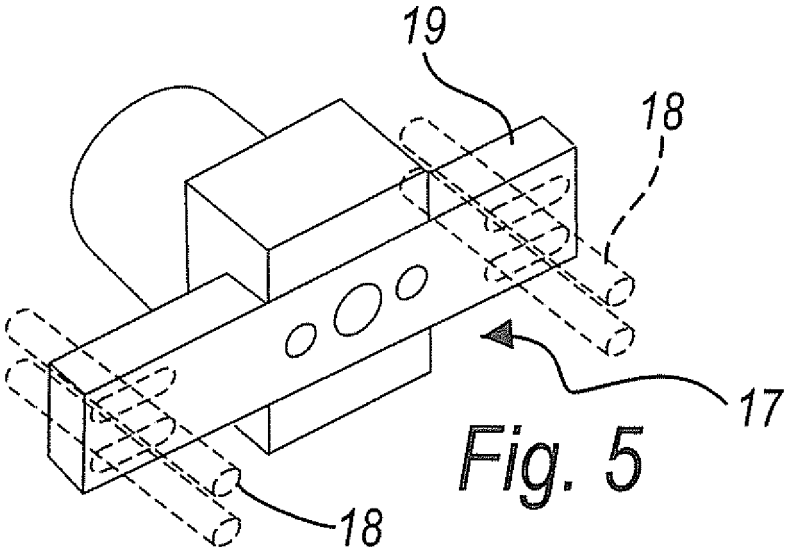

Fig. 5

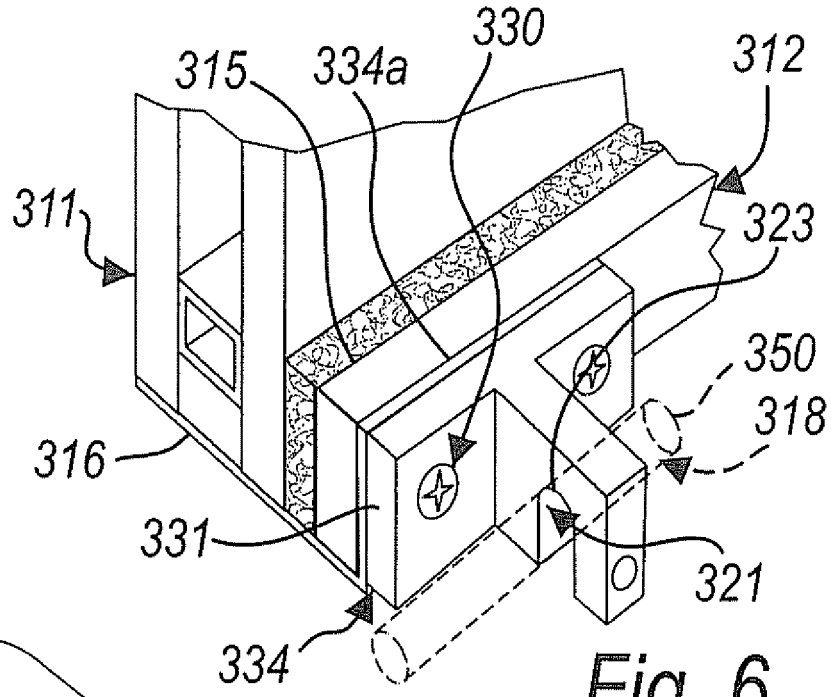

Fig. 6

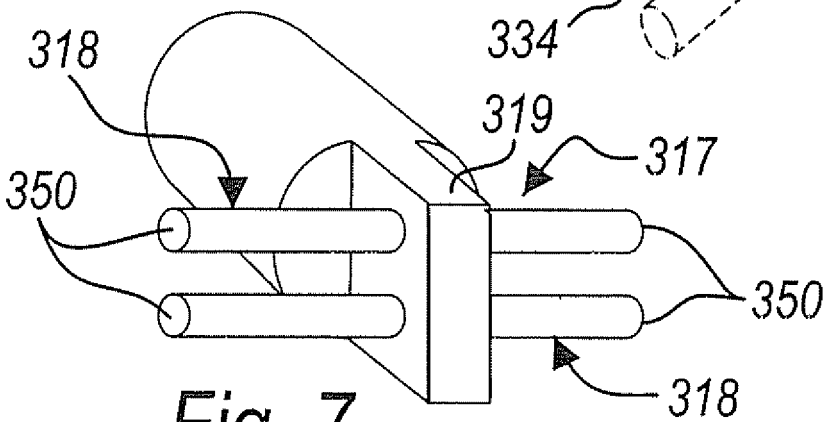

Fig. 7

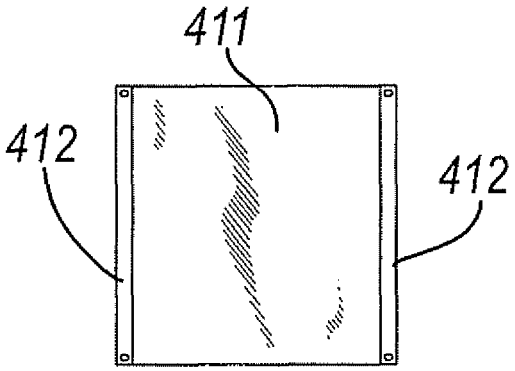

Fig. 8

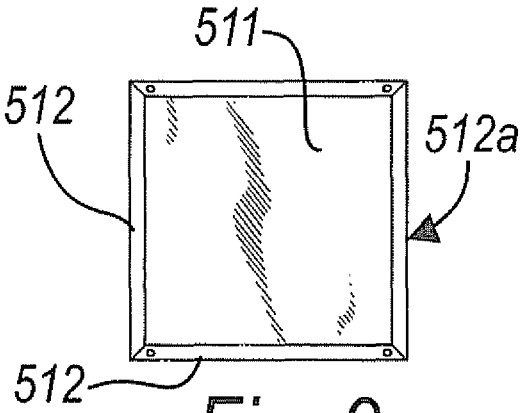

Fig. 9

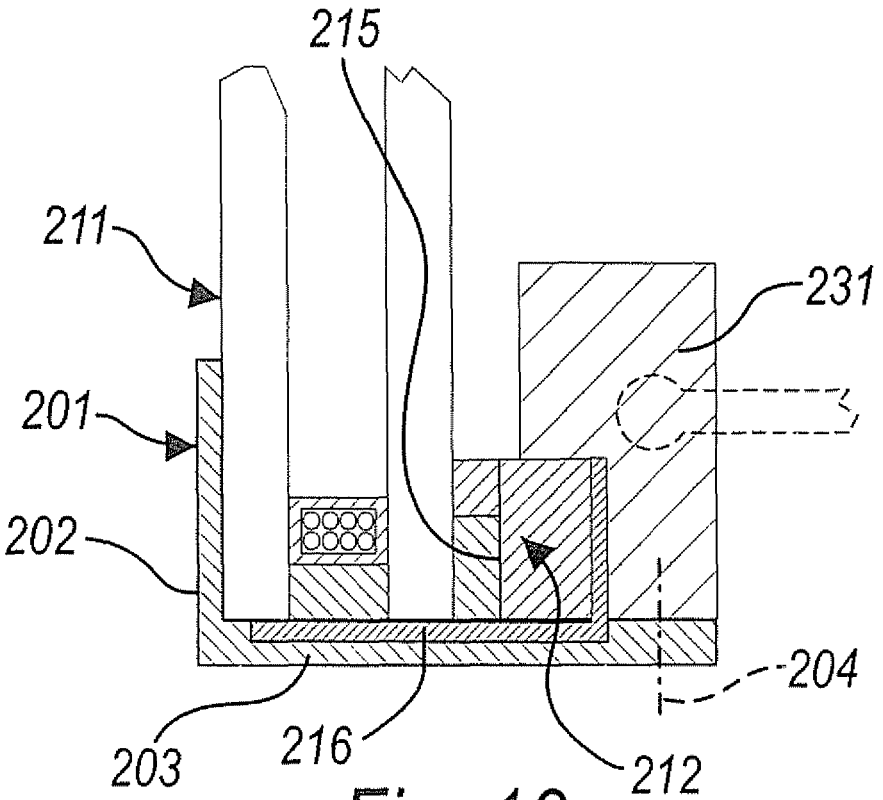

Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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