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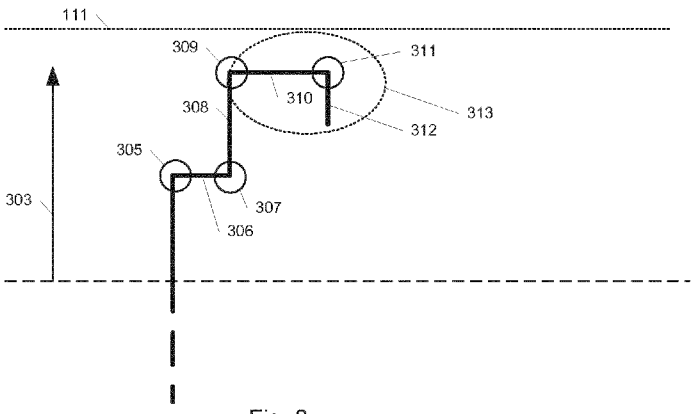

Fig. 3

(57) Abstract: The present invention relates to a spacer profile (101) for mounting between glass panes (103, 105) for forming a spacing between said glass panes, wherein said spacer comprises an inner surface (111) directed towards the inner space when mounted between said panes, an outer surface (113) opposite said inner surface, opposite side faces (107, 109) connecting said inner surface and said outer surface comprising a first side layer material substantially extending in a direction (303) between said inner surface (111) and outer surface (113). Thereby, the spacer profile comprises two parts, i.e. an upper part (115) including the inner surface of said spacer profile connected to the upper section (121, 123) of the opposite side faces (107, 109) and a lower part (117) including the outer surface of said spacer profile connected to the lower section (125, 127) of the opposite side faces (107, 109). Throughout this application, the lower section is the part that comprises the smooth side surface part adapted for adding a connecting material, such as a butyl layer, when connecting said glass panes to said spacer profile. At least four bendings (305, 307, 309, 311) are present at each of said opposite side faces of said upper section of said side surfaces, wherein a bending is a change in direction in which said side layer extends followed by a segment (306, 308, 310, 312) of said side layer material extending in a new direction and wherein each of said opposite side faces comprises two substantially parallel overlapping layers.

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TITLE

A spacer profile with improved stiffness

FIELD OF THE INVENTION

The present invention relates to a spacer profile for mounting between glass panes for forming a spacing between said glass panes.

DESCRIPTION OF PRIOR ART

It is well known to provide spacers in order to define the spacing between the panes of isolating glazing consisting of a plurality of parallel glass panes spaced by an isolating cavity.

A plurality of such spacers made of various materials and of various shapes is known in the art. Spacers made by roll forming of a metal foil are widely used in the art and considered to be one of the preferred alternatives because of their stability and their low gas diffusion properties.

Insulating Glass Units (IG units) having a plurality of glass panes are made by automatic manufacturing machines. Spacers are automatically bent to the desired size and shape and are arranged between two neighboring glass panes. Spacers made of metal foils can be easily bent and will remain in the bent position.

Furthermore, spacers made of metal foils have a high resistance against diffusion of gases and moisture penetration. Within the space between the neighboring glass panes, a gas is arranged, for instance argon having good isolating properties. In order to avoid any loss of gas, the spacers delimiting the cavity need to be resistant against diffusion of such gaseous elements.

However, known spacers, which are exclusively made of metal, such as aluminum and galvanized steel, also have some disadvantages. Due to a relatively high heat conductivity of metal, spacers made of a metal foil still have a heat conductivity which may be too high under certain circumstances.

In order to reduce the heat conductivity further, it has been suggested to use plastic material for forming such spacers. Plastic material has, however, relatively high gas

diffusion as compared to metal. Thus, it has been suggested to provide a metal foil over a plastic body. Such a spacer is shown in e.g. EP 852280.

A further problem of spacers made of plastic material is their instability during the manufacturing process. In particular, a spacer bent to the desired frame shape may be slightly deformed during assembly because of the resiliency of plastic material. Thus, misalignments of the spacer during manufacturing are possible. In order to avoid this problem, it has been suggested in EP 852280 to use fibreglass-reinforced plastic material. Furthermore, plastics spacers including stabilising material in a plastic body have been proposed e.g. in WO 99/15753 or in WO 99/41481. However, these solutions also have some disadvantages. In particular, manufacturing is relatively complicated.

Similar spacers made from a body of plastic material are further known from DE 9 214 799, EP 1022424, EP 947659 A2, EP 1233136 A1, WO 99/42693 or WO 03/074830. U.S. Pat. No. 5,630,306 discloses an insulating spacer which comprises a main body formed of a plastic material. Metallic leg members are attached to the plastic main body. While the problem of heat conduction and diffusion can be addressed with such spacer, some problems remain in connection with bending the spacer into the desired frame shape and later during assembly of an IG Unit. In particular, the lateral legs may be deformed during bending out of their plane so that an irregular shape may result therefrom. Such an irregular shape is particularly disadvantageous if a sealing contact between the spacer and a glass pane shall be achieved.

Another way of making spacers with a low heat conductivity could be by making the spacers from thin materials Thereby the amount of material is reduced, but this also results in a soft and flexible spacer being difficult to handle while mounting between panes.

Spacer profiles are initially made as elongated elements, which are then bent into a shape corresponding to the shape and dimensions of the window panes between which the spacers are to be used. The process of creating a spacer with good insulating properties when mounting between panes and where handling of the elongated profiles from production via bending and finally mounting them between the glass panes introduces a dilemma. This dilemma is that on one hand, it is of interest to use thin material and thereby reducing heat transmission and making it easier to bend the profile according to the shape of the window panes using the existing bending tools and on the other hand, it is of interest

to obtain a stiff profile which can easily be handled.

Based on the above, it is thereby a problem to create spacers from thin material having a sufficient stiffness when handling them.

It is known to add bendings along the metallic surface along the edge of the profile, but the problem with known solutions is that either the added bendings do not result in a spacer profile being sufficiently stiff for handling or the resulting spacer profiles become too stiff to be bent in the machinery owned by window producers bending the spacer profiles according to the shape of the final window.

SUMMARY OF THE INVENTION

An object of the present invention is to solve some of the aforementioned problems. More specifically, it is an object of the present invention to provide a spacer profile for mounting between glass panes for forming a spacing between said glass panes, wherein said spacer comprises an inner surface directed towards the inner space when mounted between said panes, an outer surface opposite said inner surface, opposite side faces connecting said inner surface and said outer surface comprising a first side layer material substantially extending in a direction between said inner surface and outer surface. Thereby, the spacer profile comprises two parts, i.e. an upper part including the inner surface of said spacer profile connected to the upper section of the opposite side faces and a lower part including the outer surface of said spacer profile connected to the lower section of the opposite side faces. Throughout this application, the lower section is the part that comprises the smooth side surface part adapted for adding a connecting material, such as a butyl layer, when connecting said glass panes to said spacer profile. At least four bendings are present at each of said opposite side faces of said upper section of said side surfaces, wherein a bending is a change in direction in which said side layer extends followed by a segment of said side layer material extending in a new direction and wherein each of said opposite side faces comprises two substantially parallel overlapping layers.

Tests have shown that by having at least four bendings as well as parallel overlapping layers at each side, a significant increase of the stiffness of the spacer is obtained especially due to the positioning at the upper part above the lower part after the part of the side face connected to the panes via connecting material such as a glue like butyl. This

stiffness is obtained without compromising the very important thermic properties of the spacer. In addition, thin material can be used, and a spacer profile is created, where it can be bent using existing bending tools.

It is to be noted that the at least four bendings are positioned at the top part and more specifically at the upper section of the side layers in the upper part of the spacer which also comprises the inner surface of the profile spacer. The upper sections are positioned after the section on the side layer for adding butyl being for connecting each side of a spacer to a pane. The four bendings as defined in the current invention describe at least four bendings positioned at the upper section of the side layers above the butyl layer and near the inner surface of the spacer profile.

A spacer according to the present invention can be made using very thin material, where the thickness is less than 0.1 mm. Such spacer has very good thermal properties and can become stiff and easy to handle due to the four bendings and the overlapping surfaces. Further, even after bending the frame to be mounted between the panes, the frame becomes stable and maintains its shape which is also referred to as a high corner stability of the frame. Further, the risk of bending down the elongated profile parts in the frame is significantly reduced. A solution is described, where the butyl to be added before connecting to the glass panes can easily be added.

Thereby, after production, the long elongated spacers are quite stiff and any subsequent handling of the spacers is significantly easier. The subsequent handling could be the transport from the production facility to the window manufacturer, but also at the window production facility, the steps of handling the elongated spacers as well as spacers bent to fit between panes of a specific window are easier.

In one embodiment, the spacer profile comprising side faces according to the present invention could be a profile comprising two parts being respectively a first synthetic part and a second metal foil. In one embodiment, the synthetic part is profile-shaped, where the metal foil extends along the side faces of the synthetic profile. In another embodiment, the synthetic part only extends along the inner surface and is connected to a U-shaped metal part comprising lower surfaces and side surfaces of the spacer profile.

In yet another embodiment, the profile is solely made from a single material, where the

opposite side surfaces comprise bendings according to the present invention.

In an embodiment, at least one of said substantially parallel layers at a side face is obtained by attaching a second layer to said side layer material. By adding a layer, stiffness can be increased without having to bend the side faces of the spacer profile. Thereby, any shape of the spacer profile can be made stiffer by simply adding the additional layer.

In an embodiment, at least one of said substantially parallel layers at a side face is obtained by performing multiple bendings of said side face layer directions resulting in at least two substantially parallel layers. Thereby, simply by bending the side faces in a specific manner, substantially parallel layers can be obtained in each side thus increasing the stiffness of the spacer significantly.

In an embodiment, said side layer material extends between said opposite side faces via said lower part, and wherein the lower part defines the outer surface of said spacer profile, and wherein multiple bendings are added to said lower part. By also adding bendings on the lower surface, the spacer is stiffened further.

In an embodiment, at least two of said bendings result in the upper part of said sidelayer material along the side faces is displaced relative to the remaining part of sidelayer material along said side faces. A displacement at the sidelayer along the side faces combined with additionally at least two more bendings has proven to result in a stiff spacer profile which can still be handled as necessary.

In an embodiment, the side layer material along the side faces comprises an end part extending away from the side face. Thereby, material can be added away from the centerline of the spacer which makes handling properties better due to a good moment of inertia in the end product.

In an embodiment, said end part forms at least one layer of said two substantially parallel overlapping layers. Thereby, material is away from the center line and adds stiffness to the profile.

In an embodiment, said end part comprises a 180 degrees bending which forms layers for

said at least two substantially parallel overlapping layers. This has proven an efficient way of obtaining parallel overlapping layers of the same material.

In an embodiment, said spacer is made from two interconnected elements being an upper element comprising the inner surface of said spacer and an outer element comprising the outer surface of said spacer, respectively. Thereby, material for each element can be different and considered separately to obtain a spacer profile with optimised properties, i.e. both mechanical and thermal.

In an embodiment, at least said upper element is made of a synthetic material.

In an embodiment, at least said lower element is made of a metal material.

In an embodiment, said lower part comprises a layer with multiple bendings, and these bendings combined with the features described above for the upper part have proven to result in a profile with good properties relating to

- production of the spacer profile,
- stiffness for handling when transporting,
- stiffness for making it bendable using standard tools and without collapsible corners,
- sufficiently smooth side face for applying glue/butyl,
- handling during mounting between panes.

In an embodiment, said bendings are present at the outer surface of said spacer profile.

In an embodiment, said sidelayer material extends between said opposite side faces via said lower part, and wherein the lower part defines the outer surface of said spacer profile.

In an embodiment, said profile comprises multiple layers of material at each side.

The invention also relates to a windows system comprising glass panes spaced apart by a spacer as described above and wherein the panes are connected to said spacer by a connecting material e.g. a glue such as butyl. The connecting material is positioned on the smooth side surfaces of the lower section in the lower part of the spacer.

LIST OF FIGURES

Fig. 1 is a schematic illustration of a spacer profile positioned between two glass panes.

Fig. 2 is a schematic illustration of the spacer profile,

Fig. 3 is a schematic illustration of a subpart of a side face of a spacer profile comprising bendings according to the present invention.

Fig. 4 illustrates an embodiment of the entire spacer profile, where the bendings are according to Fig. 3.

Figs. 5 and 6 show alternative embodiments of subpart of a side face of a spacer profile comprising bendings according to the present invention.

Fig. 7 shows an embodiment of the lower surface of a spacer according to the present invention.

Fig. 8 shows an embodiment of the entire spacer profile being a two part spacer, where the bendings are according to Fig. 5A.

Fig. 9 shows an embodiment of the entire spacer profile being a two part spacer, where the bendings are according to Fig. 6E.

Fig. 10 shows an embodiment of the entire spacer profile being a one part spacer, where the bendings are according to Fig. 6G.

Fig. 11 shows an embodiment of the lower surface of a spacer according to the present invention.

Fig. 12 shows an embodiment of the lower surface of a spacer according to the present invention.

Fig. 13 shows an embodiment of the profile with transverse grooves according to the present invention.

DESCRIPTION OF DRAWINGS

In Fig. 1, a spacer profile 101 is illustrated as mounted between two glass panes 103, 105. The spacer profile is connected to the glass panes at the opposite side surfaces 107, 109. The spacer profile further has an inner surface 111 and an opposite outer surface 113.

The spacer profile can be made of various types of material, e.g. by combining several types of material or by using a single material, and materials used for spacer profiles are metal, plastic, fibreglass. An important aspect of designing spacer profiles is to consider the heat transfer properties and insure that the insulating windows formed by the spaced apart panes maintain good insulation properties e.g. by avoiding that the profile part becomes a weak point due to the generation of a heat bridge. In one embodiment, the spacer comprises a first inner part comprising the inner surface, and this inner part is made of Polypropylene. Further, the material would typically be colored in order to obtain a specific design but in addition, the color also influences the thermal properties of the spacer. The inner part is connected to an outer part comprising the outer surface, and this part could be made of stainless steel.

Typically, the spacers are connected to the panes using a glue, such as butyl or similar, and since a gas, such as Argon, is typically positioned in the space between the panes, it is important that the spacer profile is connected to the panes in a gastight manner, whereby it can be assured that the Argon does not leave the pane space and it is avoided that atmospheric air enters the pane space. Further, the spacer bar itself is filled with a desiccant to absorb any residual moisture within the cavity and thus prevent condensation within the double-glazing window.

Typically, small perforated lines or openings are also made along the inner surface. These are breather holes allowing the passage of gas into the spacer bar, where the previously described desiccant is held.

As an alternative to the schematic embodiment of Fig. 1, there could also be two spacer profiles positioned between three panes thereby generating a three layer window.

In the following, details of a spacer according to the present invention are described by

referring to schematic illustrations of spacers. These schematic illustrations are solely to be used for understanding the concept of the present invention, and details not relevant for explaining this concept are not show. Such details could be the breather holes, the desiccant and the detail shaping.

Fig. 2 is a schematic illustration of a spacer profile, where the spacer profile comprises the inner surface 111, the opposite side surfaces 109, 113. Further, in the figure, a dotted line 119 is illustrated to divide the spacer profile into an upper part 115 comprising the inner surface 111 and the upper part of the opposite side surfaces 121, 123 connected to the inner surface. Besides comprising the upper part 115, the profile spacer also comprises the lower part 117 comprising the outer surface 113 and the lower part 125, 127 of the opposite side surfaces 121, 123 connected to the outer surface 113. As mentioned, each of the side surfaces are to be connected to the panes using a glue, such as butyl. The upper part illustrated above the dotted line comprises an upper section of the side surfaces, said upper section being above the lower section of the side surfaces, and said lover section comprising the smooth side surface part where butyl should be added. The dotted line illustrated in all figures is a line illustrating the separation between the upper and the lower sections of the side surfaces and thereby also illustrating the part of the side surfaces above the butyl layer. The upper section of the side surface considered to be in the upper part of the profile spacer is above the part of the profile side surface where butyl is added. The butyl layer is to be added to the side surface being part of the lower section of the side surfaces.

It is to be noted that all figures are to be understood in a schematic manner. The exact dimensions and ratios do not have to be as illustrated. Even though the dotted line is illustrated as being in the middle of the profile, it is solely an illustration. The line separating the upper part from the lower part would probably be closer to the inner surface than the outer surface and always above the smooth part of the side surface where butyl is to be added.

Fig. 3 is a schematic illustration of a subpart of side layer material along a side face of a spacer profile comprising bendings according to the present invention. In the figure, an embodiment of the left upper part of the spacer profile according to Fig. 2 is illustrated. The figure illustrates the upper part of the side layer material generally extending in a direction 303 towards the inner surface 304 illustrated by a dotted line.

The side layer comprises four bendings 305, 307, 309 and 311, and each bending is followed by an elongated segment 306, 308, 310, 312 of said side layer extending in a direction different from the direction before the bending. The four bendings followed by the segments of said layer results in a significant stiffening of the entire elongated spacer profile and further, the resulting two substantially parallel overlapping layers of segment 308 and 312 also increase the stiffness of the spacer profile. All bendings illustrated in this figure is 90 degree bendings, but bendings could be both more or less that 90 degrees. In an embodiment, at least one bending could be 180 degrees.

In the embodiment, the initial bendings 305 and 307 result in a displacement of the top part of side layer material extending along the side face of the profile. In other words, the segment 308 is displaced relative to the first part of side layer material covering the side face of the spacer profile. The upper part the end part 313 pointing away from the side face, and this is obtained by having the bendings 309, 311 as well as the segments 310 and 312. Then, the end part 313 comprises bendings forming segments which form a layer 312 being substantially parallel and overlapping the layer 308.

Fig. 4A illustrates an embodiment of a complete spacer comprising the subpart of the side face illustrated in Fig. 3. The spacer profile comprises similar opposite side faces 401, 403 and in the embodiment, the spacer profile comprises two parts being an open metal profile comprising two similar opposite side faces 401, 403 connected via a lower part 405 and further, a top part 407 is connected to the open metal profile e.g. where the top part is made of a synthetic material, such as polypropylene, fibreglass or similar. In one embodiment, the parts could be connected by gluing them together and as an alternative, the top part could be from plastic or fibreglass and moulded onto the lower metal part.

In the embodiment, one type of two part spacers is illustrated but as an alternative, a closed profile 409 could be made of synthetic material and the side layer be added as a metal foil layer on the outer surface extending to the side faces. Such embodiment is illustrated in Fib. 4B.

When adding the bendings to the top part of the side layer, it is important that a smooth surface is maintained at each side face. In Fig. 4A this smooth and plane surface part is indicated as 404. This smooth surface is needed when adding glue such as butyl before

connecting each side face to the glass panes, and the smooth surface is required in order to ensure a good connection between the glass pane and the side face. In order to ensure a sufficiently good connection, the surface should also be at least 3 mm, i.e. a requirement that further limits the area along the side layer in which bendings can be provided.

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In Fig. 5, alternative embodiments of the spacer profile and the left upper part of the spacer profile according to the present invention are illustrated as A, B, C and D. Instead of illustrating the entire profile, schematic illustrations of a subpart of a side face of a spacer profile is illustrated in a similar manner as the illustrations of Fig. 3.

In each illustration, at least four bendings are present followed by a segment of side layer material and further, two substantially parallel layers are also present in each illustration. Bendings are marked with the symbol "*". Segments following a bending are marked with the symbol "+", and substantially parallel overlapping layers are further labelled with the symbol "#".

A - illustrates an embodiment, where four bendings are present and each bending being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises two layers of substantially parallel overlapping side layer material. In the embodiment, the overlapping layers are formed by segments being perpendicular to the direction in which the side layer extends.

B - illustrates an embodiment, where five bendings are present and each being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises four layers of substantially parallel overlapping side layer material, where two of these layers are perpendicular to the direction in which the side layer extends, and two are substantially parallel to the direction in which the side layer extends.

C - illustrates an embodiment, where eight bendings are present and each being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises segments of substantially parallel overlapping side layer material.

D - illustrates an embodiment, where four bendings are present and each being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises four segments of substantially parallel overlapping side layer

material, where two of the layers are perpendicular to the direction in which the side layer extends, and two are substantially parallel to the direction in which the side layer extends. In this embodiment, an elongated substantially parallel layer 501 is connected to the inner surface of the side layer of the elongated spacer. This layer forms one of the side layer bendings and parts of the substantially parallel overlapping layers.

In Fig. 6, further alternative embodiments of the spacer profile according to the present invention are illustrated as E, F, G.

E - illustrates an embodiment, where four bendings are present and each being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises two segments of substantially parallel overlapping side layer material, where two of these layers are parallel and two are perpendicular to the direction in which the side layer extends. This embodiment is quite similar to B, but the displaced segment at the top part of the side layer is shorter in E than B.

F - illustrates an embodiment, where five bendings are present and each being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises four segments of substantially parallel overlapping side layer material, where two of these layers are perpendicular to the direction in which the side layer extends and two are parallel.

G - illustrates an embodiment, where seven bendings are present and each being followed by a segment of side layer material extending in a different direction and further, the embodiment comprises two segments of substantially parallel overlapping side layer material, where these layers are perpendicular to the direction in which the side layer extends. In this embodiment, an elongated substantially parallel layer 601 is connected to the inner surface of the side layer of the elongated spacer.

It is noted that in all of the above, the side layer material comprises a top part along the side face and an end part extending away from the side face. In all embodiments, the top part is displaced relative to the part of the side face part to be connected to the glass panes.

The above examples have been given in order to show how the spacer profile can be

made significantly more stiff by having side layers in the profile with at least four bendings and substantially parallel overlapping layers of material.

An important part when designing the profile is that the four bendings and the overlapping parallel surfaces are added along the sides in a manner whereby a smooth side surface is maintained for adding a butyl layer. Typically, this smooth surface needs to be at least 3 mm to obtain a strong bonding to the glass panes connected to the spacer profile. Further, it is of importance to maintain a specific moment of inertia in the final spacer profile and therefore, it is of interest to ensure that as much material as possible is far from the centreline of the spacer profile. A further issue that needs to be dealt with when designing the bends and overlap is that the machinery has to be able to handle bendings, and they often limit how short a segment between two bendings can be.

Generally, further bendings can be added to further increase stiffness, and these bendings could be in other areas in the spacer profile.

Fig. 7 is a schematic illustration of the lower part 701, where bendings are provided on the outer surface to further enhance stiffness of the spacer profile. In one embodiment, the distance 703 between bottom and top of a bending could be between 0.1 – 0.7 mm and preferable between 0.25 and 0.30 mm. These bendings increase the stiffness of the profile significantly.

Different bendings could be added to the lower part, and even though the bendings illustrated in the figure create grooves extending along the length of the spacer profile and have an illustrated shape, they could have different shapes such as waives e.g. sinus-shaped or other shapes, and the bendings on one surface do not all have to have the same shape. The bendings do not have to be evenly distributed along the outer surface. There could e.g be bendings only near the side faces and/or only at the center of the outer surface. Further, as an alternative to bending grooves extending along the length of the spacer profile, the bendings could also extend in a different direction e.g. along the width of the spacer profile and also in any other direction such as in a 45 degree angle to the spacer profile length. Again, a combination of bending groove extension angles and different shapes could be added to the same profile. When considering the bendings to be added, some of the considerations relate to the obtained stiffness compared to the ease of production. Naturally, it is of interest to obtain a stiff profile which can be produced

easily.

Fig. 8 shows an embodiment of the entire spacer profile being a two part spacer, where the bendings are according to Fig. 5A.

Fig. 9 shows an embodiment of the entire spacer profile being a two part spacer, where the bendings are according to Fig. 6E.

In both Figs. 8 and 9, a top part has been mounted onto the metal part similar to the embodiment described in Fig. 4A.

Fig. 10 shows an embodiment of the entire spacer profile being a one part spacer, where the bendings are according to Fig. 6G. In this embodiment, the entire profile is made of a single material, such as steel, being bend as illustrated with at least four bendings and one overlapping layer in the top part of each side.

Fig. 11 is an embodiment of the lower part, where bendings are provided on the outer surface but only as two-wave shapes 1101 at each side of the profile and then a transition radius 1103 from the bottom to the sides. These bendings 1101 and 1103 at each side can be sufficient to increase the stiffness of the profile

Fig. 12 is an embodiment of the lower part, where bendings are provided on the outer surface but only as one-wave shapes 1201 at each side of the profile and then a transition radius 1203 from the bottom to the sides. These bendings 1201 and 1203 at each side can be sufficient to increase the stiffness of the profile.

In the bottom part of Figs. 11 and 12, e.g. at the part indicated by reference numerals 1105, 1205, grooves could be positioned along the width of the profile. Again, this will increase the stiffness of the profile. In Fig. 13, part of the length of an elongated profile and the grooves 1301 are illustrated. In the illustration, only the grooves are shown being bendings extending perpendicular to the bendings as explained in Figs. 11 and 12. The bendings explained in Figs. 11 and 12 are not shown, but could also be there. The figures are solely for illustrating the grooves extending along the width of the profile and not the length.

REFERENCES

101 – Spacer profile

103, 105 – Panes

107, 109 – Opposite side faces

111 – Inner surface

113 – Outer surface

115 – Upper part of spacer profile

117 – Lower part of spacer profile

121, 123 – Upper section of opposite side faces

125, 127 – Lower section of opposite side faces

305, 307, 309, 311 – Bendings in upper section of one side face

306, 308, 310, 312 – Segment of side layer material following a bending

313 – End part of side layer material extending away from the side face

401, 403 – Opposite side faces of an open metal profile

404 – Smooth and plane side layer surface for connection to glass pane

405 – Open metal profile

407 – Top part connected to open metal profile

409 – A closed profile connected to open metal profile

501, 601 – Added layer to upper part of the material at the side face

701 – Outer layer of profile with bends

CLAIMS

1. A spacer profile (101) for mounting between glass panes (103, 105) for forming a spacing between said glass panes, wherein said spacer comprises

- an inner surface (111) directed towards the inner space when mounted between said panes,
- an outer surface (113) opposite said inner surface,
- opposite side faces (107, 109) connecting said inner surface and said outer surface and comprising a first side layer material substantially extending in a direction (303) between said inner surface (111) and outer surface (113) and wherein said opposite side faces comprise a smooth side surface being a sub part of the entire side face adapted for adding a connecting material e.g. a glue such as butyl for fastening said spacer profile between said glass panes,

said spacer profile thereby comprising two parts, i.e.

- an upper part (115) including the inner surface of said spacer profile connected to the upper section (121, 123) of the opposite side faces (107, 109) and
- a lower part (117) including the outer surface of said spacer profile connected to the lower section (125, 127) of the opposite side faces (107, 109), said lower section comprising a smooth side surface adapted for adding a butyl layer when connecting said glass panes to said spacer profile,

characterised in, that

- at least four bendings (305, 307, 309, 311) are present at said upper section of the upper side faces of said upper part, wherein a bending is a change in direction in which said side layer material extends followed by a segment (306, 308, 310, 312) of said side layer material extending in a new direction, and wherein said side layer material on each of said opposite side faces connecting said inner and outer surface comprises two substantially parallel overlapping layers (308, 310).

2. A spacer according to claim 1, wherein at least one of said substantially parallel overlapping layers at a side face is obtained due to at least one bend of said side face

layer directions resulting in at least two substantially parallel overlapping layers (308, 310).

3. A spacer according to claim 1, wherein at least one of said substantially parallel layers at a side face is obtained by attaching a second layer (501) to said side layer material.

4. A spacer according to claims 1-3, wherein at least two of said bendings result in the upper part of said side layer material along the side faces being displaced relative to the remaining part of side layer material along said side faces.

5. A spacer according to claims 1-4, wherein the side layer material along the side faces comprises an end part extending away from the side face.

6. A spacer according to claims 1-5, wherein said end part forms at least one layer of said two substantially parallel overlapping layers.

7. A spacer according to claims 1-6, wherein said end part comprises a 180 degrees bend forming layers for said at least two substantially parallel overlapping layers.

8. A spacer according to claims 1-7, wherein said spacer is made from two interconnected elements being an upper element comprising the inner surface of said spacer and an outer element comprising the outer surface of said spacer respectively.

9. A spacer according to claim 8, wherein at least said upper element is made of a synthetic material.

10. A spacer according to claim 8-9, wherein at least said lower element is made of a metal material.

11. A spacer according to claims 1-10, wherein and said lower part also comprises a layer with multiple bendings.

12. A spacer according to claim 11, wherein said bendings are present at the outer surface of said spacer profile.

13. A spacer according to claims 1-12, wherein said side layer material extends between

said opposite side faces via said lower part, and wherein the lower part defines the outer surface of said spacer profile.

14. A spacer according to claims 1-13, wherein said profile comprises multiple layers of material at each side.

15. A windows system comprising glass panes spaced apart by a spacer according to claims 1 – 14, wherein the panes are connected to said spacer by a connecting material, e.g. a glue such as butyl, and wherein said connecting material is positioned on smooth side surfaces of said lower section in the lower part of said spacer.

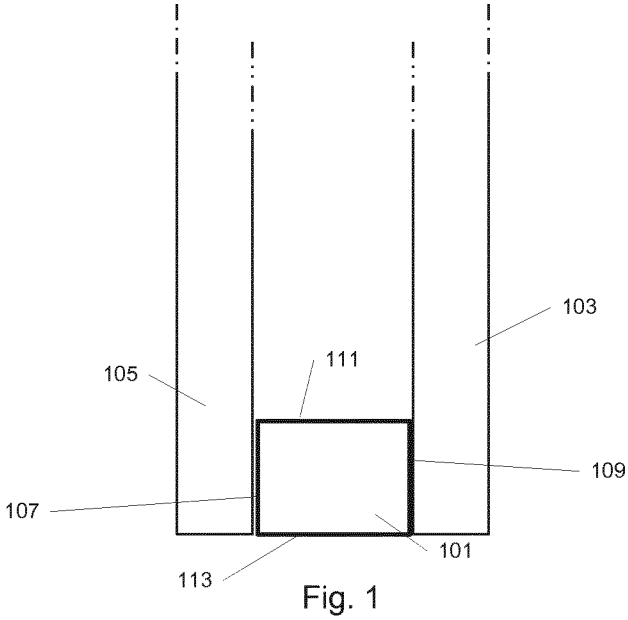

Fig. 1

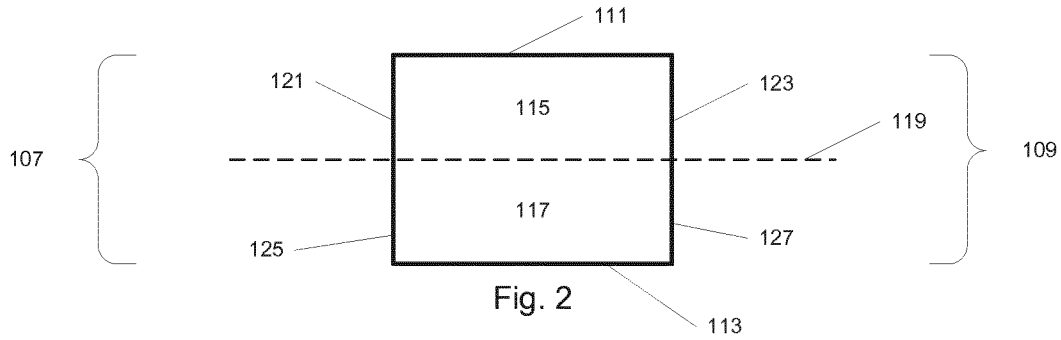

Fig. 2

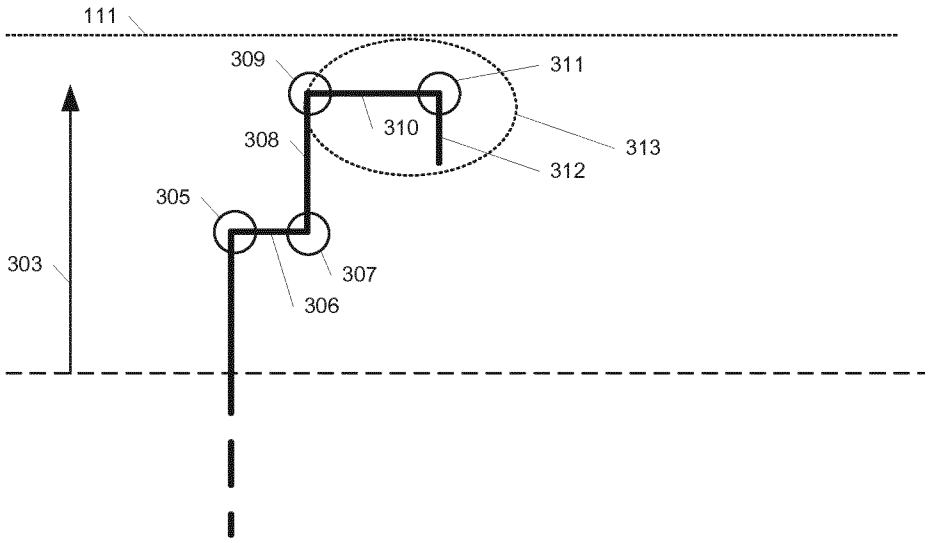

Fig. 3

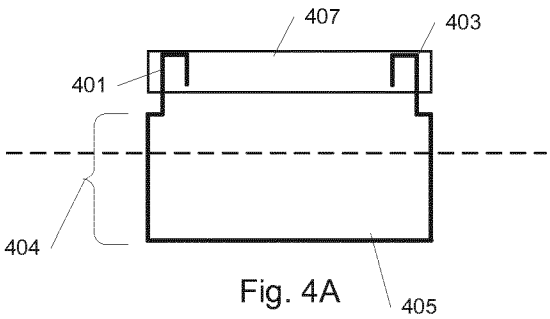

Fig. 4A

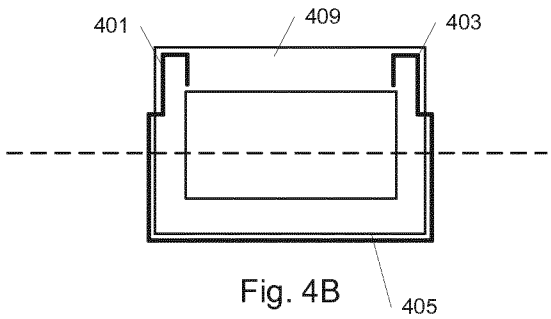

Fig. 4B

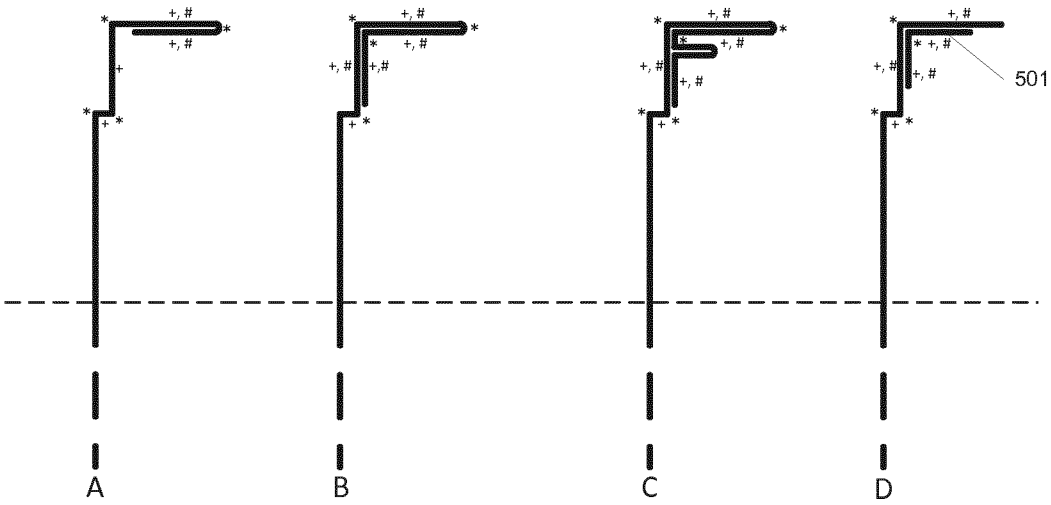

Fig. 5

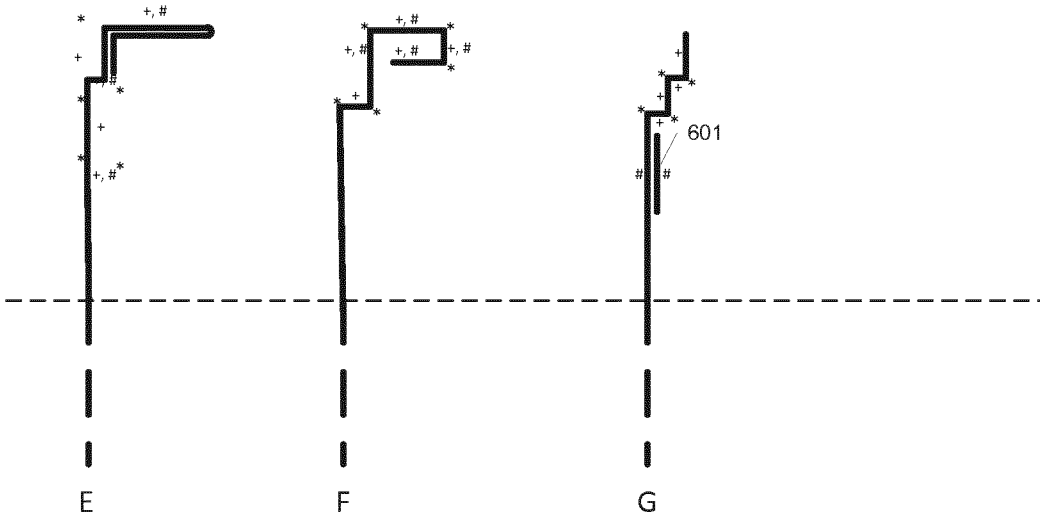

Fig. 6

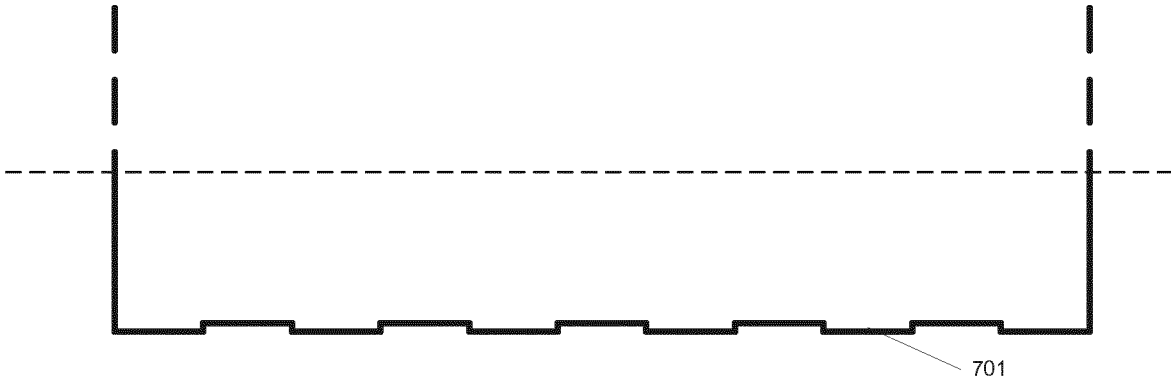

Fig. 7

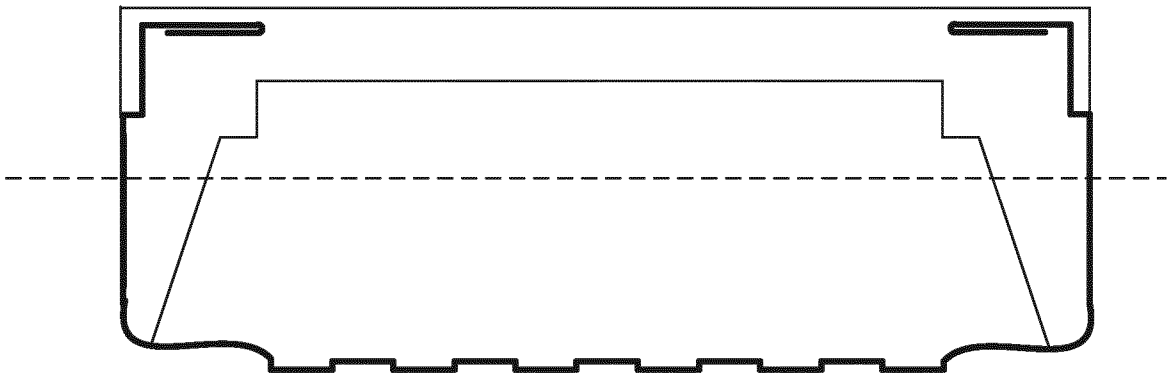

Fig. 8

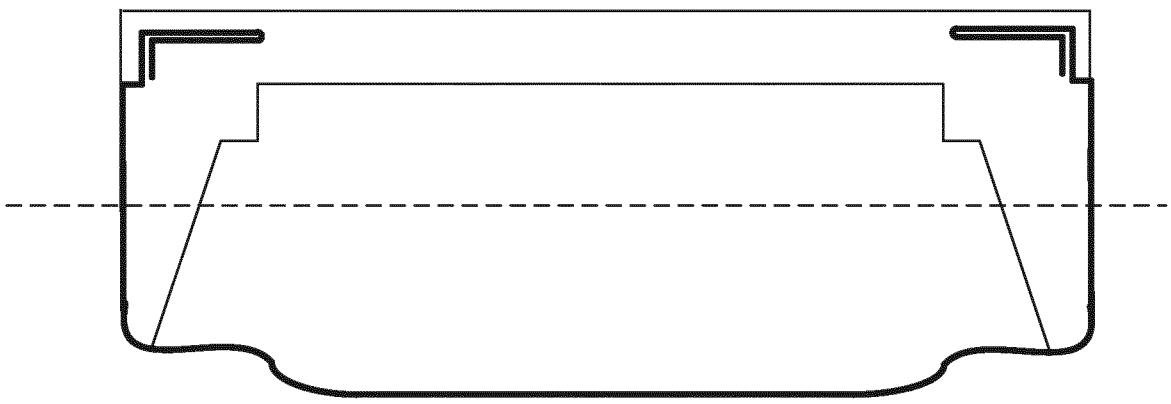

Fig. 9

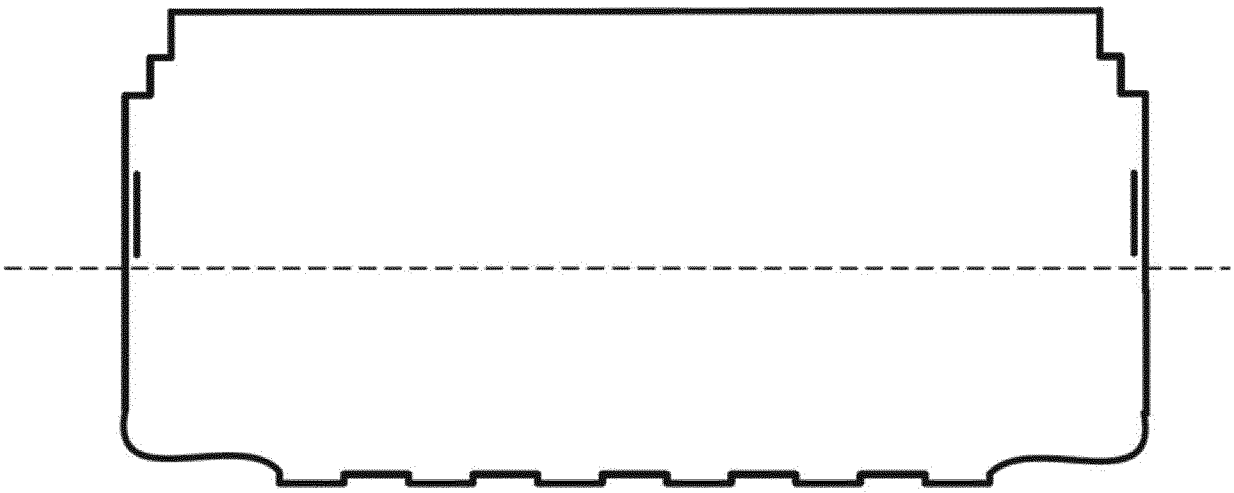

Fig. 10

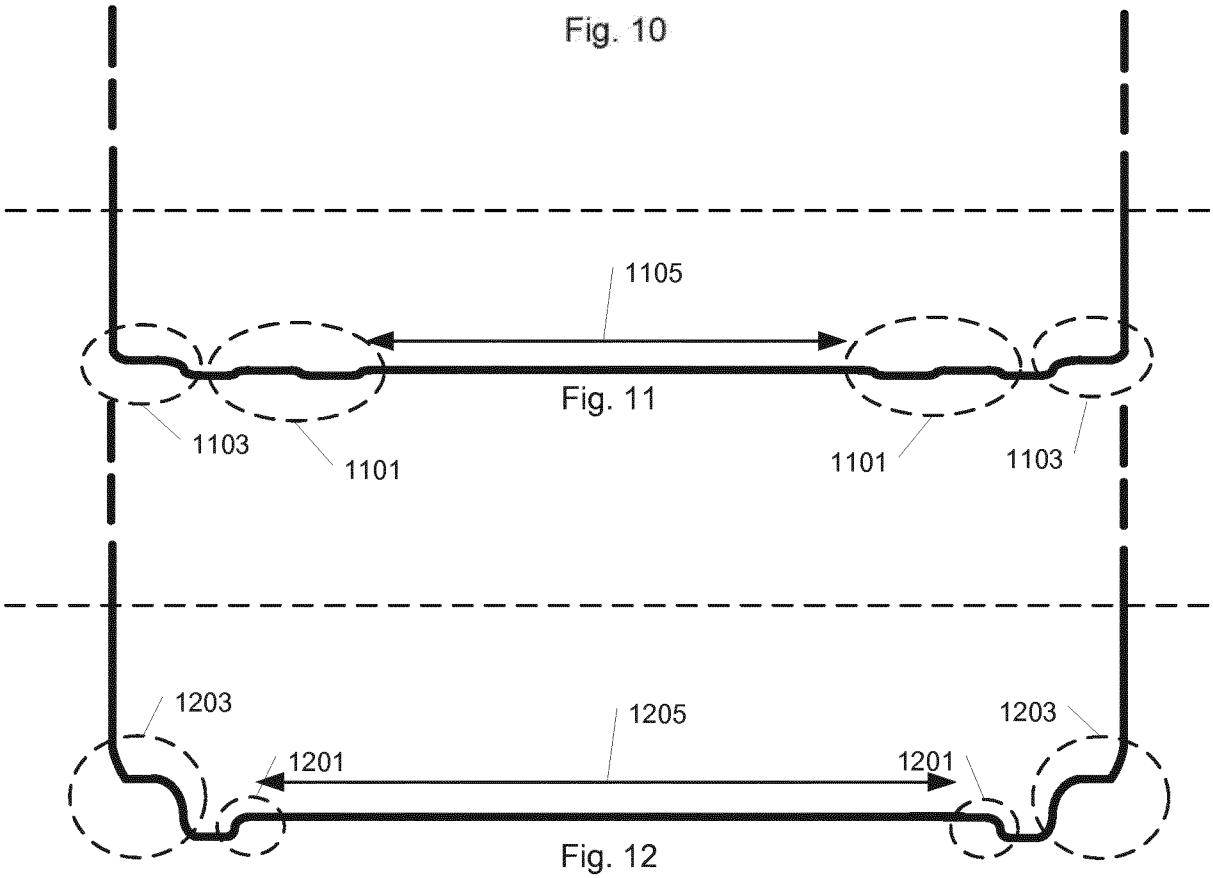

Fig. 11

Fig. 12

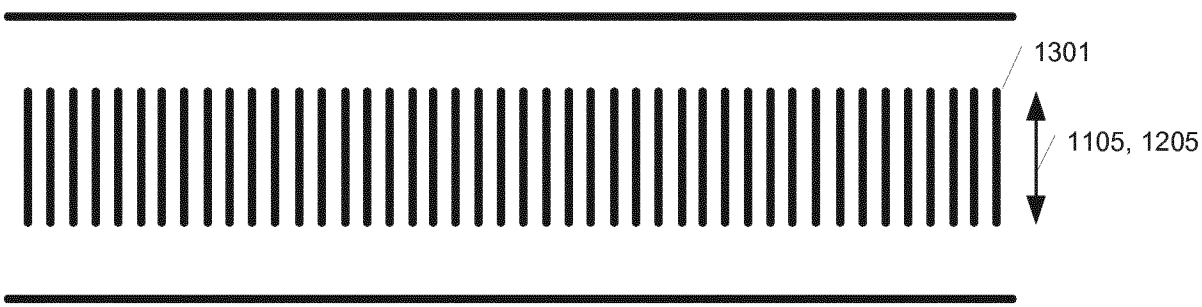

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/058854

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06B3/663
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/031591 A1 (GALLAGHER RAYMOND G [US]) 11 February 2010 (2010-02-11) figures 1, 4 -----	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 May 2018	16/05/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cobusneanu, D

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2018/058854

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010031591 A1	11-02-2010	NONE	