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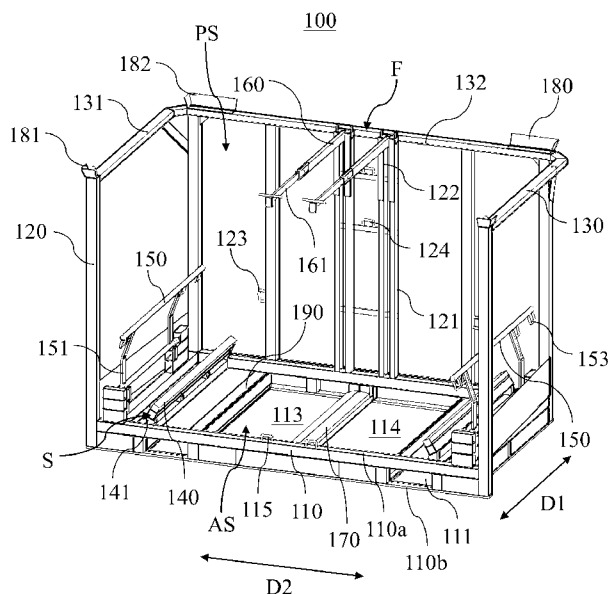


FIG. 1

(57) Abstract: A device for carrying a glass plate comprises a frame comprising a bottom frame(110), a plurality of longitudinal beams(120) extending vertically from the bottom frame, and a cross beam(130) located between at least two adjacent longitudinal beams, wherein the bottom frame has an upper surface(110a) and a lower surface(110b); a placing space located above the upper surface of the bottom frame to place at least portion of the glass plate; a supporting assembly extending from the bottom frame toward the placing space to support the glass plate; and an accommodating space located between the upper surface and the lower surface of the bottom frame for intrusion of at least portion of the glass plate. By providing the accommodating space for intrusion of at least portion of the glass plate, the device for carrying a glass plate improves the space utilization rate of the device, reduces the overall height of the device, thereby saving the production cost, making it possible to stack and transport multiple layers of the devices, and effectively

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reducing the transportation cost.

DEVICE FOR CARRYING GLASS PLATE

FIELD

The present disclosure relates to the technical field of packaging and transportation, in particular to a device for carrying a glass plate, which is suitable for carrying and transporting, for example, vehicle window glass.

BACKGROUND

During transportation of glass, in order to avoid the glass from being damaged due to excessive pressure, it is necessary to transport the glass by using a glass carrier. With the popularization of vehicle, the demand for vehicle window glass is increasing day by day, and the size of vehicle glass is gradually increased. Due to the large size and fragile property, windshield, skylight glass and vehicle door glass often have high breakage rate during transportation, which increases the production cost and may lead to personal injury. Therefore, transportation safety is the key factor in the design of the glass carrier, and the existing glass carrier is usually improved in terms of fixing and vibration reduction. However, in practical application, due to the consideration of production cost and transportation cost, manufacturers and users expect to carry more glasses through the glass carrier, which also challenges the design of the glass carrier.

SUMMARY

The object of the present disclosure is to propose a device for carrying a glass plate, which is especially suitable for carrying large glass plates such as windshield, skylight glass and vehicle door glass of the vehicle. By improving the structural design of the device for carrying a glass plate, the space utilization rate of the device is improved while providing constraints on the glass plate to reduce or even eliminate the glass breakage rate, making it possible to increase the glass transportation volume.

To this end, the present disclosure provides a device for carrying a glass plate. The device comprises a frame comprising a bottom frame, a plurality of longitudinal beams extending vertically from the bottom frame, and a cross beam located between at least two adjacent

longitudinal beams, wherein the bottom frame has an upper surface and a lower surface; a placing space located above the upper surface of the bottom frame to place at least portion of the glass plate; a supporting assembly extending from the bottom frame toward the placing space to support the glass plate; and an accommodating space located between the upper surface and the lower surface of the bottom frame for intrusion of at least portion of the glass plate.

According to the above technical concept, the embodiment of the present disclosure may further include any one or more of the following alternative forms.

In some alternative forms, the device comprises a limiting assembly for limiting placing position of the glass plate.

In some alternative forms, the limiting assembly comprises a bottom limiting component having a limiting surface, and at least portion of the limiting surface is located below the upper surface of the bottom frame.

In some alternative forms, the limiting surface of the bottom limiting component is wholly located below the upper surface of the bottom frame.

In some alternative forms, the bottom limiting component comprises at least one inclined limiting surface.

In some alternative forms, the bottom limiting component comprises at least two limiting surfaces respectively inclined toward opposite directions.

In some alternative forms, the bottom limiting component is configured to be capable of moving along the bottom frame, and the bottom frame is provided with a channel or a guide rail for the bottom limiting component to move.

In some alternative forms, the supporting assembly comprises a bottom supporting seat and a bottom supporting bracket, and the bottom supporting seat is connected to the bottom frame through the bottom supporting bracket.

In some alternative forms, at least one bottom supporting seat is arranged obliquely at an angle relative to the bottom frame to adapt to the shape of the bottom of the glass plate.

In some alternative forms, at least one bottom supporting seat is provided with a plurality of accommodating grooves arranged in sequence to be suitable for supporting a plurality of glass plates vertically and spacing apart the plurality of glass plates in sequence.

In some alternative forms, at least one bottom supporting seat is configured to be capable of moving along the bottom supporting bracket and/or rotating relative to the bottom supporting bracket; and/or at least one bottom supporting bracket is configured to be capable of moving along the bottom frame and/or rotating relative to the bottom frame; the bottom supporting bracket and/or the bottom frame is provided with a channel or a guide rail for providing movement and/or a rotating shaft for providing rotation.

In some alternative forms, the limiting assembly comprises a side limiting assembly, the side limiting assembly comprises a side limiting seat parallel to the bottom supporting seat; and a side supporting bracket, the side limiting seat is connected to the bottom frame, the longitudinal beam or the cross beam through the side support bracket.

In some alternative forms, at least one side limiting seat is arranged obliquely at an angle relative to the bottom frame to adapt to the shape of the edge of the glass plate.

In some alternative forms, at least one side limiting seat is provided with a plurality of accommodating grooves arranged in sequence to be suitable for limiting a plurality of glass plates vertically and spacing apart the plurality of glass plates in sequence.

In some alternative forms, at least one side limiting seat is configured to be capable of moving along the side supporting bracket and/or rotating relative to the side supporting bracket; and/or at least one side supporting bracket is configured to be capable of moving along the bottom frame and/or rotating relative to the bottom frame; the side supporting bracket and/or the bottom frame is provided with a channel or a guide rail for providing movement and/or a rotating shaft for providing rotation.

In some alternative forms, the limiting assembly comprises a top limiting seat arranged on the cross beam or the longitudinal beam and parallel to the bottom supporting seat.

In some alternative forms, the top limiting seat is configured to be capable of moving along the cross beam and/or the longitudinal beam, and the cross beam and/or the longitudinal beam is provided with a channel or a guide rail for the top limiting seat to move.

In some alternative forms, the device further comprises an insertion component for a lifting tool, the insertion component is located below the upper surface of the bottom frame, and the accommodating space is arranged offset from the insertion component.

In some alternative forms, the top of the frame is provided with a nested component, and

the nested component of one device is adapted to the bottom frame of another device, so as to be suitable for stacking a plurality of devices in the vertical direction.

In some alternative forms, the device is provided with a fixing ring arranged on at least one of the bottom frame, the longitudinal beam, the cross beam and the supporting assembly,
5 so as to be suitable for fixing a tie component.

In some alternative forms, the fixing ring is arranged on the limiting assembly.

In some alternative forms, the glass plate is a vehicle window glass comprising front windshield, rear windshield, skylight or vehicle door glass.

By providing the accommodating space for intrusion of at least portion of the glass plate,
10 the device for carrying a glass plate of the present disclosure improves the space utilization rate of the device, reduces the overall height of the device, thereby saving the production cost, making it possible to stack and transport multiple layers of the devices, which effectively reduces the transportation cost. Combining the design of the limiting assembly to improve the transportation safety of the glass plate carried, the device for carrying a glass plate disclosed
15 by the present disclosure can be applied to various forms of plates including but not limited to the glass, and the working efficiency is improved while ensuring the transportation stability.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present disclosure will be better understood by the
20 following alternative embodiments described in detail in conjunction with the accompanying drawings, in which the same numerals identify the same or similar parts, in the drawings:

Fig. 1 is a schematic view of a device for carrying a glass plate according to an embodiment of the present disclosure;

Fig. 2 is a schematic view of one form of carrying a glass plate by using an
25 accommodating space in the device for carrying a glass plate;

Fig. 3 is a schematic view of another form of carrying the glass plate by using the accommodating space in the device for carrying a glass plate;

Fig. 4A is a schematic plan view of the device for carrying a glass plate, illustrating a bottom limiting component of an embodiment, and Figs. 4B to 4C respectively illustrate the
30 bottom limiting component of several other embodiments;

Figs. 5A and 5B are schematic plan views of the contact between the bottom limiting component of the device for carrying a glass plate and the glass plate, respectively illustrating two contact modes and corresponding limiting surfaces.

5 DETAILED DESCRIPTION OF EMBODIMENTS

The implementation and use of the embodiments are discussed in detail below. However, it should be understood that the specific embodiments discussed merely exemplify the specific ways of implementing and using the present disclosure, and do not limit the scope of the present disclosure. When describing the structural positions of various components, such as the directions of upper, lower, top, bottom, etc., the description is not absolute, but relative. When the various components are arranged as shown in the figures, these directional expressions are appropriate, but when the positions of the various components in the figures would be changed, these directional expressions would also be changed accordingly.

In this context, the expression "comprising" or similar expressions "having" which are synonymous are open, and do not exclude additional unlisted elements, steps or ingredients.

In this context, the meanings of "a plurality of" and "multiple layers" refer to two or more than two, unless otherwise specified.

In this context, unless otherwise specified, the terms such as "connection" should be understood broadly. For example, it can be fixed connection, detachable connection or integrated; it can be directly connected or indirectly connected through an intermediate medium, and it can be the internal communication of two components or the interaction between two components. For those skilled in the art, the specific meanings of the above terms in this context can be understood according to specific situations.

As daily necessities in people's lives, large-sized glass is often used in the fields of architecture or transportation means. Hereinafter, it will be described that the device for carrying a glass plate is applied to transport the vehicle window glass, including but not limited to front windshield, rear windshield, skylight glass and vehicle door glass. In addition, it is not excluded that the device for carrying a glass plate disclosed in the present disclosure can be applied to the carrying and transportation environment of door, window, curtain wall, aircraft glass or ship glass, and can be applied to any suitable carrying and transportation

environment of the glass plates with special-shaped structures.

It has been realized that the large-sized glasses are likely to collide with each other and with the carrier due to the bump of the transport vehicle during transportation, thus causing the glasses to break. Therefore, the design of the glass carrier usually focuses on reducing or avoiding the glass breakage rate. With the increasing size of the glass and the increasing cost, for the manufacturers or the users, it is also expected that the glass carrier will be suitable for various forms of glasses to reduce the production cost of the carrier while ensuring the stability of transportation. Moreover, if the glass carrier can realize stacked transportation, the way to carry more glasses will greatly reduce the transportation cost.

Figs. 1 to 3 illustrate a device for carrying a glass plate according to an embodiment of the present disclosure, specifically exemplified as a transport rack 100 suitable for the windshield. The transport rack 100 includes a frame F, a placing space PS, a supporting assembly S and an accommodating space AS.

In the illustrated embodiment, the frame F includes a bottom frame 110, a plurality of longitudinal beams 120 vertically extending from the bottom frame 110, and a cross beam 130 located between at least two adjacent longitudinal beams 120, and the bottom frame 110 has an upper surface 110a and a lower surface 110b. It should be understood that the bottom frame 110 is generally arranged parallel to the ground or the horizontal plane, the longitudinal beam 120 refers to the structural beam extending from the bottom frame in a generally vertical direction, and the cross beam 130 refers to the structural beam extending in a generally horizontal direction. In the illustrated embodiment, the bottom frame 110 is a substantially cuboid, the upper surface 110a of the bottom frame 110 is the upper surface of the cuboid, and the lower surface 110b of the bottom frame 110 is the lower surface of the cuboid. When placed on the ground, the lower surface 110a of the bottom frame 110 usually coincides with the ground. A frame structure surrounded by three sides is formed by the longitudinal beams 120 arranged on each vertical side of the cuboid and the cross beam arranged between the longitudinal beams 120. The cross beam 130 comprises a first cross beam 131 extending horizontally along a direction D1 and a second cross beam 132 extending horizontally along a direction D2, and the direction D1 is substantially perpendicular to the direction D2, so that a plurality of glass plates can be placed on the transport rack 100 in sequence in the direction

D1 shown in the figure. However, the shown structure is only an example, and the frame F can also be constructed in other suitable configurations suitable for placing the glass plates, for example, without some of the cross beams and the longitudinal beams. Generally, the frame can be welded or riveted with conventional materials such as carbon steel, aluminum alloy and stainless steel, etc.

In the illustrated embodiment, the placing space PS is located above the upper surface 110a of the bottom frame 110 to place at least portion of the glass plate, such as the upper half of the glass plate. The supporting assembly S extends from the bottom frame 110 toward the placing space PS to support the glass plate. In addition, the transport rack 100 is also provided with the accommodating space AS located between the upper surface 110a and the lower surface 110b of the bottom frame 110 for intrusion of at least portion of the glass plate, such as the lower half of the glass plate with a special-shaped structure. Here, the accommodating space is especially suitable for accommodating the special-shaped portion of the glass plate, such as the protruding structure of the windshield. In this way, the device for carrying a glass plate or the transport rack of the present disclosure provides the accommodating space suitable for the intrusion of special-shaped portion of the glass plate, and compared with the existing transport rack, the space utilization rate of the transport rack is improved without affecting the number of loaded glass plates, the height dimension of the overall structure is significantly reduced, and the production cost of the transport rack is correspondingly reduced. In addition, with the reduction of the overall height of the transport rack, it is possible to carry out stacked transportation of two or even more layers of transport racks on the transport vehicle, which will bring the beneficial effect of reducing the transportation cost by at least 50%. It should be understood that although the transport rack provided with the accommodating space is especially suitable for, for example, the windshield, the skylight glass or the vehicle door glass with special-shaped portions, the transport rack of the present disclosure is also suitable for the glass plate with regular structure, and it is also possible to realize stacked transportation of multiple layers of transport racks under the condition that the size allows.

In some embodiments, the transport rack 100 includes a limiting assembly for limiting the placing position of the glass plate. The limiting assembly includes but is not limited to a bottom limiting assembly and/or a side limiting assembly and/or a top limiting assembly. Any

structure for limiting the placing position of the glass plate belongs to the limiting assembly. When the limiting assembly places the glass plate in a reasonable placing position, the edge of the glass plate will not protrude beyond the outermost boundary of the transport rack 100 in the direction where the limiting assembly is arranged, so that the glass plate is reasonably limited in the placing position.

In some embodiments, the limiting assembly includes bottom limiting components 170, 190, and the bottom limiting components 170, 190 have limiting surfaces. It should be understood that the limiting surface is the surface where the bottom limiting component may contact the glass plate. As shown in Fig. 5A, when a glass plate 200 is in contact with one surface 171 of one type of the bottom limiting component 170a, the surface 171 is defined as the limiting surface; as shown in Fig. 5B, when the glass plate 200 is simultaneously in contact with two surfaces 191, 192 of another type of the bottom limiting component 190b, both surfaces 191, 192 are defined as the limiting surfaces. The bottom limiting components 170, 190 can play the role of limiting the bottom of the glass plate 200, that is, to prevent the lower special-shaped structure of the glass plate 200 from intruding below the accommodating space AS and protruding beyond the lower surface 110b of the bottom frame 110 due to dimensional tolerance, improper placement or transportation bump, etc., to cause the glass plate to be damaged. At the same time, the bottom limiting components 170, 190 are connected with the bottom frame 110, which can strengthen the structural strength of the bottom frame 110 and further strengthen the structural strength of the transport rack. The contact between the glass plate 200 and the limiting surface can be point contact, line contact or surface contact, but the contact between the glass plate 200 and the limiting surface is only one possibility, and the glass plate 200 may or may not contact the limiting surface. That is to say, if the glass plate 200 moves due to dimensional tolerance, improper placement or during transportation, a portion of the glass plate may contact the limiting surface. Preferably, the limiting surface is not necessarily in contact with the bottom edge of the glass plate, but a distance of, for example, about 3mm is reserved.

In some embodiments, at least portion of the limiting surface of the bottom limiting component is located below the upper surface 110a of the bottom frame 110. As shown in Fig. 4A, the limiting surface 171 of one type of the bottom limiting component 170 is located

below the upper surface 110a of the bottom frame 110, and at least portion of the limiting surfaces 171, 172 of other types of the bottom limiting components 170a, 170b and 170c exemplarily shown in Fig. 4B are located below the upper surface 110a of the bottom frame 110, so as to adapt to the lower special-shaped structure of the glass plate 200 and limit it, the space below the upper surface 110a of the bottom frame 110 is reasonably utilized, and the space utilization rate of the transport rack 100 is improved.

In some embodiments, at least one limiting surface of the bottom limiting components 170, 170a, 170b and 170c is located below the upper surface 110a of the bottom frame 110, or the limiting surface 171 of the bottom limiting component 170 is wholly located below the upper surface 110a of the bottom frame 110, as shown in Fig. 4A. Fig. 4C exemplarily illustrates another arrangement of the bottom limiting components 170a, 170b, 170c. The limiting surfaces 171, 172 of the bottom limiting components 170a, 170b, 170c are all located below the upper surface 110a of the bottom frame 110, so that the space below the upper surface 110a of the bottom frame 110 is utilized more reasonably while adapting to the lower special-shaped structure of the glass plate 200 and limiting it, and the space utilization rate of the transport rack 100 is further improved. When the arrangement shown in Fig. 4C is adopted, the top surfaces 173 of the bottom limiting components 170b, 170c can also be configured as the limiting surfaces. In the illustrated embodiment, the vertical height h_2 of the bottom limiting component 170, 170a, 170b or 170c may be, for example, 20-300mm.

In some embodiments, according to different glass plate configurations, more than one bottom limiting component can be provided. The bottom limiting component can be located near two sides of the bottom frame, or in the middle of the bottom frame, or the bottom limiting components are arranged at both sides and the middle of the bottom frame, such as the bottom limiting components 170, 190 shown in Fig. 1. Fig. 4B and Fig. 4C also exemplarily illustrate other types of the bottom limiting components 190a, 190b and 190c respectively, wherein at least portion of the limiting surface 191 is located below the upper surface 110a of the bottom frame 110 or the limiting surface 191 is wholly located below the upper surface 110a, such as the limiting surface 192 at the top of the bottom limiting component 190c and the limiting surfaces 192 at the top of the bottom limiting components 190a, 190b in Fig. 4C. When the bottom limiting component 170 is arranged at the middle position of the frame, the glass plates

with special-shaped structures can be arranged in sequence, so that the special-shaped structures of the glass plates are respectively arranged at the left and right sides of the middle bottom limiting component 170 in sequence, so as to balance the carrying weight of the left and right sides of the transport rack 100 and stabilize the center of gravity.

5 In the illustrated embodiment, at least one of the limiting surfaces of the bottom limiting components 170, 170a, 170b, 170c, 190, 190a, 190b and 190c is inclined, and the inclined angle of the limiting surface can be designed according to the bottom shape of the glass plate to be loaded by the transport rack. For example, with reference to Fig. 4A, the bottom limiting component 170 may be provided with an inclined limiting surface 171. In some embodiments,
10 at least two of the limiting surfaces of the bottom limiting component are inclined toward opposite directions respectively. It should be understood that at least two limiting surfaces inclined toward opposite directions respectively include two limiting surfaces formed on one bottom limiting component and two opposite limiting surfaces formed on two adjacent bottom limiting components. As shown in Figs. 1 to 3, 4B and 4C, the two limiting surfaces 171, 172
15 of each of the bottom limiting components 170, 170a, 170b and 170c may be respectively inclined toward opposite directions, or as shown in Figs. 4B and 4C, the two adjacent limiting surfaces 191, 172 of the two adjacent bottom limiting components 190b, 170a may be respectively inclined toward opposite directions. The inclined limiting surface makes the bottom limiting component better adapt to the lower special-shaped structure of the glass plate
20 200 and limit it, which reasonably utilizes the space below the upper surface 110a of the bottom frame 110, improves the space utilization rate of the transport rack 100, and makes the transport rack suitable for placing the glass plates in a more diversified way.

Each of the limiting surfaces of the bottom limiting component can be constructed to be made of flexible material, such as resin material or rubber material. Alternatively, materials
25 such as Ethylene Propylene Diene Monomer (EPDM), polyurethane (PU) or high density polyethylene (HDPE) can be chosen. In some embodiments, the limiting surface of the bottom limiting component can be constructed as a detachable separate component, such as a single layer or multiple layers of flexible material, which can be fixed to a supporting component by bonding or riveting. In this way, when the glass plate is in contact with the limiting surface of
30 the bottom limiting component due to dimensional tolerance, improper placement, dead

weight or bump, the limiting surface can play a certain supporting role and prevent the glass from being damaged, and can be detached and replaced after being used for a period of time to ensure the support and effective protection of the glass plate.

In some embodiments, the bottom limiting component is configured to be capable of moving along the bottom frame 110, for example, moving in the direction D2, so that it can be suitable for the glass plates of different forms and sizes, especially for the intrusion position of the bottom special-shaped portion of the glass plate, to perform adjustable limit. Accordingly, the bottom frame 110 is provided with a channel or a guide rail for the bottom limiting component to move.

In the illustrated embodiment, the supporting assembly includes a bottom supporting seat 140 and a bottom supporting bracket 141, and the bottom supporting seat 140 is connected to the bottom frame 110 through the bottom supporting bracket 141. The bottom supporting seat 140 is in contact with the bottom of the glass plate and can support the bottom of the glass plate in a substantially vertical supporting manner. The bottom supporting seat 140 may be located above or below the upper surface 110a of the bottom frame 110, or the upper surface 110a of the bottom frame 110 may pass through the bottom supporting seat 140. Advantageously, at least one bottom supporting seat 140 is arranged obliquely at an angle with respect to the bottom frame 110, so as to adapt to the bottom edge shape of the glass plate, especially the windshields 200, 300 with a convex bottom edge shape exemplified in Figs. 2 and 3. In some embodiments, the bottom supporting seat 140 can be arranged all over the bottom frame 110 along the direction D1, and is provided with a plurality of accommodating grooves (not shown) arranged in sequence to be suitable for vertically limiting a plurality of glass plates and stably supporting the bottoms of the plurality of glass plates. At the same time, it is suitable for separating and clamping adjacent glass plates, so as to at least avoid the glass plates from moving in the horizontal direction, ensure the fixing effect of the glass plates, and improve the stability of the glass plates during transportation.

In some embodiments, at least one bottom supporting seat 140 is configured to be capable of moving along the bottom supporting bracket 141 and/or rotating relative to the bottom supporting bracket 141; and/or at least one bottom supporting bracket 141 is configured to be capable of moving along the bottom frame 110 and/or rotating relative to the bottom frame

110. That is, the bottom supporting seat 140 can move along the bottom supporting bracket 141, and/or the bottom supporting bracket 141 can move along the bottom frame 110 in the direction D2, to adjust the height of the bottom supporting seat 140 relative to the bottom frame and the distance between the bottom supporting seats 140. The bottom supporting seat
5 140 can rotate relative to the bottom supporting bracket 141, and/or the bottom supporting bracket 141 can rotate relative to the bottom frame 110 to adjust the height of the bottom supporting seat 140 relative to the bottom frame 110 and the distance between the bottom supporting seats 140. In this way, the bottom supporting seat 140 can be adjusted to adapt to the glass plates of different forms and sizes, so that the application range of the transport rack
10 is wider and thus the production cost is saved. In some embodiments, the bottom supporting bracket 140 and/or the bottom frame 110 is provided with a channel or a guide rail to provide movement and/or a rotating shaft to provide rotation. Alternatively, as shown in Fig. 4, the distance L between a pair of bottom supporting seats 140 may be 500-1900mm, and the vertical height h1 of the bottom supporting seat 140 may be 100-500mm since the bottom
15 supporting seat 140 is arranged above the accommodating space, so as to be suitable for the glass plates of most forms and sizes on the premise of reducing the overall height of the transport rack.

In some embodiments, the limiting assembly further comprises a side limiting assembly, and the side limiting assembly can limit the side of the glass plate. The side limiting assembly
20 comprises a side limiting seat 150 and a side supporting bracket 151, wherein the side limiting seat 150 is parallel to the bottom supporting seat 140, and the side limiting seat 150 is in contact with the bottom of the glass plate. The side limiting seat 150 is connected to the bottom frame 110, the longitudinal beam 120 or the cross beam 130 through the side supporting bracket 151. With reference to Fig. 1 and Fig. 4, the side limiting seat 150 is farther away
25 from the bottom frame 110 in the vertical direction than the bottom supporting seat 140. In this way, the bottom supporting seat 140 serves as the main supporting component for the glass plate to support and limit the bottom of the glass plate, while the side limiting seat 150 can limit the side of the glass plate and provide auxiliary support.

In some embodiments, at least one side limiting seat 150 is arranged obliquely at an angle
30 relative to the bottom frame 110 to adapt to the shape of the side edge of the glass plate,

especially the side edge of the windshield. In some embodiments, the side limiting seat 150 can be arranged all over the bottom frame 110 along the direction D1, and is provided with a plurality of accommodating grooves (not shown) arranged in sequence to be suitable for vertically limiting a plurality of glass plates and spacing apart the sides of the plurality of the glass plates in sequence.

In some alternative forms, at least one side limiting seat 150 is configured to be capable of moving along the side supporting bracket 151 and/or rotating relative to the side supporting bracket 151; and/or at least one side supporting bracket 151 is configured to be capable of moving along the bottom frame 110 and/or rotating relative to the bottom frame 110. That is, similar to the bottom supporting seat 140, the side limiting seat 150 can move along the side supporting bracket 151, and/or the side supporting bracket 151 can move in the direction D2 along the bottom frame 110 to adjust the height of the side limiting seat 150 relative to the bottom frame 110 and the distance between the side limiting seats 150; and/or the side limiting seat 150 can rotate relative to the side supporting bracket 151, and/or the side supporting bracket 151 can rotate relative to the bottom frame 110 to adjust the height of the side limiting seat 150 relative to the bottom frame 110 and the distance between the side limiting seats 150. No matter how it is adjusted, the side limiting seat 150 is still farther away from the bottom frame 110 in the vertical direction than the bottom supporting seat 140. In this way, the side limiting seat 150 can be adjusted to adapt to the glass plates of different forms and sizes, which makes the application range of the transport rack wider and thus saves the production cost. In some embodiments, the side supporting bracket 151 and/or the bottom frame 110 is provided with a channel or a guide rail to provide movement and/or a rotating shaft to provide rotation. As an example, as shown in Fig. 4A, the side supporting bracket 151 can be regarded as a rocker arm that can rotate relative to the bottom frame 110, and the radius R of the rocker arm can range from 100 to 1000 mm. The bottom supporting bracket 141 and the side supporting bracket 151 may be made of metal material such as iron or stainless steel to provide sufficient support strength. Advantageously, the bottom supporting seat 140, which is in direct contact with the glass plate, can be made of a material with a certain degree of flexibility, such as resin material or rubber material, which can at least absorb the impact energy of the glass plate in the vertical direction while providing support. In other words, when the glass plate is

impacted and tends to move in the vertical direction, the bottom supporting seat, which plays the main supporting role, can absorb the impact energy caused by the movement especially in the vertical direction of the glass plate during the transportation process, thus forming a good shock absorption and protection function for the glass plate and preventing the glass plate from being damaged. Alternatively, the surface of the bottom supporting seat contacting with the glass plate can be made of materials such as Ethylene Propylene Diene Monomer (EPDM), polyurethane (PU) or high density polyethylene (HDPE). Similarly, the side limiting seat 150 can also be made of the above materials.

In some embodiments, the bottom supporting seat 140 and the side limiting seat 150 can be constructed as detachable separate components, such as single layer or multiple layers of flexible material connected with corresponding supporting brackets by riveting or bonding, and can be detached and replaced after being used for a period of time, so as to ensure the support and effective protection of the glass plate.

In some embodiments, the limiting assembly further comprises a top limiting seat arranged on the cross beam 130 or the longitudinal beam 120 and parallel to the pair of bottom supporting seats 140. In the embodiment shown in Fig. 1, a pair of top limiting seats 160 are respectively arranged on the longitudinal beam and extend in the direction D1, so that the glass plate can be limited at the top edge of the glass plate after the glass plate is stacked. In some embodiments, a retractable top adjusting component 161 may be provided at the free end of the top limiting seat 160. In some cases, if the glass plates stacked in sequence along the direction D1 do not completely fill the placing space, the top of the outermost glass plate can be limited by the top adjusting component 161 to ensure the transportation safety.

In some embodiments, the top limiting seat 160 is configured to be capable of moving along the cross beam 130 and/or the longitudinal beam 120, thereby being adaptable to the glass plates of different forms and sizes. Accordingly, the cross beam 130 and/or the longitudinal beam 120 is provided with a channel or a guide rail for the top limiting seat 160 to move. In the embodiment shown in Fig. 1, a pair of longitudinal beams 121 respectively provided with a guide rail 122 are exemplarily illustrated, and each top limiting seat 160 can move vertically along the corresponding guide rail 122 of the longitudinal beam 121, thereby adjusting the vertical height of the top limiting seat 160. It should be understood that when a

pair of top limiting seats are provided, a guide rail can also be provided on the cross beam (for example, the second cross beam 132), so that the top limiting seats 160 can move in the direction D2 to adjust the distance between the pair of top limiting seats.

It should be understood that in the embodiment including the top limiting seat, the distance between the top limiting seat 160 and the bottom limiting component 170 should be smaller than the vertical height of the glass plate when the glass plate is placed on the frame.

In the embodiment shown in Fig. 2, one form of windshield 200 can be limited in the frame by a pair of bottom supporting seats 140, a pair of side limiting seats 150 and a pair of top limiting seats 160, and the bottom supporting seats 140 provide the main supporting function. A bottom convex portion 210 of the windshield 200 intrudes and is accommodated in an accommodating space 114, and the bottom edge of the windshield 200 is adapted to the limiting surface 171 of the bottom limiting component 170.

In the embodiment shown in Fig. 3, two windshields 200, 300 stacked in sequence are illustrated, which are limited in the frame by a pair of bottom supporting seats 140, a pair of side limiting seats 150 and a pair of top limiting seats 160 respectively, and the bottom supporting seats 140 provide the main supporting function. The bottom convex portion 210 of the windshield 200 intrudes and is accommodated in the accommodating space 114 on the right, and a bottom convex portion 310 of the windshield 300 intrudes and is accommodated in an accommodating space 113 on the left. At this time, the bottom edge of the windshield 200 is adapted to the limiting surface 171 of the bottom limiting component 170, and the bottom edge of the windshield 300 is adapted to the limiting surface 172 of the bottom limiting component 170.

From the above examples, it can be seen that the space utilization rate of the transport rack is improved and the overall height of the transport rack is effectively reduced by providing the accommodating space on the bottom frame to accommodate the convex portion of the glass plate. With the reduction of the height, the two-layer stacked transportation of the transport rack can be carried out on the transport vehicle, thus reducing the transportation cost by nearly 50% and improving the utilization rate of the transport vehicle. To this end, in some embodiments, in conjunction with Fig. 1 and 4, the top of the frame may be provided with a nested component 180, and the nested component 180 of one transport rack is adapted to the

bottom frame 110 of another transport rack, so as to be suitable for stacking a plurality of transport racks in the vertical direction. For example, the nested component 180 may include a first nested component 181 arranged at the top end of the longitudinal beam 120 and/or a second nested component 182 arranged adjacent to the corner. The first nested component 181 and the second nested component 182 may be constructed as a stopping structure, which provides a certain structural strength while providing nesting interaction with the bottom frame of another transport rack, and ensures the structural stability of the two-layer stacked transport racks.

In some embodiments, the bottom frame 110 may also be provided with an insertion component 111 for inserting a lifting tool (such as a forklift). As shown in Fig. 1, the insertion component 111 is located below the upper surface 110a of the bottom frame 110, and the accommodating spaces 113, 114 and/or the bottom limiting component 170 are arranged offset from the insertion component to avoid mutual interference. As an example, the insertion component 111 may be configured in the form of a slot.

In some embodiments, in order to further ensure the transportation safety of the glass plate, the transport rack can be provided with a fixing ring arranged on at least one of the bottom frame 110, the longitudinal beam 120, the cross beam 130, the supporting assembly and the limiting assembly, so as to be suitable for fixing a tie component to provide more reliable restraint on the glass plate. Fig. 1 exemplarily illustrates a plurality of fixing rings, including fixing rings 115 arranged on the bottom frame 110, fixing rings 123 arranged on the longitudinal beams 120, fixing rings 124 arranged on the cross beams between the longitudinal beams 121 provided with the guide rails 122, and fixing rings 153 arranged on the side limiting seats 150.

As can be seen from the above description, the device for carrying a glass plate of the present disclosure allows at least portion of the glass plate to intrude by providing the accommodating space below the upper surface of the bottom frame, which improves the space utilization rate of the device and reduces the overall height of the device, thus making it possible to stack and transport multiple layers of the devices or transport racks, and improving the transport efficiency with significantly reduced cost. In addition, the large-size glass plate, especially the windshield, is effectively limited by the limiting assembly, especially the

bottom limiting component, so as to avoid the displacement and damage of the glass plate, improve the stability and safety during the transportation process, and have the beneficial effects of simple structure, obvious performance improvement, economical cost and the like.

5 It should be understood here that the embodiments shown in the drawings only illustrate the various optional architectures, shapes, sizes and arrangements of the device for carrying a glass plate according to the present disclosure; however, it is only illustrative rather than restrictive, and other shapes, sizes and arrangements can be adopted without departing from the spirit and scope of the present disclosure.

10 The technical content and technical features of the present disclosure have been disclosed above. However, it can be understood that those skilled in the art can make various changes and improvements to the above disclosed concept under the creative idea of the present disclosure, all of which fall within the protection scope of the present disclosure. The description of the above embodiments is illustrative rather than restrictive, and the protection scope of the present disclosure is determined by the claims.

CLAIMS

1. A device for carrying a glass plate, the device comprising:

a frame comprising a bottom frame, a plurality of longitudinal beams extending vertically from the bottom frame, and a cross beam located between at least two adjacent longitudinal beams, wherein the bottom frame has an upper surface and a lower surface;

a placing space located above the upper surface of the bottom frame to place at least portion of the glass plate;

a supporting assembly extending from the bottom frame toward the placing space to support the glass plate; and

an accommodating space located between the upper surface and the lower surface of the bottom frame for intrusion of at least portion of the glass plate.

2. The device for carrying a glass plate according to claim 1, wherein the device comprises a limiting assembly for limiting placing position of the glass plate.

3. The device for carrying a glass plate according to claim 2, wherein the limiting assembly comprises a bottom limiting component having a limiting surface, and at least portion of the limiting surface is located below the upper surface of the bottom frame.

4. The device for carrying a glass plate according to claim 3, wherein the limiting surface of the bottom limiting component is wholly located below the upper surface of the bottom frame.

5. The device for carrying a glass plate according to claim 3, wherein the bottom limiting component comprises at least one inclined limiting surface.

6. The device for carrying a glass plate according to claim 5, wherein the bottom limiting component comprises at least two limiting surfaces respectively inclined toward opposite directions.

7. The device for carrying a glass plate according to claim 3, wherein the bottom limiting component is configured to be capable of moving along the bottom frame, and the bottom frame is provided with a channel or a guide rail for the bottom limiting component to move.

5 8. The device for carrying a glass plate according to claim 1, wherein the supporting assembly comprises:

 a bottom supporting seat and a bottom supporting bracket, and the bottom supporting seat is connected to the bottom frame through the bottom supporting bracket.

10 9. The device for carrying a glass plate according to claim 8, wherein at least one bottom supporting seat is arranged obliquely at an angle relative to the bottom frame to adapt to the shape of the bottom of the glass plate.

15 10. The device for carrying a glass plate according to claim 8, wherein at least one bottom supporting seat is provided with a plurality of accommodating grooves arranged in sequence to be suitable for supporting a plurality of glass plates vertically and spacing apart the plurality of glass plates in sequence.

20 11. The device for carrying a glass plate according to claim 8, wherein,
 at least one bottom supporting seat is configured to be capable of moving along the bottom supporting bracket and/or rotating relative to the bottom supporting bracket; and/or
 at least one bottom supporting bracket is configured to be capable of moving along the bottom frame and/or rotating relative to the bottom frame;
 the bottom supporting bracket and/or the bottom frame is provided with a channel or a
25 guide rail for providing movement and/or a rotating shaft for providing rotation.

 12. The device for carrying a glass plate according to claim 8, wherein the device comprises a limiting assembly for limiting placing position of the glass plate, and the limiting assembly comprises a side limiting assembly, the side limiting assembly comprises:
30 a side limiting seat parallel to the bottom supporting seat; and

a side supporting bracket,

wherein the side limiting seat is connected with the bottom frame, the longitudinal beam or the cross beam through the side supporting bracket.

5 13. The device for carrying a glass plate according to claim 12, wherein at least one side limiting seat is arranged obliquely at an angle relative to the bottom frame to adapt to the shape of the edge of the glass plate.

10 14. The device for carrying a glass plate according to claim 12, wherein at least one side limiting seat is provided with a plurality of accommodating grooves arranged in sequence to be suitable for limiting a plurality of glass plates vertically and spacing apart the plurality of glass plates in sequence.

15 15. The device for carrying a glass plate according to claim 12, wherein,
at least one side limiting seat is configured to be capable of moving along the side supporting bracket and/or to rotating relative to the side supporting bracket; and/or
at least one side supporting bracket is configured to be capable of moving along the bottom frame and/or rotating relative to the bottom frame;
the side supporting bracket and/or the bottom frame is provided with a channel or a guide
20 rail for providing movement and/or a rotating shaft for providing rotation.

25 16. The device for carrying a glass plate according to claim 8, wherein the device comprises a limiting assembly for limiting placing position of the glass plate, and the limiting assembly comprises a top limiting seat arranged on the cross beam or the longitudinal beam and parallel to the bottom supporting seat.

30 17. The device for carrying a glass plate according to claim 16, wherein the top limiting seat is configured to be capable of moving along the cross beam and/or the longitudinal beam, and the cross beam and/or the longitudinal beam is provided with a channel or a guide rail for the top limiting seat to move.

18. The device for carrying a glass plate according to claim 1, wherein the device further comprises an insertion component for inserting a lifting tool, the insertion component is located below the upper surface of the bottom frame, and the accommodating space is arranged offset from the insertion component.

19. The device for carrying a glass plate according to anyone of claims 1 to 18, wherein the top of the frame is provided with a nested component, and the nested component of one device is adapted to the bottom frame of another device, so as to be suitable for stacking a plurality of devices in the vertical direction.

20. The device for carrying a glass plate according to anyone of claims 1 to 18, wherein the device is provided with a fixing ring arranged on at least one of the bottom frame, the longitudinal beam, the cross beam and the supporting assembly, so as to be suitable for fixing a tie component.

21. The device for carrying a glass plate according to claim 20, wherein the device comprises a limiting assembly for limiting placing position of the glass plate, and the fixing ring is arranged on the limiting assembly.

22. The device for carrying a glass plate according to anyone of claims 1 to 18, wherein the glass plate is a vehicle window glass comprising front windshield, rear windshield, skylight glass or vehicle door glass.

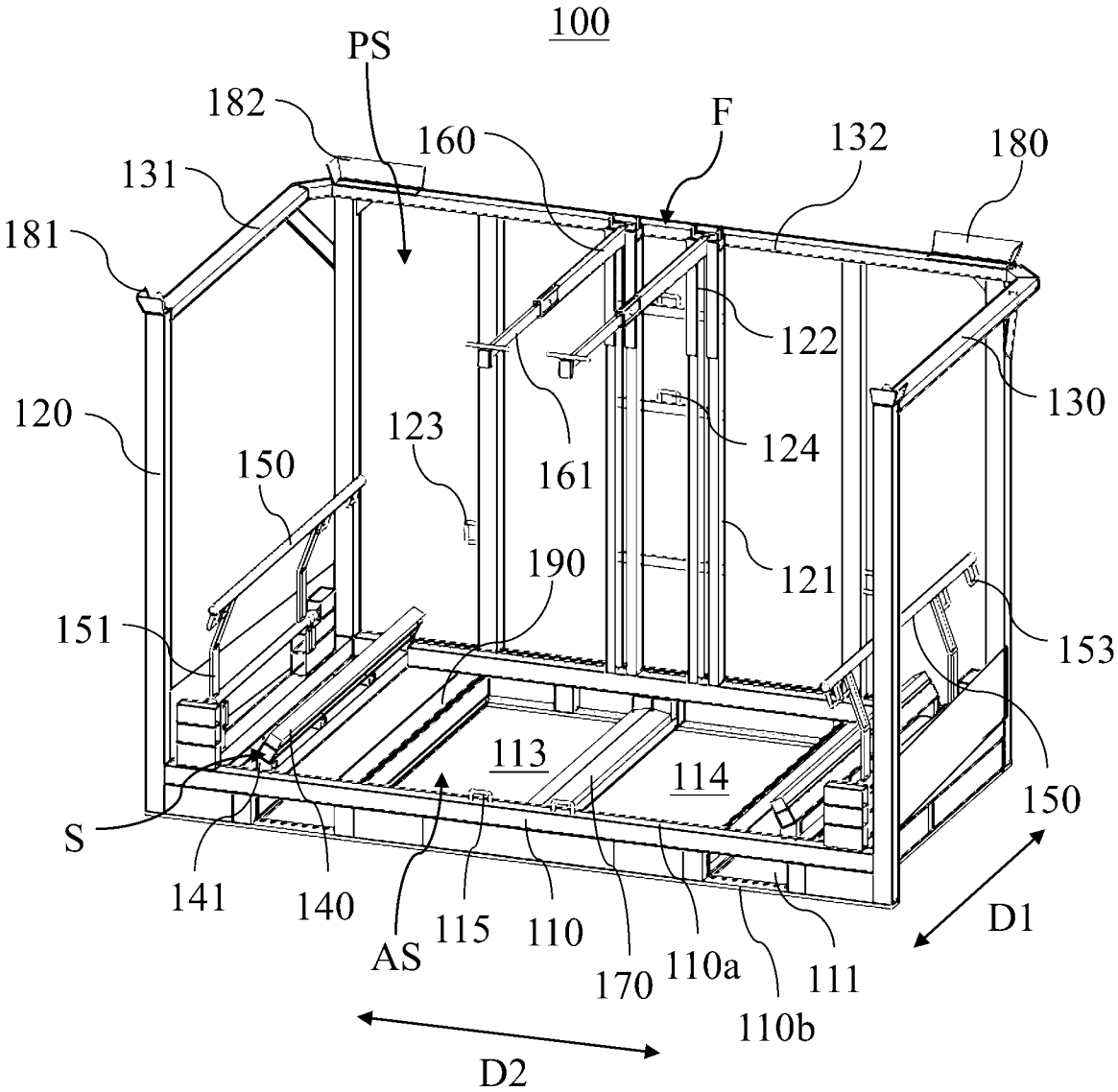


FIG. 1

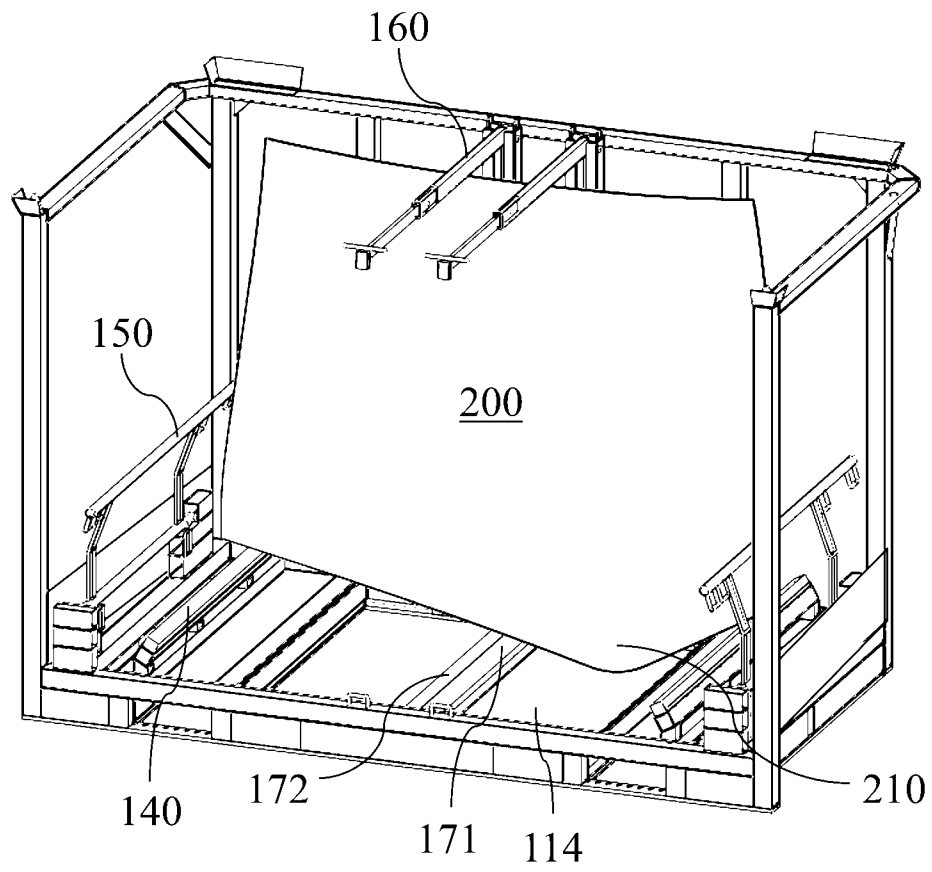


FIG. 2

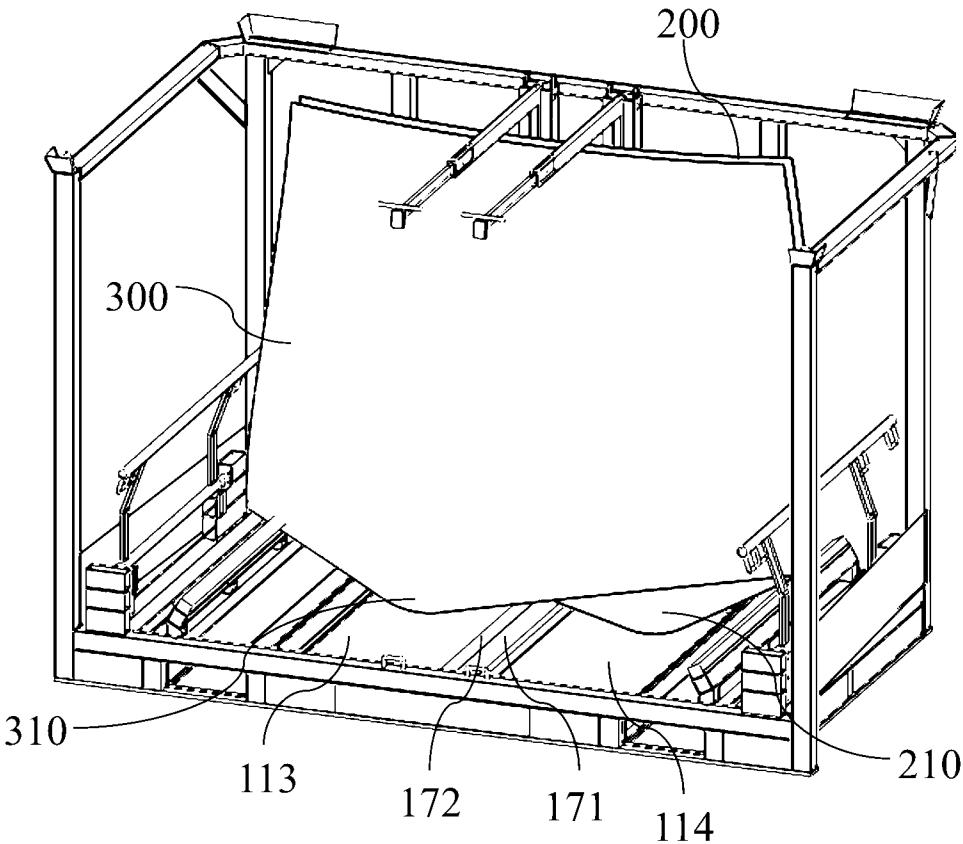


FIG. 3

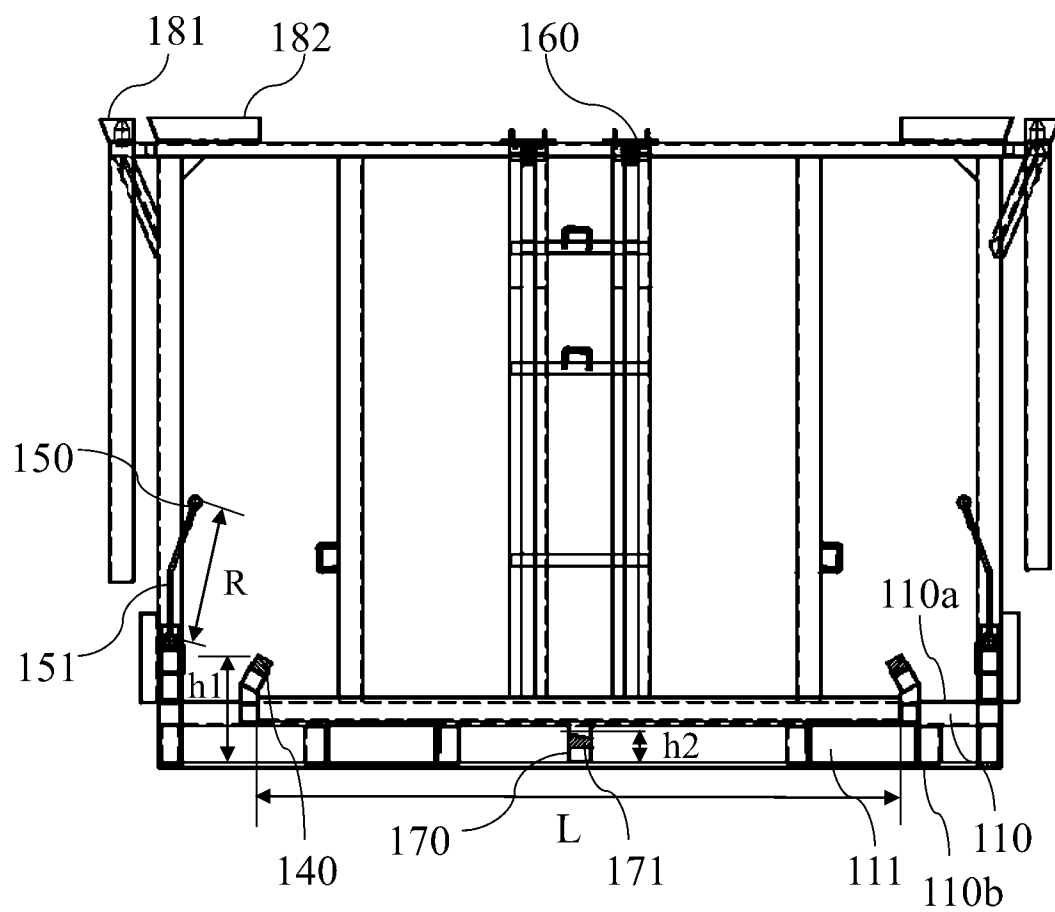


FIG. 4A

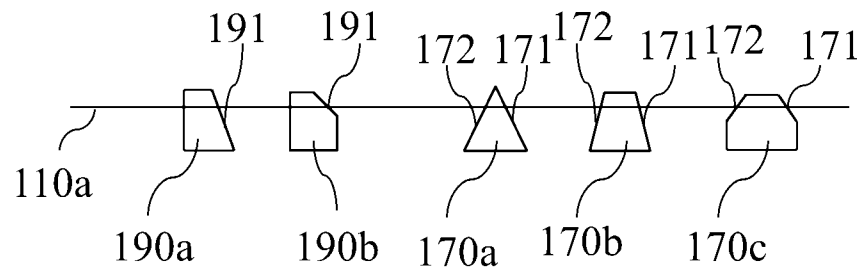


FIG. 4B

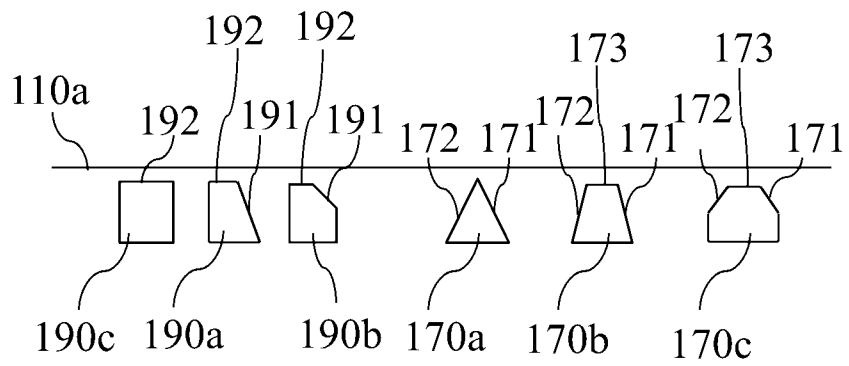


FIG. 4C

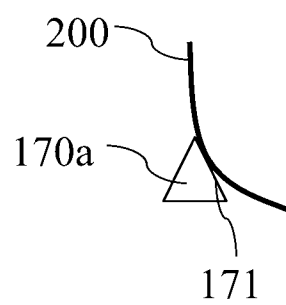


FIG. 5A

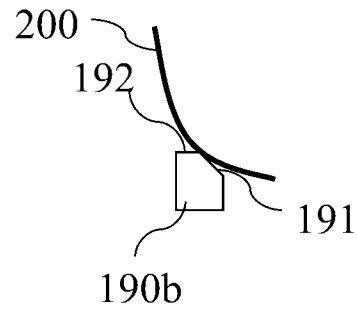


FIG. 5B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/102825

A. CLASSIFICATION OF SUBJECT MATTER B65D 85/48(2006.01)i; B65G 49/06(2006.01)i 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) IPC:B65D; B65G 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) CNTXT,ENTXTC,VEN,CJFD>window glass,windshield,skylight,door glass,automotive,		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4086263 A (PPG INDUSTRIES INC) 25 April 1978 (1978-04-25) description,column 2,line 5 - column 7,line 26 and figures 1-5	1-11,18-22
Y	US 4086263 A (PPG INDUSTRIES INC) 25 April 1978 (1978-04-25) description,column 2,line 5 - column 7,line 26 and figures 1-5	12-17
Y	CN 205312265 U (MING CHI GLASS CO., LTD.) 15 June 2016 (2016-06-15) description,paragraphs[0030]-[0036] and figures 1-6	12-17
A	CN 208199768 U (XINYI ENERGY SAVING GLASS (SICHUAN) CO., LTD.) 07 December 2018 (2018-12-07) description,the whole document	1-22
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “D” document cited by the applicant in the international application “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 19 August 2024		Date of mailing of the international search report 09 September 2024
Name and mailing address of the ISA/CN CHINA NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China		Authorized officer Telephone No. (+86) 010-62084145

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2024/102825

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
US	4086263	A	25 April 1978	None	
CN	205312265	U	15 June 2016	None	
CN	208199768	U	07 December 2018	None	