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(54) **MANUFACTURING DEVICE AND MANUFACTURING METHOD FOR COMPONENT WITH OUTER LAYER**

(57) An apparatus for manufacturing a surface-layered part comprises: a main support that supports a surface layer member to be placed under a base member; a pulling device arranged at a periphery of the main support, wherein the pulling device includes a pulling member that pulls an edge of the surface layer member, which is in a position away from the edge of the base member, outward with respect to the base member; a base member clamping device that fixedly clamps the surface layer member, having been pulled outward by the pulling member of the pulling device, against the main support via the base member placed over the surface layer member; and a relieving device that separates the pulling member from the edge of the surface layer member, which has been moved outward with respect to the base member by the pulling device, to allow the edge of the surface layer member to wrap around the edge of the base member by an elastic restoring force of the surface layer member, thereby integrating them; and a control device that drives and controls the base member clamping device, the pulling device, and the relieving device.

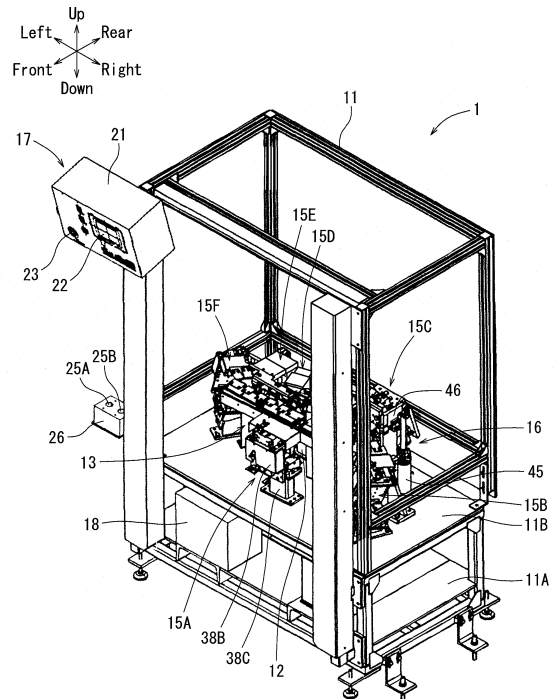


Fig. 1

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Description

Technical Field

[0001] The present disclosure relates to apparatuses and methods for manufacturing a surface-layered part.

Background Art

[0002] Various techniques associated with a surface-layered part that includes a base member and a surface layer member covering the surface of the base member have been proposed. For example, Japanese Patent Application Publication No. 2006-213134 discloses a vehicle armrest that includes a molded plastic armrest core and a cushion attached to the upper surface of the armrest core. The armrest core and the cushion are covered with a cover-shaped armrest skin, which has wrapping portions at its peripheral edge that are hooked on the edges of the armrest core.

Summary of the Invention

[0003] The vehicle armrest described in the above publication has the disadvantage that when attaching the armrest skin to the armrest core, workers are required to start with one corner of the armrest skin and hook all wrapping portions at the peripheral edge of the armrest skin onto the armrest core with their fingers. This results in a long time needed for the assembly. It is thus desired to improve the productivity by automating the work of wrapping the edge of the surface layer member around the edge of the base member.

[0004] The present disclosure provides, in an aspect, an apparatus for manufacturing a surface-layered part, comprising: a main support that supports a surface layer member placed under a base member; a pulling device arranged at a periphery of the main support, wherein the pulling device includes a pulling member that pulls an edge of the surface layer member, the edge of the surface layer member being in a position away from an edge of the base member, outward with respect to the base member; a base member clamping device that fixedly clamps the surface layer member, after having been pulled outward by the pulling member of the pulling device, against the main support via the base member placed over the surface layer member; a relieving device that separates the pulling member from the edge of the surface layer member, the edge of the surface layer member having been moved outward with respect to the base member by the pulling device, to allow the edge of the surface layer member to wrap around the edge of the base member owing to an elastic restoring force of the surface layer member, thereby integrating the surface layer member and the base member; and a control device that drives and controls the base member clamping device, the pulling device, and the relieving device.

[0005] In some embodiments, the apparatus further

comprises a peripheral support arranged along an edge of a lip of the main support, wherein the peripheral support serves as a bending restraint on the surface layer member as the surface layer member is being bent back outward over the peripheral support by the pulling member while being fixed, together with the base member, to the main support by the base member clamping device.

[0006] In some embodiments, the peripheral support comprises one or more round rail arranged along the edge of the lip of the main support.

[0007] In some embodiments, the base member clamping device pushes the base member into the main support so that a peripheral edge of the base member comes in close contact with the surface layer member to thereby clamp the surface layer member.

[0008] In some embodiments, the pulling member is shaped so as to hook the edge of the surface layer member and to be separated from the edge of the surface layer member.

[0009] The present disclosure provides, in another aspect, a method for manufacturing a surface-layered part using the apparatus described above, the method comprising: a first step of placing the surface layer member on the main support; a second step of pulling the edge of the surface layer member, which was placed in the first step, outward with respect to the base member by the pulling member; a third step of fixedly clamping the surface layer member, which has been pulled outward by the pulling member in the second step, against the main support by the base member clamping device via the base member placed over the surface layer member; and a fourth step of separating the pulling member from the edge of the surface layer member, which has been fixedly clamped against the main support via the base member in the third step, by the relieving device to allow the edge of the surface layer member to wrap around the edge of the base member owing to the elastic restoring force of the surface layer member, thereby integrating the surface layer member and the base member.

Brief Description of the Drawings

[0010]

Fig. 1 is a perspective view of an exemplary apparatus for manufacturing a surface-layered part according to one embodiment.

Fig. 2 is a plan view of the apparatus for manufacturing a surface-layered part of Fig. 1.

Fig. 3 is a cross-sectional view of the manufacturing apparatus of FIG. 2 taken along the line III-III of Fig. 2. Fig. 4 is a perspective view of the peripheral support of Fig. 3.

Fig. 5 is a perspective view of a main portion of the pulling device shown in Fig. 1.

Fig. 6 is a perspective view of a main portion of the base member clamping device shown in Fig. 2.

Fig. 7 is a side view of the base member clamping

device of Fig. 6 in a pushing position.

Fig. 8 is a perspective view of an example of a surface layer member.

Fig. 9 is a cross-sectional view of the surface layer member of Fig. 8 taken along line IX-IX of Fig. 8.

Fig. 10 is a perspective view of an example of a base member.

Fig. 11 is an illustration of a method for manufacturing a surface-layered part.

Fig. 12 is a perspective view of an example of a surface-layered part.

Fig. 13 is a cross-sectional view of the surface-layered part of Fig. 12 taken along line XIII-XIII of Fig. 12.

Modes for Carrying Out the Invention

[0011] Hereinafter, various embodiments of the present disclosure will be described in detail with reference to the drawings.

[Manufacturing equipment]

[0012] First, the apparatus 1 for manufacturing a surface-layered part will be described with reference to Figs. 1 to 7. In each figure, the side on which the worker stands is the front side of the manufacturing apparatus 1, and the directions of the manufacturing apparatus 1 are indicated by arrows. In the following description, directional terms will be used on the basis of the directions as shown.

[0013] As shown in Figs. 1 and 2, the manufacturing apparatus 1 includes a frame 11, and a main support 12 for supporting a base member 3 and a surface layer member 2 (see, Fig. 8) in such a way that the surface layer member 2 is layered on the lower side of the base member 3 (see, Fig. 10). The apparatus 1 further includes peripheral supports 13 arranged along the peripheral edge of an lip 12A (Fig. 3) of the main support 12. The apparatus 1 further includes pulling devices 15A-15F arranged around the main support 12 and configured to pull the edges 2A (Fig. 8) of the surface layer member 2 outward. The apparatus 1 further includes a pair of base member clamping devices 16 arranged at the left and right ends and on the rear side of the main support 12. The base member clamping devices 16 are configured to clamp the base member 3 layered on top of the surface layer member 2 by pushing the base member 3 into the main support 12. The apparatus 1 further includes a control device 17 configured to drive and control the pulling devices 15A-15F and the base member clamping devices 16.

[0014] In Fig. 1, the base member clamping device 16 on the left side is omitted. In Fig. 2, the base member clamping devices 16 that are pressing down the base member are indicated by double-dashed lines.

[0015] Referring to Figs. 1 and 2, the frame 11 may be box shaped with a left to right long rectangular shape in a plan view. The frame 11 may be slightly higher than the height of a worker (e.g. about 180 cm high). A base

plate 11A may be provided at the lower ends of the frame 11. A junction box 18 may be mounted on the base plate 11A for housing an air supply switching valve (not shown) or an electromagnetic relay (not shown) electrically connected to the control device 17. A flat mounting base plate 11B may be positioned above the junction box 18, for example at about the height of the worker's knee, for mounting equipment devices, such as the pulling devices 15A-15F, the main support 12, the peripheral supports 13, and the base member clamping devices 16, which may be secured by bolts or other means to the mounting base plate 11B.

[0016] The control device 17 includes a control circuit board, not shown, including: a CPU; a RAM, ROM, and/or EEPROM; an interface circuit; a timer; and so on, housed in a generally box-shaped housing 21 attached to the upper left front corner of the frame 11. A display 22 and operation buttons, such as a power button 23, electrically connected to the control circuit board may be provided on the front side of the housing 21. An operation box 26 with two operation buttons 25A, 25B for giving instructions, such as starting the operation, arranged on the upper surface may be attached to the front left member of the frame 11, at a height slightly lower than the worker's waist. The operation buttons 25A and 25B are electrically connected to the interface circuit of the control device 17.

[0017] Referring to Figs. 2 and 3, the main support 12 may be mounted on the mounting base plate 11B generally at the center in a position extending left to right. The bottom of the main support 12 may be fixed to the mounting base plate 11B with bolts or by any other means (not shown). The upper surface of the main support 12 is recessed downward to define a recess 28. The recess 28 may have a left to right long, generally rectangular shape in a plan view and a generally U-shaped cross section over its entire length. A surface layer member 2 is to be set on the recess 28 (see, Fig. 11), as will be further described later. The left to right long, generally rectangular shape in a plan view and the generally U-shaped cross section over the entire length of the recess 28 may be, for example, in accordance with the shape of the outer surface of a surface-layered part, such as an armrest attached to the inner panel of the left door of an automobile, that is visible from inside of the vehicle. Accordingly, the recess 28 is open upward and has a left to right long, generally rectangular shape in a plan view. The surface layer member 2 can be set in the recess 28 from above.

[0018] Referring to Figs. 3 and 4, each peripheral support 13 may include support plates 31 arranged along the periphery of the main support 12, which has a left to right long, generally rectangular shape in a plan view. Each support plate 31 may have a vertically long rectangular shape in a front view. The peripheral support 13 further includes one or more round rail 32 welded or otherwise fixed in a substantially horizontal position along the upper end(s) of the respective support plates 31. The lower end of each support plate 31 is fixed to the mounting

base plate 11B by bolting or the like, such that it extends substantially vertically. The support plate 31 is positioned at a height above the mounting base plate 11B substantially equal to or slightly higher than the lip 12A of the main support 12.

[0019] Each round rail 32 may be positioned slightly higher, for example by the diameter of the round rail 32, than the lip 12A of the main support 12 at the corresponding support plate 31. Each round rail 32 may have an appropriate length so that it traces the portion of the periphery of the lip 12A of the main support 12 that faces the corresponding support plate 31. Each round rail 32 may be appropriately curved along the periphery of the lip 12A. As a result, the round rails 32 serve as restraints on the peripheral edges 2A (Fig. 8) of the surface layer member 2 that are being bent back outwardly when the peripheral edges 2A are pulled outward while the base member 3 and the surface layer member 2 layered under it are clamped against the surface of the recess 28 (see, Fig. 11), as will be further described later.

[0020] Referring now to Figs. 1 to 3 and 5, the general configuration of the pulling devices 15A-15F, which are arranged around the main support 12 and configured to pull the peripheral edges 2A (Fig. 8) of the surface layer member 2 outward, will be described. As shown in Figs. 1 and 2, one pulling device 15A is positioned on the front side of the main support 12, substantially at the center in the left-to-right direction. Another pulling device 15B is positioned at the right end of the main support 12. Other pulling devices 15C, 15D, 15E are positioned along the rear side of the main support 12, left to right in this order. Still another pulling device 15F is positioned at the left end of the main support 12. The pulling devices 15A-15F may be fixed to the mounting base plate 11B by bolting or any other means.

[0021] The pulling devices 15A-15F may be configured in the same way, and therefore only the configuration of one pulling device 15A will be described, with reference to Figs. 3 and 5. As shown, the pulling device 15A includes a plurality of (e.g. nine) claws 35, each having a sideways L-shape in a side view and situated above the lip 12A of the main support 12, and claw supporting member 36 for supporting the claws 35 along the corresponding portion of the lip 12A of the main support 12. The pulling device 15A further includes a generally box-shaped pulling mechanism 37 configured to move the claw supporting member 36 across the lip 12A of the main support 12, and a vertical movement mechanism 38 configured to move the pulling mechanism 37 vertically.

[0022] The claws 35 may be formed from a sheet of a hard plastic or a metal, such as aluminum. Each edge of the claw 35 toward the main support 12 may have an L-shaped profile. The claws 35 may be bent downward so as to be able to hook (see, Fig. 11) a generally U-shaped wrapping portion 2B (Fig. 9) formed at the edge 2A (Fig. 8) of the surface layer member 2. The claws 35 may be arranged at intervals and screwed or otherwise fixed, at

their respective edges on the far side from the main support 12, to the upper surface of the long rectangular claw supporting member 36 at the edge that extends toward the main support 12.

[0023] As shown in Fig. 5, the claw supporting member 36 may be rectangular in a plan view with a length substantially equal to the length of the portion of the lip 12A (Fig. 3) of the main support 12 that faces the claw supporting member 36. The edge of the claw supporting member 36 opposite to the main support 12 may extend downward by a length, thereby forming an L-shaped profile. The claw supporting member 36 may be made of sheets of metal, such as aluminum or stainless steel. The edge of the claw supporting member 36 opposite to the main support 12 is attached, generally at the center of its length, to the surface of the outer box part 37A of the pulling mechanism 37 that faces the main support 12.

[0024] The pulling mechanism 37 may include a generally box-shaped outer box part 37A having an open side opposite to the main support 12, a generally box-shaped base part 37B inserted in the open side of the outer box part 37A opposite to the main support 12, and a moving mechanism (not shown) housed in the base part 37B and configured to move the outer box 37A relative to the base part 37B linearly in the insertion direction. The moving mechanism (not shown) in the base part 37B may be configured with at least one of an air cylinder, a pinion gear and a rack, a nut and a ball screw, or the like, powered by compressed air, an electric motor, or any other source, to move the outer box 37A linearly relative to the base part 37B. When the outer box part 37A is moved linearly relative to the base part 37B, the claws 35 on the claw supporting member 36 are moved linearly forward or rearward relative to the main support 12 (in the direction of arrow 41 in Fig. 3).

[0025] The vertical movement mechanism 38 may include a generally box-shaped base part 38A connected at a substantially right angle to the lower surface of a portion of the base part 37B of the pulling mechanism 37 opposite from the claw supporting member 36, thereby forming a generally L-shaped profile. The vertical movement mechanism 38 further includes a generally box-shaped supporting part 38B with an open upper side, in which the base part 38A is inserted, and a moving mechanism (not shown) housed inside the base part 38A and configured to linearly move the base part 38A itself relative to the supporting part 38B in the insertion direction (i.e. vertically).

[0026] The moving mechanism (not shown) in the base part 38A may be configured with at least one of an air cylinder, a pinion gear and a rack, a nut and a ball screw, etc., powered by compressed air, motor drive, or other means, to move the base part 38A linearly and vertically relative to the supporting part 38B. As shown in Fig. 1, the supporting part 38B of the vertical movement mechanism 38 is bolted or otherwise fixed at a base flange 38C to the mounting base plate 11B. As a result, when the base part 38A moves linearly and vertically relative

to the supporting part 38B, the claw supporting member 36 attached to the outer box part 37A and the claws 35 on it are moved linearly vertically (in the direction of arrow 42 in Fig. 3) relative to the main support 12 by way of the base part 37B of the pulling mechanism 37.

[0027] Referring now to Figs. 1, 2, 6 and 7, a pair of base member clamping devices 16 for pushing and clamping the base member 3 layered on the surface layer member 2 against the main support 12 will be described. In Fig. 2, alternate long/short dashed lines indicate the base member clamping devices 16 pushing the base member 3, which is placed on top of the surface layer member 2, into the main support 12.

[0028] As shown in Figs. 1 and 2, the base member clamping devices 16 may be configured substantially symmetrically, and therefore only the base member clamping device 16 on the right side will be described. The base member clamping device 16 may include an air cylinder 45 configured to extend and retract vertically, and a base member pressing device 46 rotatably connected at its rear end to the tip of the air cylinder 45 so that base member pressing device 46 is moved vertically in a pivoting manner as the air cylinder 45 extends and retracts.

[0029] As shown in Fig. 6, the base member pressing device 46 may include an arm 47 having an L-shape in a plan view and configured to be rotated downward when the air cylinder 45 (Fig. 1) extends out. The arm 47 may have a generally L-shaped cross section. The base member pressing device 46 may include a plurality of (e.g. six) contact elements 48 arranged left to right at intervals and mounted on the lower side of the arm 47. The contact elements 48 are configured to contact the inner side surface of the base member 3 and to press the base member 3 downward. Each contact element 48 may be made of elastic rubber and may have a generally columnar shape.

[0030] Four support plates 51, each bent into a U-shaped profile, are mounted on the lower surface of the arm 47 and arranged left to right at substantially equal intervals. Four of the six contact elements 48 are attached to the tips of the support plates 51 such that they extend diagonally downward in the forward direction. Two elongated support plates 52 extend downward from of the lower surface of the arm 47 diagonally in the forward direction at the left and right ends of the arm 47. The other two of the six contact elements 48 are attached to the tips of the corresponding support plates 52, such that they extend downward diagonally in the rearward direction.

[0031] Referring to Fig. 7, when the air cylinder 45 (Fig. 1) of the base member clamping device 16 extends out to rotate the base member pressing device 46 downward, some contact elements 48 attached to the U-shaped support plates 51 are brought in contact with an area of the inner side surface of the base member 3 that rises diagonally toward the forward side and press down the base member 3 diagonally forward. At the same time, the other contact elements 48 attached to the support plates 52

are brought in contact with an area of the inner side surface of the base member 3 that rises diagonally toward the rear side and press down the base member 3 diagonally rearward. As a result, the base member 3 is pushed downward, and the upward peripheral edge 3A is more opened such that the base member 3 comes in close contact, at its periphery, with the inner side surface of the surface layer member 2, as will be further described later (see, Fig. 11).

[0032] Referring now to Figs. 8 and 9, an illustrative surface layer member 2 to be set down in the recess 28 of the main support 12 will be described. As shown, the surface layer member 2 may be a left to right long, generally rectangular sheet formed with a generally U-shaped cross section to be convex on its visual side so that it can be set in the recess 28 defined in the upper side of the main support 12. As used herein, the visual side refers to the side of the surface layer member 2 that is visible to the user when the surface layer member 2 is attached to the base member 3. For an armrest (as a surface-layered part) attached to a vehicle door, for example, the visual side is the side of the armrest that faces the inside of the vehicle.

[0033] The surface layer member 2 has generally U-shaped wrapping portions 2B on the peripheral edge 2A over its entire circumference. In the embodiment shown in Fig. 8, the wrapping portion 2B has, in the inwardly bent portion of its U-shape, breaks 2C each having a width (e.g., about 3 mm) at appropriate intervals along the periphery. The breaks 2C allow the peripheral edge 2A of the surface layer member 2 to be elastically deformed more smoothly when the wrapping portion 2B is hooked and pulled by the claws 35 of the pulling devices 15A-15F, as will be further described later (see, Fig. 11).

[0034] The surface layer member 2 may be made of a relatively soft (or flexible) and stretchable material that is easily elastically deformed when the wrapping portion 2B is hooked and pulled by the claws 35 of the pulling devices 15A-15F. The surface layer member 2 is preferably made of an olefinic elastomer. However, various thermoplastics such as soft polyvinyl chloride or styrenic, olefinic, or polyester materials may be preferably used. Alternatively, other materials such as elastic woven fabric, non-woven fabric, knitted fabric, synthetic leather, leather, vinyl chloride, and soft film can be used for the surface layer member 2.

[0035] Referring now to Fig. 10, an illustrative base member 3 to be placed on the non-visual side of the surface layer member 2 will be described. As used herein, the non-visual side refers to the side of the surface layer member 2 opposite to the visual side, i.e. the inner side that is not visible to the user when the surface layer member 2 is attached to the base member 3. As shown in Fig. 10, the base member 3 is a flat member with a left to right long, generally rectangular shape in a plan view. The base member may generally have U-shaped cross section (Fig. 13) so that the base member 3 can be layered on top of the surface layer member 2 that has been set

in the recess 28 defined in the upper side of the main support 12.

[0036] The peripheral edge 3A of the base member 3 includes tabs 3B, which are configured to be fitted into the breaks 2C defined in the edge 2A of the surface layer member 2. The tabs 3B are attached to the outer side of the base member 3. The protrusion height of the tabs 3B may be substantially equal to the thickness of the surface layer member 2. When the surface layer member 2 is attached to the base member 3 so that the wrapping portions 2B wrap around the peripheral edge 3A of the base member 3, the tabs 3B allow the surface layer member 2 to be positioned in place along the periphery relative to the base member 3. This also reduces positional deviations along the periphery.

[0037] The base member 3 includes, on its outer surface (i.e. the surface toward the surface layer member 2) of the right rear portion, a concave portion 3C having a generally rectangular shape in front view, in which a flat cushion member 55 can be attached. Accordingly, the base member 3 will be layered on the non-visual side of the surface layer member 2 with the cushion member 55 attached to the recessed portion 3C.

[0038] The base member 3 may preferably be made of a relatively hard synthetic plastic, and more preferably of any thermoplastic with a higher rigidity than the surface layer member 2, such as polypropylene, hard polyvinyl chloride, ABS (acrylonitrile butadiene styrene), or SAN (styrene acrylonitrile). Alternatively, the base member 3 may be a press-formed steel sheet. The cushion member 55 may be made of a synthetic plastic, such as polypropylene or polyurethane, and may have a desired elasticity, that is, a cushioning property of being elastically deformed when pressed. Preferably, polyurethane foam, foam rubber, or the like may be used.

[Manufacturing method]

[0039] Referring now to Figs. 11 to 13, a method for manufacturing the surface-layered part 5 (Fig. 12) using the manufacturing apparatus 1 configured as described above will be described. As shown in Fig. 11, in Step 1 (a first step as claimed), the worker sets a flat surface layer member 2, which has a left to right long, generally rectangular shape and a generally U-shaped cross section, down into the recess 28 of the main support 12, which has a left to right long, generally rectangular shape in a plan view, of the manufacturing apparatus 1, so that the surface layer member 2 fits in the shape of the recess 28. That is, the surface layer member 2 is set such that its visual side faces the bottom surface of the recess 28 in the main support 12.

[0040] The worker then presses the start button 25A on the operation box 26 of the manufacturing apparatus 1 to send a start signal to the control device 17. The control device 17, upon receiving the start signal, drives the pulling mechanisms 37 of the pulling devices 15A-15F to move the outer box part 37A substantially hori-

zontally toward the main support 12 to position the claws 35 inside the peripheral edge 2A of the surface layer member 2 in a plan view.

[0041] Subsequently, the control device 17 drives the vertical movement mechanisms 38 of the pulling devices 15A-15F to move the base part 37B of the pulling mechanism 37 downward until the inner side of the tip portion of the claws 35 attached to the outer box part 37A reach a position facing the respective wrapping portions 2B of the edge 2A of the surface layer member 2.

[0042] In Step 2 (the second step as claimed), the control device 17 drives the pulling mechanisms 37 of the pulling devices 15A-15F to move the outer box part 37A substantially horizontally in the outward direction with respect to the main support 12 by a distance and then stop. During this, the claws 35 hook the respective wrapping portions 2B of the surface layer member 2 and move outward substantially horizontally by a distance. As a result, the surface layer member 2 set in the recess 28 is elastically deformed and lifted from the bottom surface of the recess 28. The peripheral edges 2A along the entire circumference are elastically bent back, while being restrained by the round rails 32 of the peripheral supports 13, to be outwardly opened.

[0043] The bending of the peripheral edges 2A of the surface layer member 2 outward over the restraining round rails 32 can prevent the claws 35 of the pulling devices 15A-15F from slipping off from the edges 2A of the surface layer member 2. The outer side surfaces (i.e. visual sides) of the edges 2A of the surface layer member 2 are in contact with the cylindrical surface of the round rails 32. This effectively prevents the surface layer member 2 from being scratched on its visual side, resulting in an improvement to the quality of the product.

[0044] In Step 3, after waiting for the pulling mechanisms 37 of the pulling devices 15A-15F to stop while it continues to be pulling the surface layer member 2 outward, the worker sets the flat base member 3, which has a left to right long, generally rectangular shape in a plan view and a generally U-shaped cross section, down on the surface layer member 2 in a position that fits to the shape of the surface layer member 2. The worker then presses the clamp operation button 25B on the operation box 26 of the manufacturing apparatus 1 to send a clamp signal to the control device 17 for starting the clamping of the base member 3.

[0045] As shown in Fig. 10, the worker may use, for example, a base member 3 with a flat cushion member 55 attached to the concave portion 3C defined in the outer surface of the right rear portion of the base member 3. The worker sets the base member 3 on top of the surface layer member 2 by inserting the right end of the base member 3 into the wrapping portion 2B at the right end of the surface layer member 2 such that the cushion member 55 is layered on the inner surface of the right rear portion of the surface layer member 2, as can be seen in Fig. 8. The worker then presses the clamp operation button 25B on the operation box 26 of the manu-

facturing apparatus 1 to send a clamp signal to the control device 17. This starts the clamping of the base member 3.

[0046] As shown in Fig. 11, in Step 4, the control device 17, upon receiving the clamp signal, drives the air cylinder 45 of each base member clamping device 16 to extend out in order to pivot the arm 47 of the base member pressing device 46 downward (see, Fig. 7). This allows the contact elements 48 on the bottom of the arms 47 to press the inner side surface of the base member 3, at areas that extend diagonally upward in the front direction and in the rear direction, thereby pushing downward the base member 3 so that the upward peripheral edges 3A are spread open outwardly.

[0047] As a result, the surface layer member 2 being pulled outward by the claws 35 of the pulling devices 15A-15F and the base member 3 layered on top of the surface layer member 2 are clamped together by the contact elements 48 of the base member clamping devices 16 by being pressed against the main support 12. At the same time, the surface layer member 2, with its periphery still being pulled outward by the claws 35 of the pulling devices 15A-15F, is pushed into the recess 28 of the main support 12, while being elastically stretched, by the base member 3 pushed downward by the contact elements 48. Furthermore, the base member 3 is clamped by the contact elements 48 such that its upward periphery is in close contact with the inner side surface of the surface layer member 2. The combination of Steps 3 and 4 above may correspond to an embodiment of the third step as claimed.

[0048] Subsequently, in Step 5 (the fourth step as claimed), the control device 17 drives the vertical movement mechanism 38 of each of the pulling devices 15A-15F to move the base part 37B of the pulling mechanism 37 upward and drives the pulling mechanism 37 to move the outer box part 37A further outward with respect to the main support 12 substantially horizontally by a distance. Accordingly, the control device 17 drives the vertical movement mechanism 38 and the pulling mechanism 37 at the same time to take the claws 35 of the pulling devices 15A-15F off from the wrapping portions 2B of the surface layer member 2 in a direction diagonally upward.

[0049] As a result, the wrapping portions 2B of the surface layer member 2, which has been clamped together with the base member 3 against the recess 28 of the main support 12 by the contact elements 48 of the base member clamping device 16, are further unrolled diagonally upward by the claws 35, and then relaxed. Consequently, as shown in the portion of Fig. 11 labeled "Completed, in cross section", the wrapping portions 2B of the surface layer member 2 are turned back by a strong elastic restoring force over the upward peripheral edge 3A of the base member 3 toward the inside of the recess 28 in the main support 12, thereby wrapping around the peripheral edge 3A of the base member 3 over the entire perimeter to produce a surface-layered part 5 that comprises the base member 3 integrated with the surface

layer member 2.

[0050] Referring to Figs. 12 and 13, an example of the surface-layered part 5 thus produced includes the base member 3 with a flat cushion member 55 fitted in the concave portion 3C formed in the rear outer surface of the right end portion of the base member 3, and the surface layer member 2 with its wrapping portions 2B wrapping around the peripheral edge 3A of the base member 3 over the entire perimeter. Further, the surface-layered part 5 includes tabs 3B on the peripheral edge 3A of the base member 3 fitted in the corresponding breaks 2C formed in the edge 2A of the surface layer member 2 that covers from the outside. In the way described above, the manufacturing apparatus 1 produces the surface-layered part 5 in which the surface layer member 2 and the base member 3 are integrated.

[0051] Each of the pulling devices 15A-15F is an embodiment of the pulling device and relieving device as claimed. The claw 35 is an embodiment of a pulling member as claimed.

[0052] As described above in detail, the worker, using the manufacturing apparatus 1 of the present embodiment, sets the surface layer member 2 in the recess 28 of the main support 12 and presses an operation button 25A on the operation box 26. The control device 17 then drives and controls the pulling devices 15A-15F so that the claws 35 hook on the respective wrapping portions 2B of the surface layer member 2. The pulling devices 15A-15F then move outwardly and substantially horizontally by a distance. After that, the worker sets the base member 3 on top of the surface layer member 2 and presses another operation button 25B on the operation box 26. The control device 17 then drives and controls the pulling devices 15A-15F and the base member clamping device 16 in a preset order to produce the surface-layered part 5. The surface-layered part 5 includes the base member 3 integrated with the surface layer member 2.

[0053] The manufacturing apparatus 1 can be used to automate the work of hooking the wrapping portions 2B formed in the edge 2A of the surface layer member 2 on the peripheral edge 3A of the base member 3, thereby improving productivity.

[Other Embodiments]

[0054] Further embodiments will be described below. The same reference numerals used in the following description as those of the manufacturing apparatus 1 and the surface-layered part 5 of the above embodiments indicate the same or corresponding features to those of the manufacturing apparatus 1 and the surface-layered part 5 of the above embodiments.

(A) In some cases, in Step 5 (the fourth step as claimed), the control device 17 may drive only the vertical movement mechanism 38 of each of the pulling devices 15A-15F. This may cause the base part

37B of the pulling mechanism 37 to move upward so that the claws 35 of the pulling devices 15A-15F are separated upward from the wrapping portion 2B of the surface layer member 2.

As a result, each wrapping portion 2B of the surface layer member 2, which is clamped together with the base member 3 against the recess 28 of the main support 12 by the contact elements 48 of the base member clamping device 16, is relaxed from a stretched state. The wrapping portions 2B are then flipped back by their elastic restoring force over the upward peripheral edge 3A of the base member 3 toward the surface layer member 2 (i.e. into the recess 28 of the main support 12) to hook on the peripheral edge 3A of the base member 3 over its entire circumference. The surface layer member 2 is thus integrated with the base member 3.

(B) In some cases, the surface-layered part 5 may not necessarily include the cushion member 55. For example, a number of elastic protrusions may extend from the non-visual side surface of the surface layer member 2 toward the base member 3. These protrusions function as a cushion to ensure the cushioning property of the surface layer member 2.

A surface layer member 2 with a number of such elastic protrusions on the non-visual side can be used to manufacture a surface-layered part 5 that includes the surface layer member 2 integrated with the base member 3 based on the manufacturing method using the manufacturing apparatus 1 as shown in Fig. 11. The manufacturing apparatus 1 can be used to automate the work of wrapping each wrapping portion 2B formed on the edge 2A of the surface layer member 2 around the peripheral edge 3A of the base member 3, thereby improving productivity.

(C) In some cases, the peripheral support 13 may include, instead of the plurality of round rails 32, a single round rail curved along the periphery of the lip 12A of the main support 12 and welded or otherwise fixed in a substantially horizontal position to the upper ends of the support plates 31. Alternatively, instead of the round rails 32, tubes, square bars, or the like may be welded or otherwise fixed in a substantially horizontal position to the upper ends of the support plates 31.

(D) The claws 35 have been described as having a sideways L-shape. However, they are not limited to a rectangular sideways L-shape, and may instead have an angle slightly larger than a right angle, as far as it can hook the generally U-shaped wrapping portion 2B (Fig. 9) formed at an edge 2A (Fig. 8) of the surface layer member 2 and separate from the wrapping portion 2B when moved upward. Alternatively, the claws 35 may have a T-shape or V-shape

in a side view. In this case as well, the claws 35 can hook the generally U-shaped wrapping portion 2B (Fig. 9) formed in the edge 2A (Fig. 8) of the surface layer member 2 and can separate from the wrapping portion 2B when moved upward.

(E) In some cases, instead of the sideways L-shaped claws 35 in a side view, a plurality of grabbing devices may be included to grab the generally U-shaped wrapping portion 2B (Fig. 9) formed at the edge 2A (Fig. 8) of the surface layer member 2 by sandwiching it vertically. For example, the grabbing device may include two upper and two lower thin-plate grabbing elements pivotably connected at their base ends. The grabbing elements are normally opened by a coil spring. In the grabbing operation, an electromagnetic solenoid or other actuator is driven (energized) to cause the distal ends to close against the urging force of the coil spring to grab the wrapping portion 2B. The control device 17 may be configured to drive the solenoid actuator. The grabbing device is another embodiment of the pulling member as claimed.

In Step 1, the control device 17 drives and controls the pulling mechanism 37 and the vertical movement mechanism 38 of the pulling devices 15A-15F. This causes the grabbing devices to be inserted so that the opened distal ends sandwich the generally U-shaped wrapping portions 2B formed at the edge 2A of the surface layer member 2 (Fig. 8). In Step 2, the control device 17 turns on (energizes) the solenoid actuator of each grabbing device to grip the generally U-shaped wrapping portions 2B. Subsequently, the control device 17 drives the pulling mechanism 37 of each pulling device 15A-15F to move the outer box part 37A substantially horizontally with respect to the main support 12 by a distance and then stop. Later in Step 5, the control device 17 may turn off (de-energize) the solenoid actuator of each grabbing device to open the distal ends of the grabbing device. As a result, as shown in the portion of Fig. 11 labeled "Completed, in cross section," the wrapping portions 2B of the surface layer member 2 are flipped back over the upward peripheral edge 3A of the base member 3 toward the surface layer member 2 (i.e. into the recess 28 of the main support 12) owing to the strong elastic restoring force to wrap around the entire circumference of the peripheral edge 3A of the base member 3. The surface layer member 2 and the base member 3 are thus integrated to produce the surface-layered part 5.

(F) In some cases, instead of the plurality of claws 35 having a sideways L-shape in a side view, a plurality of vacuum suction pads may be included along the edge of the claw supporting member 36 toward the main support 12 for sucking the generally U-shaped wrapping portion 2B (Fig. 9) formed in the

edge 2A (Fig. 8) of the surface layer member 2. For example, each vacuum suction pad may be brought into contact with the wrapping portion 2B. The vacuum suction pads may suck the wrapping portions to pull the edge 2A of the surface layer member 2. The suction of each vacuum suction pad can be deactivated to separate each vacuum suction pad from the edge 2A of the surface layer member 2. The control device 17 is configured to switch the activation and deactivation of the suction of each vacuum suction pad. The vacuum suction pads are an embodiment of the pulling member as claimed.

Then, in Step 1, the control device 17 drives and controls the pulling mechanism 37 and the vertical movement mechanism 38 of the pulling devices 15A-15F, and controls each vacuum suction pad to the edge 2A of the surface layer member 2 (Fig. 8) is brought into contact with the wrapping portion 2B having a generally U-shaped cross section. Subsequently, in Step 2, the control device 17 activates the suction of each vacuum suction pad to suck the wrapping portion 2B having a generally U-shaped cross section. The control device 17 then drives the pulling mechanism 37 of each pulling device 15A-15F. The outer box part 37A is then moved substantially horizontally with respect to the main support 12 by a distance and stopped.

Later, in Step 5, the control device 17 may deactivate the suction of each vacuum suction pad to cause each vacuum suction pad to separate from the edge 2A of the surface layer member 2. As a result, as shown in the portion of Fig. 11 labeled "Completed, in cross section," owing to the strong elastic restoring force, the wrapping portions 2B of the surface layer member 2 are flipped back over the upward peripheral edge 3A of the base member 3 toward the surface layer member 2 (i.e. into the recess 28 side of the main support 12). This causes the wrapping portions 2B to wrap the entire circumference of the peripheral edge 3A of the base member 3. The surface layer member 2 and the base member 3 are thus integrated to produce the surface-layered part 5.

(G) The embodiments described above may have the following advantages.

[0055] In some embodiments, the worker places the base member and the surface layer member on the main support such that the surface layer member is positioned below the base member. Then the control device drives and controls the pulling device, the base member clamping device, and the relieving device to cause the edge of the surface layer member to wrap around the edge of the base member by means of the elastic restoring force of the surface layer member. Thereby, the surface layer member is integrated with the base member. This allows for automation of the work for wrapping the edge of the surface layer member around the edge of the base mem-

ber, thereby increasing productivity.

[0056] In some embodiments, the surface layer member fixed together with the base member to the main support is bent outward while being restrained by the peripheral support. This effectively prevents the pulling member of the pulling device from separating from the edge of the surface layer member.

[0057] In some embodiments, the cylindrical surface of the round rail comes into contact with the outer side surface of the edge bent outward of the surface layer member. This effectively prevents the surface layer member from being scratched and improves its quality.

[0058] In some embodiments, the peripheral edge of the base member is clamped to be in close contact with the surface layer member. This allows the edge of the surface layer member to be reliably wrapped around the peripheral edge of the base member, leading to improved product quality.

[0059] In some embodiments, the pulling member is shaped so that it allows the edge of the surface layer member to be pulled and detached from the edge of the surface layer member. This allows the pulling member to pull the edge of the surface layer member outward. This also allows the pulling member to separate outwardly from the edge of the surface layer member pulled outward.

[0060] While specific embodiments have been described above, it should be understood that the present disclosure is not limited to these embodiments, and various improvements, modifications, additions, and deletions can be made without departing from the spirit of the present disclosure.

Claims

1. An apparatus for manufacturing a surface-layered part, comprising:

a main support that supports a surface layer member placed under a base member;
a pulling device arranged at a periphery of the main support, wherein the pulling device includes a pulling member that pulls an edge of the surface layer member, the edge of the surface layer member being in a position away from an edge of the base member, outward with respect to the base member;

a base member clamping device that fixedly clamps the surface layer member, after having been pulled outward by the pulling member of the pulling device, against the main support via the base member placed over the surface layer member;

a relieving device that separates the pulling member from the edge of the surface layer member, the edge of the surface layer member having been moved outward with respect to the

base member by the pulling device, to allow the edge of the surface layer member to wrap around the edge of the base member owing to an elastic restoring force of the surface layer member, thereby integrating the surface layer member and the base member; and a control device that drives and controls the base member clamping device, the pulling device, and the relieving device.

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2. The apparatus of claim 1, further comprising: a peripheral support arranged along an edge of a lip of the main support, wherein the peripheral support serves as a bending restraint on the surface layer member as the surface layer member is being bent back outward over the peripheral support by the pulling member while being fixed, together with the base member, to the main support by the base member clamping device.

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3. The apparatus of claim 2, wherein the peripheral support comprises one or more round rail arranged along the edge of the lip of the main support.
4. The apparatus of any one of claims 1 to 3, wherein: the base member clamping device pushes the base member into the main support so that a peripheral edge of the base member comes in close contact with the surface layer member to thereby clamp the surface layer member.

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5. The apparatus of any one of claims 1 to 4, wherein: the pulling member is shaped so as to hook the edge of the surface layer member and to be separated from the edge of the surface layer member.

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6. A method for manufacturing a surface-layered part using the apparatus of any one of claims 1 to 5, the method comprising:

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 - a first step of placing the surface layer member on the main support;
 - a second step of pulling the edge of the surface layer member, which was placed in the first step, outward with respect to the base member by the pulling member;
 - a third step of fixedly clamping the surface layer member, which has been pulled outward by the pulling member in the second step, against the main support by the base member clamping device via the base member placed over the surface layer member; and
 - a fourth step of separating the pulling member from the edge of the surface layer member, which has been fixedly clamped against the main support via the base member in the third step, by the relieving device to allow the edge of the surface layer member to wrap around the

edge of the base member owing to the elastic restoring force of the surface layer member, thereby integrating the surface layer member and the base member.

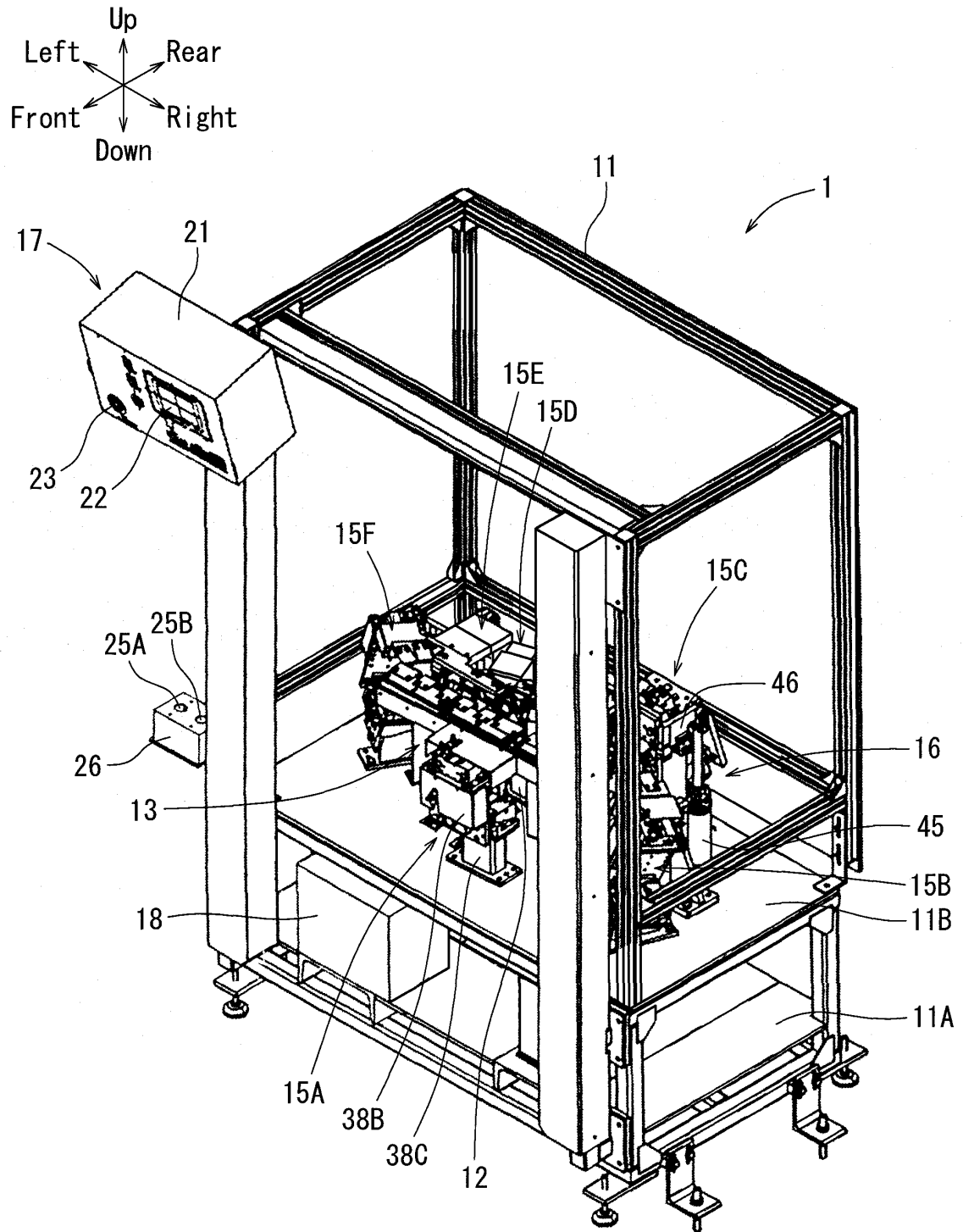


Fig. 1

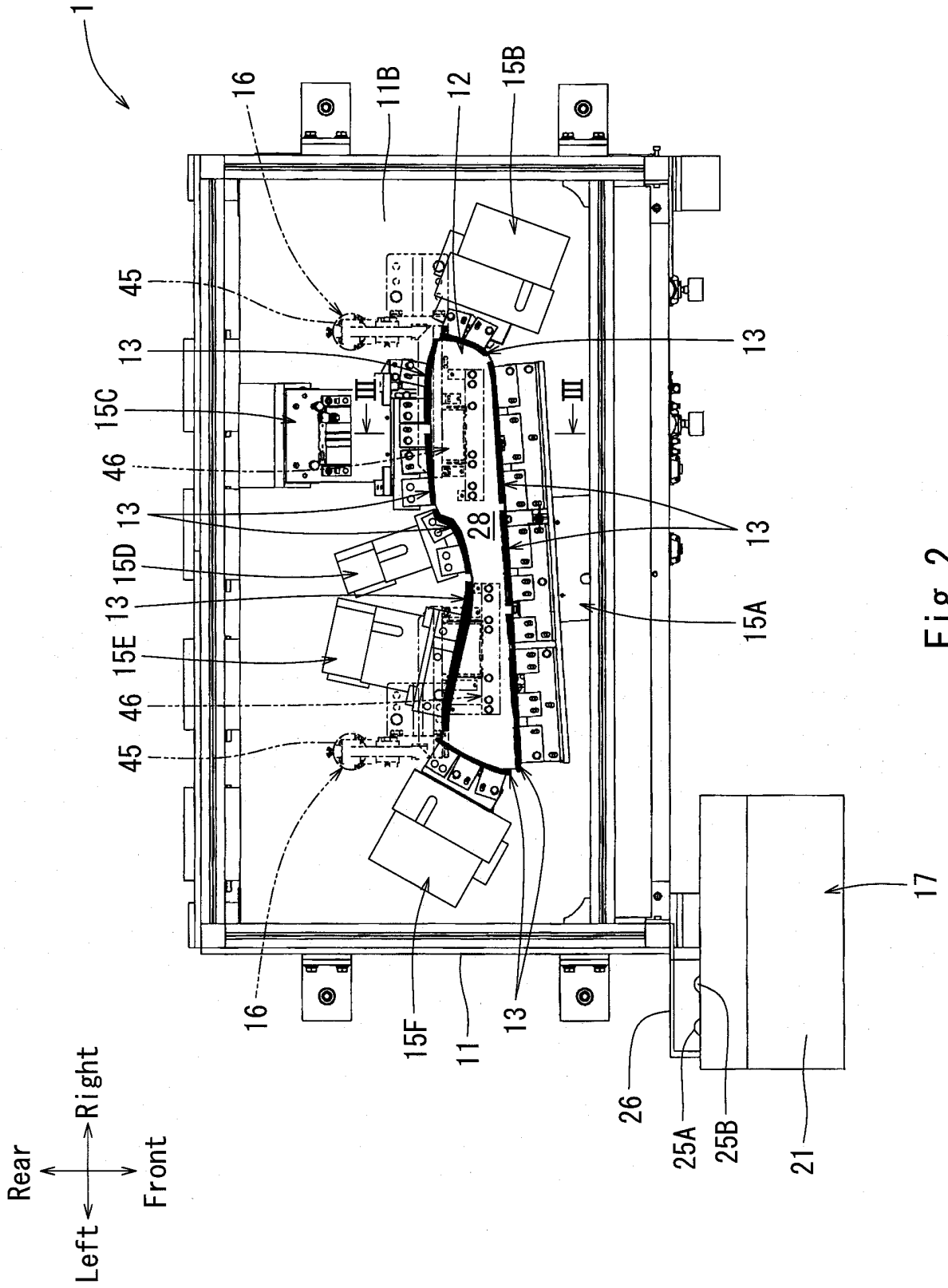


Fig. 2

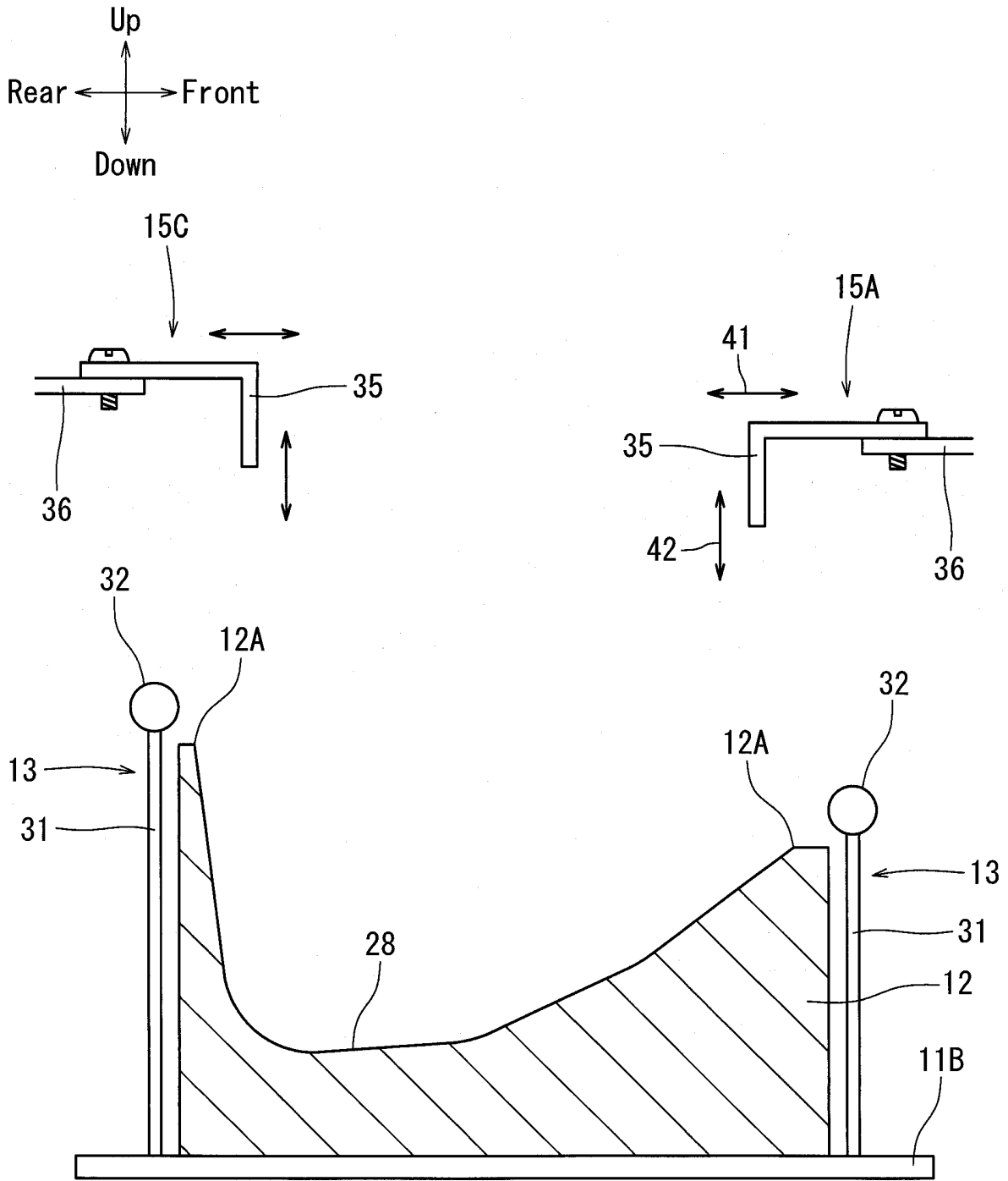


Fig. 3

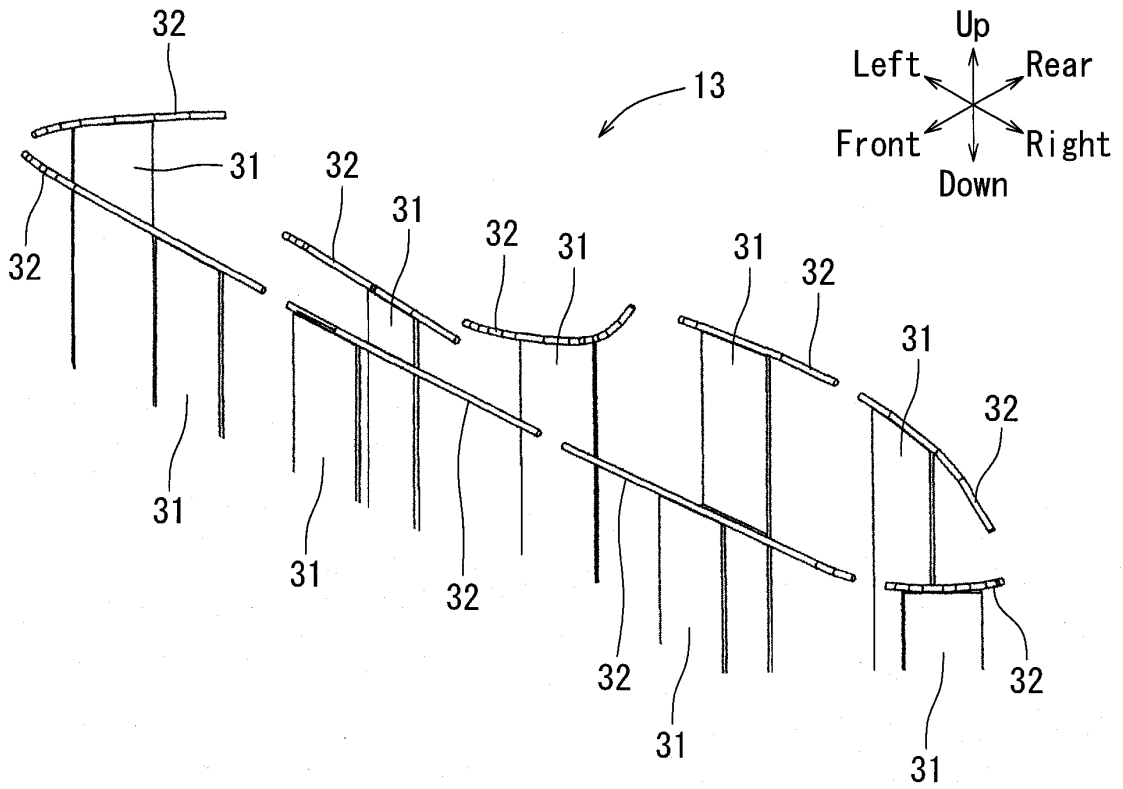


Fig. 4

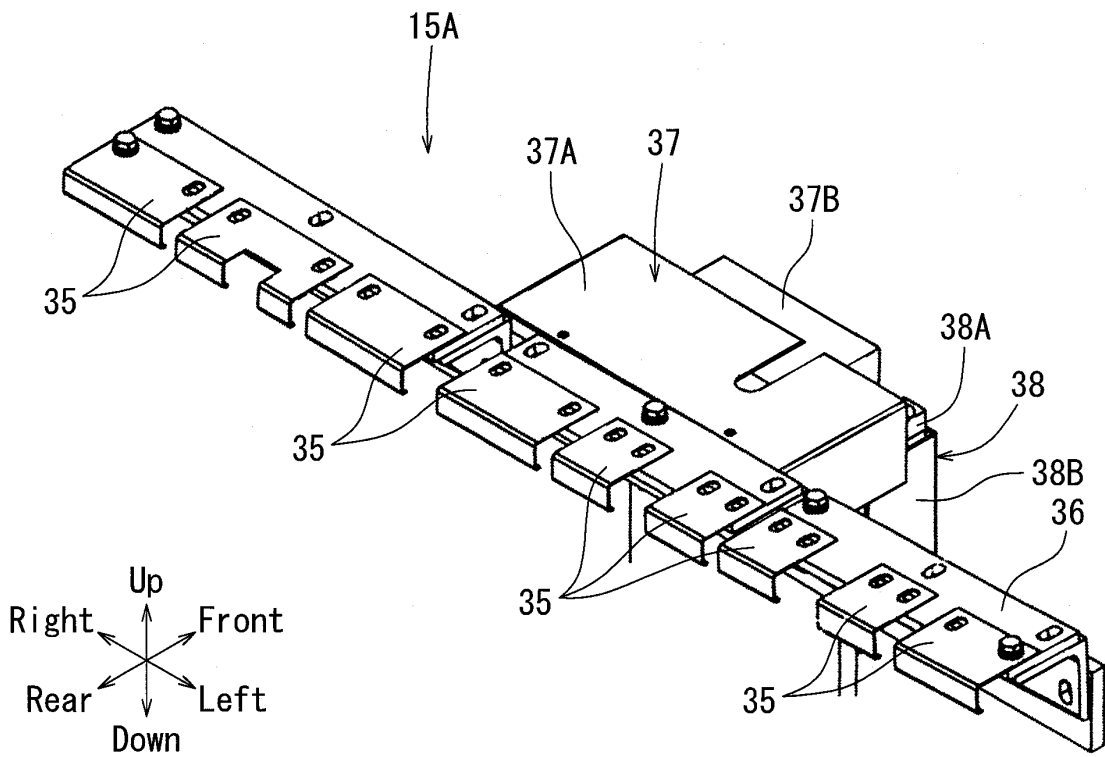


Fig. 5

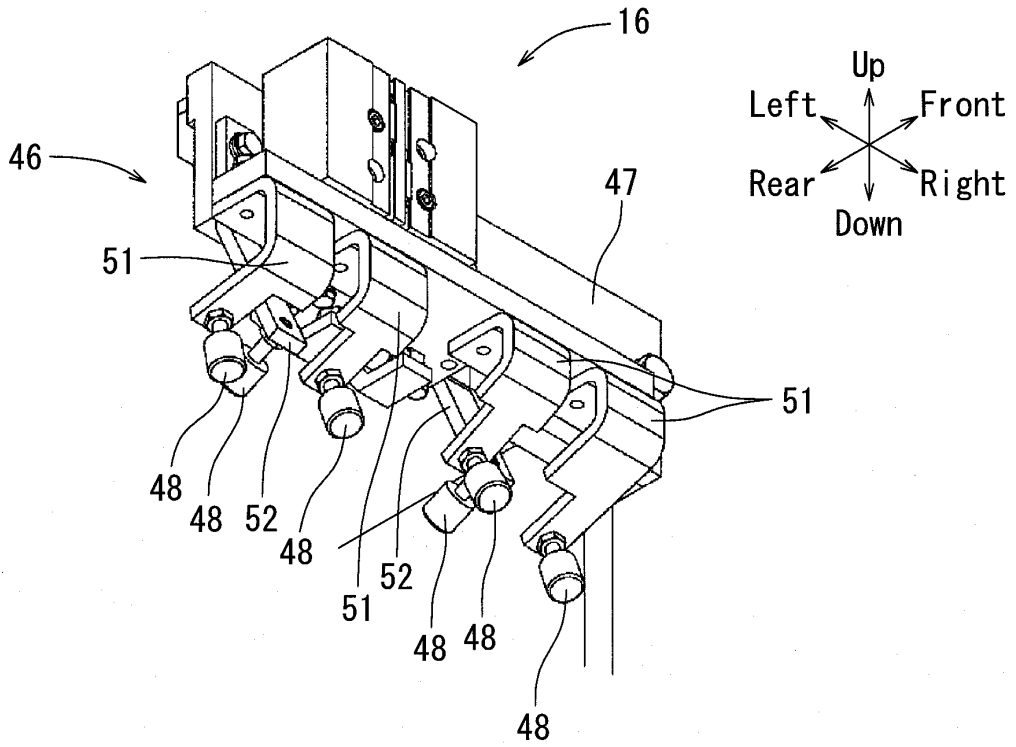


Fig. 6

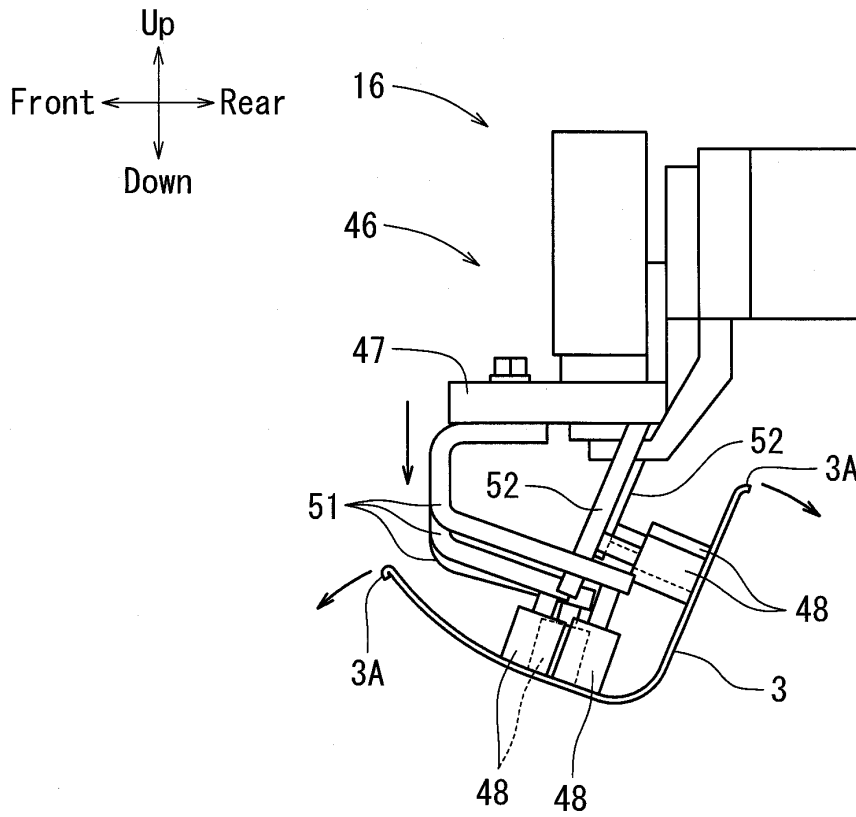


Fig. 7

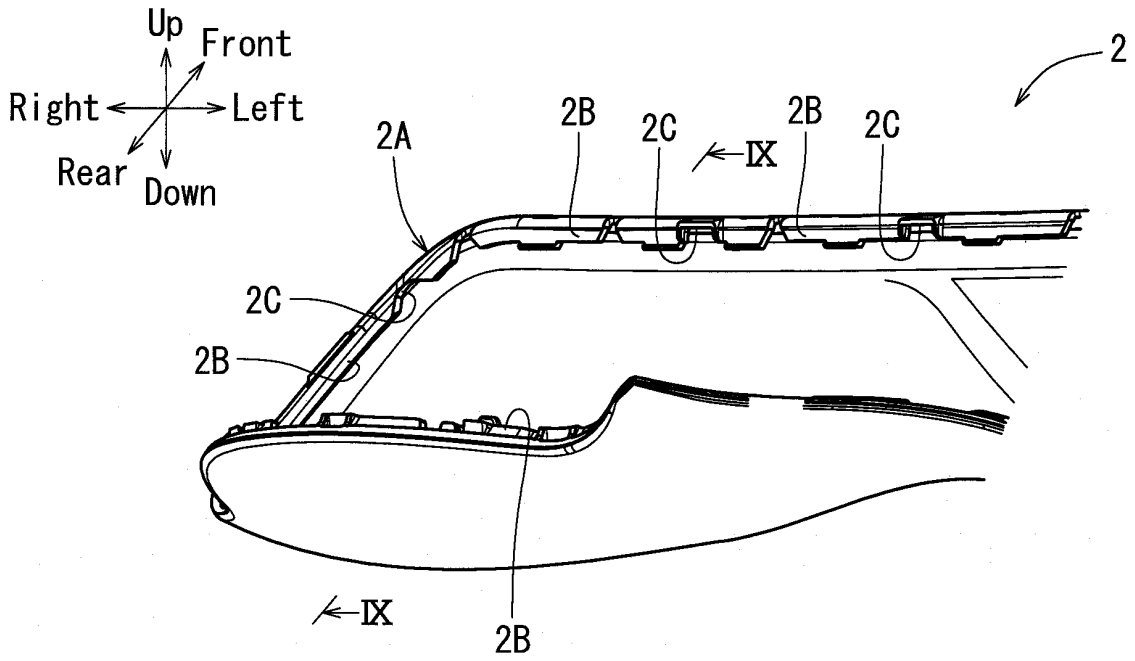


Fig. 8

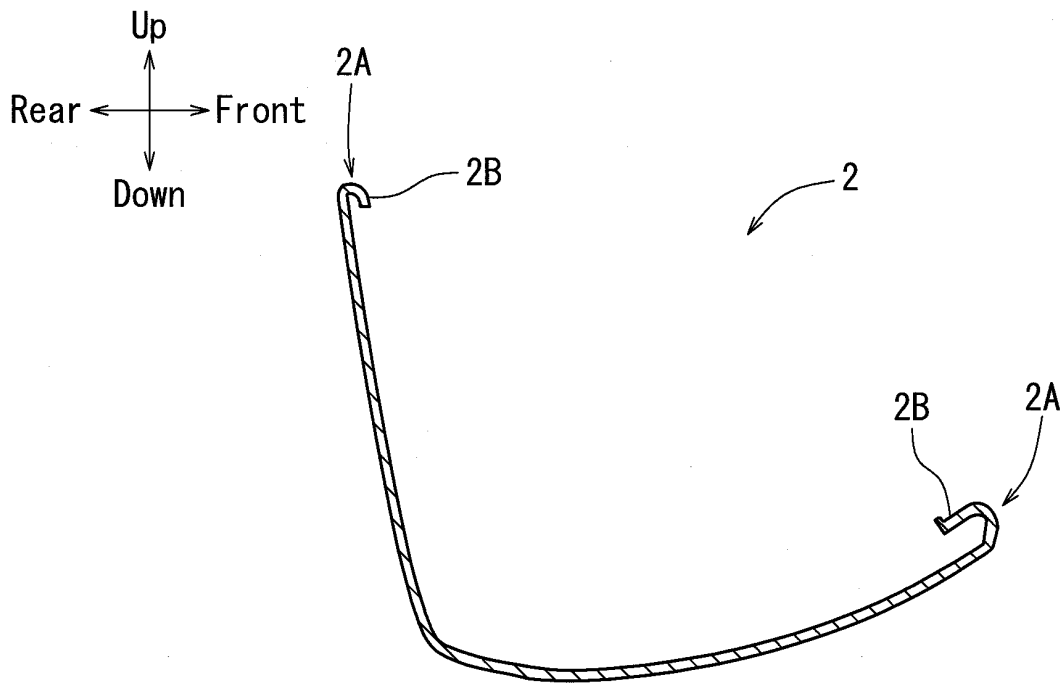


Fig. 9

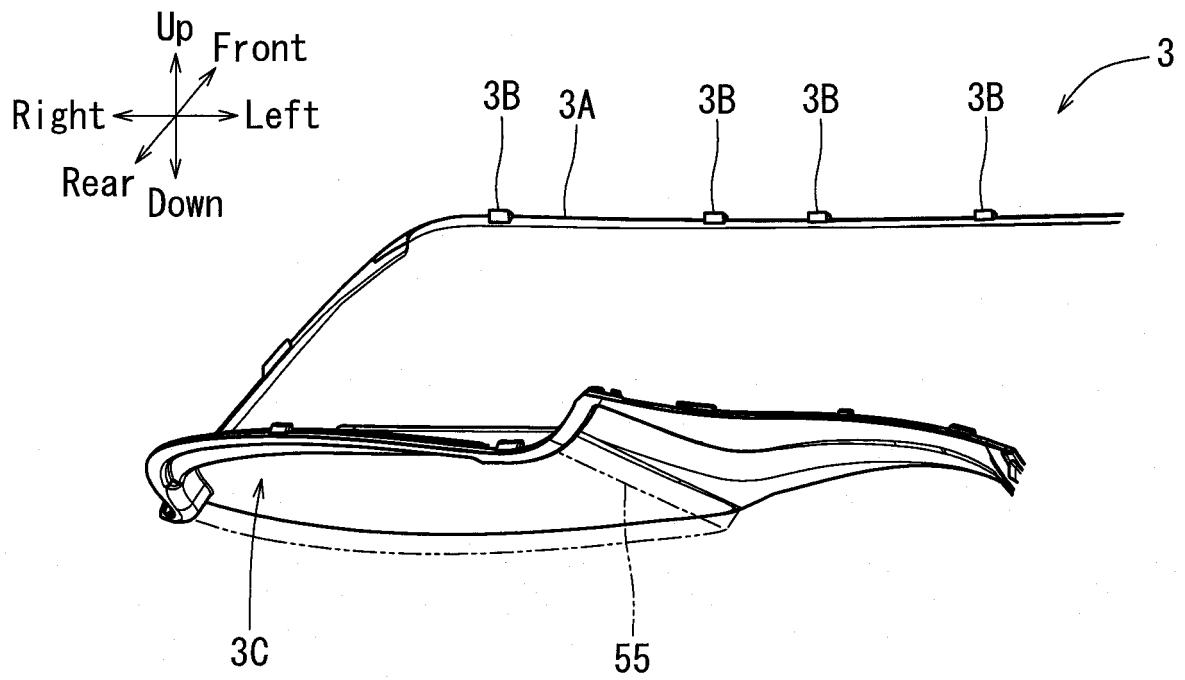


Fig. 10

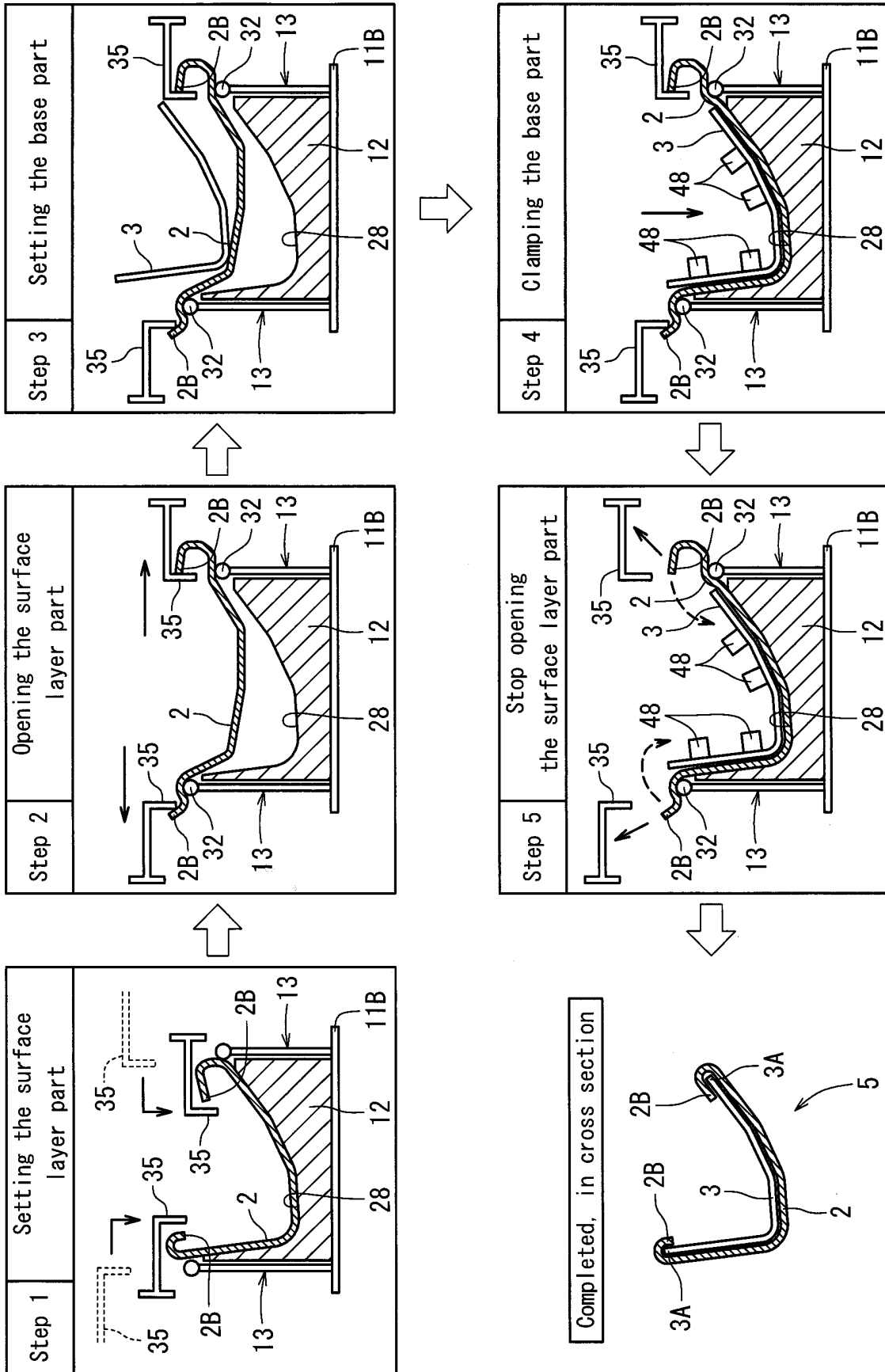


Fig. 11

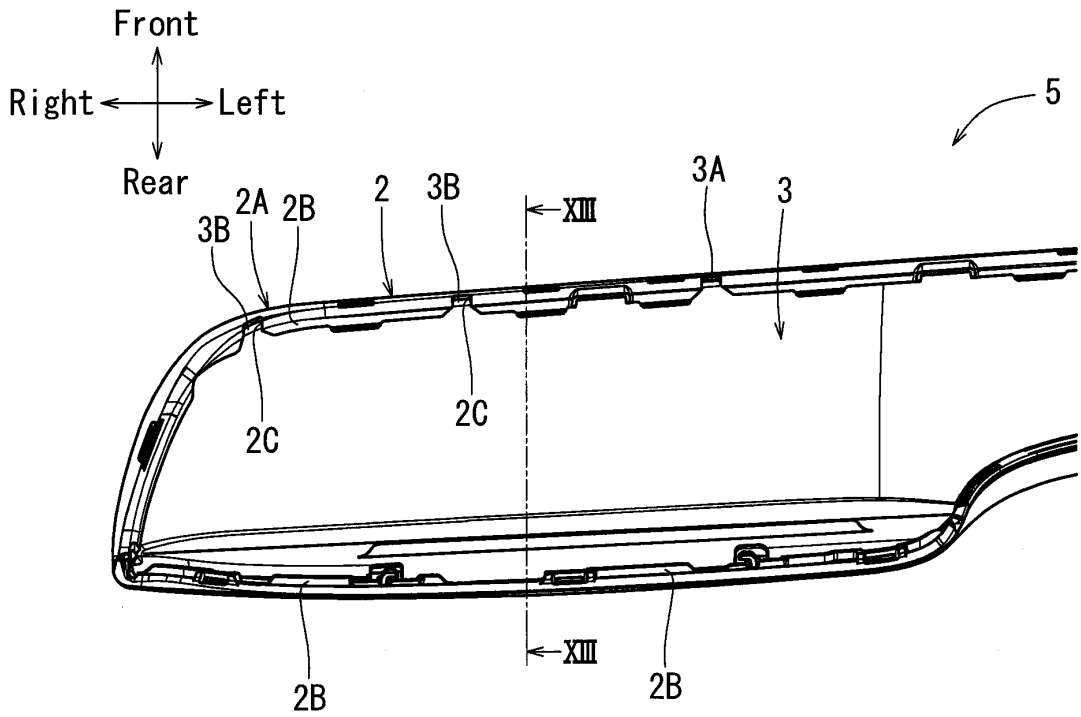


Fig. 12

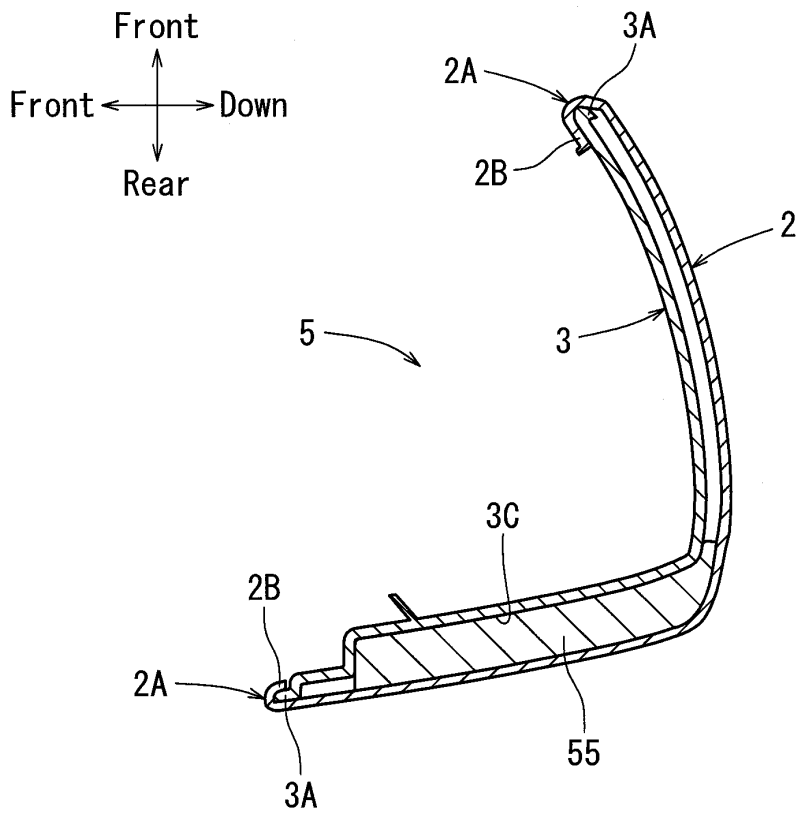


Fig. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/035215

A. CLASSIFICATION OF SUBJECT MATTER B68G 15/00 (2006.01) i; B29C 53/04 (2006.01) i; B60N 3/00 (2006.01) i FI: B60N3/00 C; B29C53/04; B68G15/00		
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) B68G1/00-99/00; B29C53/04; B60N3/00; A47C31/02-31/06; A47C7/00-7/74		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Published examined utility model applications of Japan	1922-1996	
Published unexamined utility model applications of Japan	1971-2020	
Registered utility model specifications of Japan	1996-2020	
Published registered utility model applications of Japan	1994-2020	
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 6-344442 A (SHIGERU CO., LTD.) 20 December 1994 (1994-12-20) paragraphs [0015]-[0035], fig. 1-6	1-6
Y	JP 2016-107839 A (TOYODA IRON WORKS CO., LTD.) 20 June 2016 (2016-06-20) paragraph [0008]	1-6
A	JP 2002-248682 A (NEOX LAB KK) 03 September 2002 (2002-09-03)	1-6
A	JP 2018-67244 A (TOYOTA GOSEI CO., LTD.) 26 April 2018 (2018-04-26)	1-6
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents:	"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	
"A" document defining the general state of the art which is not considered to be of particular relevance	"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	
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Date of the actual completion of the international search 19 November 2020 (19.11.2020)	Date of mailing of the international search report 08 December 2020 (08.12.2020)	
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.	

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No. PCT/JP2020/035215
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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 6-344442 A	20 Dec. 1994	(Family: none)	
JP 2016-107839 A	20 Jun. 2016	US 2017/0327055 A1 paragraph [0019] WO 2016/084813 A1	
JP 2002-248682 A	03 Sep. 2002	(Family: none)	
JP 2018-67244 A	26 Apr. 2018	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006213134 A [0002]