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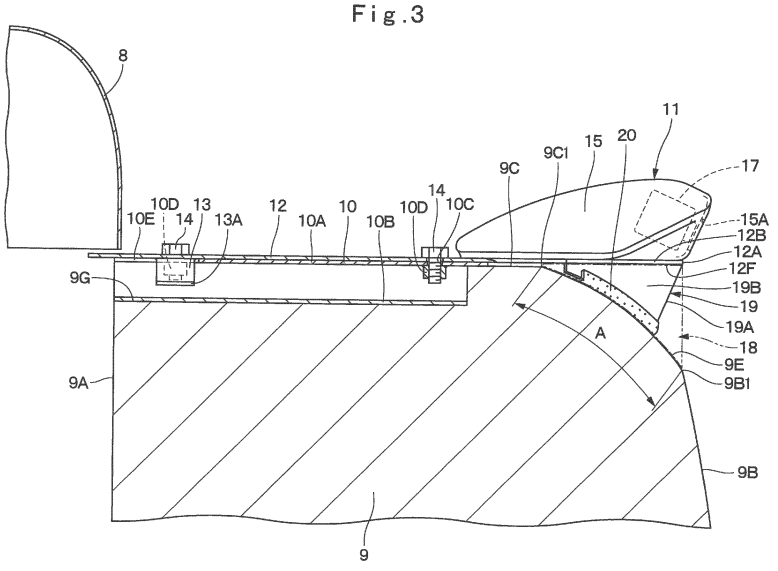
(54) **CONSTRUCTION MACHINERY**

(57) A counterweight (9) provided on a rear side of an upper revolving structure (3) is formed as a block body in which a boundary position between a rear surface (9B) and the upper surface (9C) is a projected curved surface (9E) which is curved with a projected arc shape. A rear camera device (11) mounted on the upper surface (9C) of the counterweight (9) is arranged on the upper surface (9C) of the counterweight (9) and in a state protruding rearward toward the projected curved surface (9E) of the counterweight (9). On the other hand, a cover member (19) covering a gap (18) formed by the projected curved surface (9E) is provided between the projected curved surface (9E) of the counterweight (9) and a rear part lower surface (12F) of a mounting plate (12) of the rear camera device (11).

Fig.3

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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a construction machine that is provided with a counterweight such as a hydraulic excavator, a hydraulic crane and the like.

### BACKGROUND ART

**[0002]** In general, a construction machine such as a hydraulic excavator or the like generally has its vehicle body configured by an automotive lower traveling structure and an upper revolving structure mounted rotatably on the lower traveling structure and performs an excavating work of earth and sand by using a working mechanism provided on the upper revolving structure capable of moving upward/downward. Here, the upper revolving structure has a revolving frame which becomes a base, and the working mechanism is mounted on a front side of this revolving frame. On the other hand, a counterweight for taking a weight balance with the working mechanism is provided on a rear side of the revolving frame.

**[0003]** Some of recent hydraulic excavators have a rear camera device (rear camera device) provided for obtaining a wide rear visual field. This rear camera device is to ensure a visual field in the rear of the vehicle body which makes a dead angle for an operator in a cab during an excavating work, and for that purpose, the rear camera device is mounted at a rear side position on an upper surface of the counterweight (Patent Document 1, Patent Document 2).

### PRIOR ART DOCUMENTS

### PATENT DOCUMENTS

**[0004]**

Patent Document 1: Japanese Patent Laid-Open No. 2008-231726 A
Patent Document 2: Japanese Patent Laid-Open No. 2011-42979 A

### SUMMARY OF THE INVENTION

**[0005]** In each of the above-described Patent Documents, a situation in the rear of the vehicle body can be displayed on a monitor device in the cab by mounting the rear camera device on the upper surface of the counterweight. In this case, in order to display the situation up to a position close to the counterweight, that is, a position in the vicinity of a rear part of the vehicle body, the rear camera device needs to be protruded largely to a rear side from the upper surface of the counterweight.

**[0006]** However, if the rear camera device is protruded largely to the rear side from the counterweight, a gap is formed between the rear camera device and the counterweight, and an integral feeling between the counterweight and the rear camera device is lost, and appearance deteriorates. Moreover, in a state in which the rear camera device is protruded largely to the rear side from the counterweight, a bolt fixing a camera body provided on the rear camera device is exposed to the outside, and there is a concern that the camera body is stolen by loosening the bolt.

**[0007]** The present invention was made in view of the above-described problems of the prior art and has an object to provide a construction machine which can mount the rear camera device on the counterweight with good appearance and can prevent theft of the rear camera device.

(1) The present invention is applied to a construction machine comprising: an automotive vehicle body; a working mechanism provided on a front side of the vehicle body; a counterweight provided on a rear side of the vehicle body for taking a weight balance with the working mechanism; and a rear camera device mounted on an upper surface of the counterweight for obtaining a visual field in the rear.

**[0008]** In order to solve the above-described problems, a characteristic of a configuration adopted by the present invention is that the counterweight is formed as a block body in which a boundary position between a rear surface and the upper surface is a projected curved surface which is curved with a projected arc shape; the rear camera device is arranged on the upper surface of the counterweight and in a state protruding toward the projected curved surface of the counterweight; and a cover member covering a gap formed by the projected curved surface is provided between the projected curved surface of the counterweight and a rear part lower position of the rear camera device.

**[0009]** With this arrangement, the rear camera device is arranged in the state protruding toward the projected curved surface of the counterweight. Therefore, the rear camera device can display a situation in the rear of the vehicle body up to the position in the vicinity of the vehicle body rear part (rear surface of the counterweight) without being shielded by the counterweight, and a wide rear visual field can be provided to an operator.

**[0010]** Moreover, since the cover member is provided between the projected curved surface of the counterweight and the rear part lower position of the rear camera device, the cover member can cover the gap formed between the projected curved surface of the counterweight and the rear part lower position of the rear camera device by protruding the rear camera device toward the projected curved surface.

**[0011]** As a result, even if the rear camera device is protruded largely toward the projected curved surface of the counterweight, the gap formed by the projected curved surface from the rear camera device can be covered by the cover member. As a result, the counterweight

and the rear camera device can be integrally disposed, and appearance can be made favorable.

**[0012]** Furthermore, the cover member can conceal a component constituting the rear camera device such as a bolt fixing a camera body therein and the like, for example. Therefore, the cover member can prevent such a situation that the rear camera device is disassembled and the component is stolen.

(2) According to the present invention, the rear camera device is constituted by a mounting plate extending in a front and rear direction and mounted on the upper surface of the counterweight, a camera housing provided on a rear side on the mounting plate, and a camera body accommodated in the camera housing; and the cover member is mounted on the rear part lower position of the mounting plate.

**[0013]** With this arrangement, since the cover member is configured to be mounted at the rear part lower position of the mounting plate which is a base of the rear camera device, this cover member can be mounted easily to the rear camera device by using fixing means such as welding or the like. In a state in which the cover member is mounted on the rear camera device, the bolt fixing the camera body to the mounting plate and the like can be concealed by the cover member, for example, and such a situation that the rear camera device is disassembled can be prevented.

(3) According to the present invention, an accommodating recessed portion is provided at a center part in a left and right direction on the upper surface of the counterweight; a camera device mounting member composed of a top plate covering the accommodating recessed portion and mounted on the upper surface and a recessed bottom plate mounted on a lower surface of the top plate and accommodated in the accommodating recessed portion is provided on the upper surface of the counterweight; and a welding nut having a female screw hole at a position faced with the recessed bottom plate is provided on the lower surface of the top plate; while a bolt insertion hole is provided at a position corresponding to the welding nut on the mounting plate of the rear camera device; and the mounting plate is configured to be mounted on the welding nut through the bolt insertion hole using a bolt.

**[0014]** With this arrangement, when the camera device mounting member is provided on the upper surface of the counterweight, the top plate is mounted on the upper surface of the counterweight in a state in which the recessed bottom plate is accommodated in the accommodating recessed portion. Moreover, the rear camera device can be mounted on the upper surface of the counterweight by mounting the mounting plate of the rear camera device on the top plate of the camera device mounting member by using the bolt.

(4) According to the present invention, a fringe member made of an elastic material is provided on the cover member so as to cover an end edge on a lower side faced with the projected curved surface of the counterweight.

**[0015]** With this arrangement, the cover member can be elastically brought into close contact with the projected curved surface of the counterweight through the fringe member. As a result, a gap between the cover member and the projected curved surface can be eliminated so as to improve crime prevention performances, and appearance can be also made favorable. Moreover, the fringe member made of an elastic material can prevent occurrence of a noise caused by collision of the cover member with the counterweight or damage on the cover member or the counterweight and can extend their lives.

(5) According to the present invention, the cover member is formed of a rear plate part closing a gap between a rear end of the rear part lower position of the rear camera device and the counterweight and left and right inclined plate parts extending from both left and right ends of the rear plate portion to a front side along the projected curved surface of the counterweight and closing left and right gaps from the counterweight.

**[0016]** With this arrangement, the gap formed between the projected curved surface of the counterweight and the rear part lower position of the rear camera device can be covered on the rear side thereof by the rear plate portion, and the both left and right sides can be covered by the left and right inclined plate parts.

(6) According to the present invention, end edges on lower sides of the left and right inclined plate parts of the cover member are formed each having a recessed arc shape along the projected curved surface of the counterweight. Therefore, the end edge on the lower side having the recessed arc shape of the cover member can be brought into close contact with the projected curved surface of the counterweight. As a result, the gap between the cover member and the counterweight can be made small, whereby the crime prevention performances can be improved, and appearance can be also made favorable.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0017]**

Fig. 1 is a left side view showing a hydraulic excavator according to an embodiment of the present invention.

Fig. 2 is an enlarged perspective view of an essential

part of a rear side of the hydraulic excavator seen from a diagonally rear left side.

Fig. 3 is an enlarged sectional view of an essential part showing a counterweight, an engine cover, a camera device mounting member, a rear camera device, a cover member and the like.

Fig. 4 is an enlarged perspective view of an essential part of the rear camera device and the cover member mounted on the counterweight seen from a lower side.

Fig. 5 is a perspective view of the counterweight, the camera device mounting member, the rear camera device, the cover member and the like seen from a diagonally front left side.

Fig. 6 is an exploded perspective view of the rear camera device, the cover member and the like seen from the diagonally rear left side.

Fig. 7 is a perspective view of a state in which the cover member is mounted on a mounting plate of the rear camera device seen from a diagonally upper left side.

Fig. 8 is a perspective view of a state in which the cover member is mounted on a mounting plate of the rear camera device seen from a diagonally lower left side.

Fig. 9 is an exploded perspective view of the mounting plate, the cover member, and a fringe member seen from the diagonally upper left side.

## MODE FOR CARRYING OUT THE INVENTION

**[0018]** Hereinafter, an embodiment of a construction machine according to the present invention will be described in detail by referring to Figs. 1 to 9 by taking a case in which the present invention is applied to a crawler-type hydraulic excavator as an example.

**[0019]** In Fig. 1, designated as 1 denotes a hydraulic excavator as a typical example of a construction machine. A vehicle body of this hydraulic excavator 1 is constituted by an automotive crawler-type lower traveling structure 2 and an upper revolving structure 3 mounted rotatably on the lower traveling structure 2. A working mechanism 4 for performing an excavating work of earth and sand is provided capable of moving upward/downward on a front side of the upper revolving structure 3.

**[0020]** Here, the upper revolving structure 3 has a revolving frame 5 forming a support structural body, and a base end of the working mechanism 4 is rotatably mounted on a front side of the revolving frame 5. On the other hand, a counterweight 9 which will be described later for taking a weight balance with the working mechanism 4 is mounted on a rear side of the revolving frame 5.

**[0021]** Moreover, a cab 6 into which an operator gets on when operating the hydraulic excavator 1 is disposed on a front left side of the revolving frame 5. In this cab 6, a driver's seat, various operation levers, and a monitor device (none of them is shown) are disposed. A housing cover 7 is provided on a front side of the counterweight 9, and mounted devices including an engine, a hydraulic pump, and a heat exchanging device (none of them is shown) are accommodated inside the housing cover 7. Here, as shown in Fig. 2, the housing cover 7 is constituted by left and right side surface plates 7A located on both left and right sides of the revolving frame 5 and extending in a front and rear direction and an upper surface plate 7B extending in a horizontal direction between upper parts of the side surface plates 7A. A rear side of this housing cover 7 is closed by a front surface 9A of the counterweight 9.

**[0022]** An engine cover 8 is provided on the upper surface plate 7B of the housing cover 7, and the engine cover 8 is to cover the mounted devices accommodated in the housing cover 7 from above. This engine cover 8 is to cover devices requiring a regular maintenance work in the mounted devices accommodated in the housing cover 7 such as the engine and the heat exchanger, for example, from the upper side capable of being opened/closed. In this case, the engine cover 8 is mounted rotatably in a vertical direction on a cover support frame (not shown) constituting a part of the revolving frame 5.

**[0023]** Here, as shown in Fig. 3, the engine cover 8 is constituted so that its rear part covers a front part of a mounting plate 12 of a rear camera device 11 which will be described later in a closed state. As a result, in a state in which the engine cover 8 is closed, the mounting plate 12 cannot be removed or inclined in the left and right direction.

**[0024]** Designated at 9 denotes the counterweight taking a weight balance with the working mechanism 4, and the counterweight 9 is disposed on a rear side of the revolving frame 5 constituting the upper revolving structure 3. This counterweight 9 is constituted as a block body by filling a weight adjusting material in a housing forming an outer shell. As shown in Figs. 1 and 2, the counterweight 9 has the rectangular front surface 9A extending in the left and right direction so as to face the engine, a rear surface 9B extending in the left and right direction and both sides in the left and right direction being curved in an arc state and extending to the front side toward the both end portions of the front surface 9A, a D-shaped upper surface 9C surrounded by the front surface 9A and the rear surface 9B, and a lower surface 9D placed on the revolving frame 5.

**[0025]** Here, as shown in Fig. 2, a boundary position between the rear surface 9B and the upper surface 9C of the counterweight 9 forms a projected curved surface 9E which is curved in a projected arc state so that the boundary position between the rear surface 9B and the upper surface 9C of the counterweight 9 are connected smoothly. That is, as shown in Fig. 3, assuming that a position of the uppermost part of the rear surface 9B of the counterweight 9 is an upper end part 9B1 and a position of the rearmost part of the upper surface 9C is a rear end part 9C1, the projected curved surface 9E is a range A between the upper end part 9B1 and the rear

end part 9C1. Here, in Fig. 2, the upper end part 9B1 of the rear surface 9B and the rear end part 9C1 of the upper surface 9C are expressed by a solid line, and a space between the rear surface 9B and the projected curved surface 9E and a space between the upper surface 9C and the projected curved surface 9E continue smoothly in an arc state. As shown in Fig. 1, a boundary position between the rear surface 9B and the lower surface 9D is also a projected curved surface 9F which is curved having a projected arc shape. As a result, the counterweight 9 has the upper and lower projected curved surfaces 9E and 9F and a favorable outer shape appearance.

**[0026]** On the other hand, as shown in Fig. 5, an accommodating recessed portion 9G located at a center in the left and right direction of the upper surface 9C, extending in the front and rear direction, and having a rectangular flat surface is formed on the counterweight 9, and an upper side and a front side of this accommodating recessed portion 9G are opened. Here, the accommodating recessed portion 9G is to accommodate a recessed bottom plate 10B of a camera device mounting member 10 when the camera device mounting member 10 which will be described later is mounted on the upper surface 9C of the counterweight 9.

**[0027]** The camera device mounting member 10 is provided on the counterweight 9, and the rear camera device 11 which will be described later is mounted on the camera device mounting member 10. This camera device mounting member 10 is disposed at a center position in the left and right direction on the upper surface 9C so as to cover the accommodating recessed portion 9G of the counterweight 9. As shown in Figs. 3 and 5, the camera device mounting member 10 is formed of a top plate 10A made of a rectangular plate body, covering the accommodating recessed portion 9G of the counterweight 9 and mounted on the upper surface 9C and a recessed bottom plate 10B formed with a recess so as to be mounted on the lower surface of the top plate 10A and accommodated in the accommodating recessed portion 9G. The top plate 10A constitutes a part of the upper surface 9C by being fixed to the upper surface 9C of the counterweight 9 by using welding means, for example.

**[0028]** In the top plate 10A of the camera device mounting member 10, four through holes 10C are provided at intervals in the front and rear direction and in the left and right direction at positions faced with the recessed bottom plate 10B. At the position of this through hole 10C, a welding nut 10D is provided at a position on the lower surface of the top plate 10A. Therefore, on the top plate 10A, female screw holes are formed by welding the welding nuts 10D on the lower surfaces of the four through holes 10C, respectively. Moreover, as shown in Fig. 3, an engaging groove 10E extending in the front and rear direction at a position close to front left side of the recessed bottom plate 10B is formed on the top plate 10A.

**[0029]** A hook member 13 constituting the mounting plate 12 of the rear camera device 11 which will be described later is inserted and it linearly extends from the vicinity of the left side of the welding nut 10D at the front left position to a front end portion into this engaging groove 10E. As a result, the engaging groove 10E regulates movement of the mounting plate 12 to the rear side and enables removal of the rear camera device 11 only when the mounting plate 12 is moved to the front side.

**[0030]** Subsequently, a constitution of the rear camera device 11 according to this embodiment provided on a rear side of the upper revolving structure 3 will be described.

**[0031]** That is, designated at 11 denotes the rear camera device mounted on an upper side of the counterweight 9. This rear camera device 11 is to provide an operator with a visual field in the rear of the hydraulic excavator 1 which becomes a dead angle for the operator in the cab 6. The rear camera device 11 includes the mounting plate 12 which will be described later, a camera housing 15, and a camera body 17.

**[0032]** The mounting plate 12 is a mounting base of the rear camera device 11, and this mounting plate 12 is mounted by facing the top plate 10A of the camera device mounting member 10 forming a part of the upper surface 9C of the counterweight 9. As shown in Figs. 7 to 9, the mounting plate 12 is formed as a substantially rectangular flat plate extending in the front and rear direction. A rear side of the mounting plate 12 has a narrow rear end edge 12A located at a center of a rear end of the mounting plate 12 and left and right inclined end edges 12B extending from the rear end edge 12A toward the front side so as to expand in the left and right direction. As a result, a rear side portion of the mounting plate 12 is formed having a trapezoidal shape by the left and right inclined end edges 12B and the rear end edge 12A.

**[0033]** In the mounting plate 12, four bolt insertion holes 12C are provided at intervals in the front and rear direction and in the left and right direction in a range from an intermediate portion in the front and rear direction to the front side. Bolts 14 which will be described later for mounting the mounting plate 12 on the welding nuts 10D of the camera device mounting member 10 are inserted into these four bolt insertion holes 12c. Three bolt insertion holes 12D are formed closer to the rear side of the mounting plate 12 (rear surface 9B side of the counterweight 9). Bolts 16 which will be described later for mounting the camera housing 15 on the mounting plate 12 are inserted into these three bolt insertion holes 12D. On the other hand, a harness insertion hole 12E through which a harness (not shown) located between each of the bolt insertion holes 12C and each of the bolt insertion holes 12D and extending from the camera body 17 which will be described later is provided on the mounting plate 12.

**[0034]** Moreover, the mounting plate 12 has a rear part lower surface 12F which becomes a rear part lower position on a trapezoidal portion formed by the rear end edge 12A and each of the inclined end edges 12B. As shown in Fig. 3, on this rear part lower surface 12F, a

gap 18 which will be described later is formed by the projected curved surface 9E of the counterweight 9. On the other hand, the cover member 19 which will be described later and covers the gap 18 is mounted on the rear part lower surface 12F.

**[0035]** Here, the hook member 13 is provided on the mounting plate 12 protruding downward from closer to the front side on the lower surface. That is, the hook member 13 is provided at a position corresponding to the engaging groove 10E of the camera device mounting member 10. This hook member 13 is formed by bending a tip end side of a rectangular plate body substantially at a right angle. The hook member 13 has its base end fixed to the lower surface of the mounting plate 12 by using welding means so that a retaining portion 13A formed by bending its tip end side is directed outward in the left and right direction. As shown in Fig. 5, this hook member 13 is to be inserted into the engaging groove 10E provided on the top plate 10A of the camera device mounting member 10.

**[0036]** Mounting of the mounting plate 12 configured as above on the camera device mounting member 10 will be described. First, the mounting plate 12 is arranged on the top plate 10A of the camera device mounting member 10 in a state in which its position is shifted to the front side. Subsequently, while the hook member 13 is inserted into the engaging groove 10E of the top plate 10A, the mounting plate 12 is moved to the rear side (rear surface 9B side of the counterweight 9), and the four bolt insertion holes 12C are aligned to the four welding nuts 10D. In this state, the bolts 14 inserted into the bolt insertion holes 12C are screwed with the female screw holes of the welding nuts 10D through the through holes 10C of the camera device mounting member 10. As a result, the mounting plate 12 can be mounted on the camera device mounting member 10.

**[0037]** The camera housing 15 is provided on the rear side on the mounting plate 12, and this camera housing 15 is constituted as a hollow case accommodating the camera body 17 which will be described later. As shown in Fig. 4, an opening 15A is formed at a position on a narrow rear surface part on the rear side of the camera housing 15. The camera body 17 is exposed to the outside through this opening 15A. The camera housing 15 is mounted on the mounting plate 12 by the bolts 16 (shown in Fig. 6) inserted from the lower side into each of the bolt insertion holes 12D of the mounting plate 12.

**[0038]** As shown in Figs. 3 and 4, the camera body 17 is accommodated in the camera housing 15, and the camera body 17 is fixedly mounted in the camera housing 15, for example. This camera body 17 is constituted by a CCD camera, for example, and can photograph the outside through the opening 15A. A harness (not shown) of the camera body 17 is connected into the cab 6 through the harness insertion hole 12E provided in the mounting plate 12. The camera body 17 is to photograph a range in the rear of the counterweight 9 which becomes a dead angle for the operator in the cab 6, and an image photographed by the camera body 17 can be displayed on a monitor device (not shown) arranged in the cab 6. As a result, the operator can monitor (check) the rear of the counterweight 9 by an image displayed on the monitor device while operating the hydraulic excavator 1 in the cab 6.

**[0039]** As described above, the rear camera device 11 is to photograph the range in the rear of the counterweight 9. When a position close to the rear surface 9B of the counterweight 9 is to be photographed by this rear camera device 11, it is necessary to largely protrude the camera body 17 provided on the rear camera device 11 to the rear side from above the counterweight 9 in order to avoid the projected curved surface 9E of the counterweight 9 obstructing when the lower side is to be taken. That is, as shown in Fig. 3, the rear camera device 11 is arranged in a state protruded toward the projected curved surface 9E of the counterweight 9. Specifically, the mounting plate 12 is extended to the rear side and protruded to the upper side of the projected curved surface 9E, and the camera body 17 is configured to be provided in the camera housing 15 by being located at the rear side part (upper surface of the rear part lower surface 12F) of this mounting plate 12.

**[0040]** Therefore, since the rear camera device 11 is arranged so as to be floated in a cantilever state above the projected curved surface 9E, the gap 18 caused by the projected curved surface 9E is formed between the projected curved surface 9E of the counterweight 9 and the rear part lower surface 12F of the mounting plate 12 of the rear camera device 11. Specifically, as shown in Fig. 3, the gap 18 is within a range inside a two-dot chain line connecting the rear end edge 12A of the mounting plate 12 and the upper end part 9B1 of the rear surface 9B of the counterweight 9. In this case, the gap 18 is opened having a substantially V-shape on the rear surface 9B side of the counterweight 9 when seen from the side.

**[0041]** This gap 18 eliminates an integral feeling between the counterweight 9 and the rear camera device 11 and deteriorates the appearance and moreover, there is a concern that the bolt 16 fixing the camera housing 15 (camera body 17) to the mounting plate 12 is exposed to the outside. Thus, it is configured such that the cover member 19 which will be described later is provided on the gap 18.

**[0042]** Subsequently, the cover member 19 which is a feature portion of the present invention will be described in detail for its configuration and function.

**[0043]** Designated at 19 denotes a cover member provided between the projected curved surface 9E of the counterweight 9 and the rear part lower surface 12F of the mounting plate 12 of the rear camera device 11. This cover member 19 covers the gap 18 formed by the projected curved surface 9E from the mounting plate 12. As shown in Figs. 6 to 9, the cover member 19 is formed so as to surround the rear end side of the mounting plate 12 by bending a single plate body at two spots in a length

direction.

**[0044]** That is, the cover member 19 is constituted by a rectangular rear plate part 19A extending in the left and right direction along the rear end edge 12A of the mounting plate 12 and mounted on the rear end edge 12A and left and right inclined plate part 19B extending toward the front side so as to expand in the left and right direction along the inclined end edge 12B of the mounting plate 12 from the rear plate part 19A.

**[0045]** Here, the cover member 19 is mounted on the rear part lower surface 12F of the mounting plate 12 by using welding means, for example. Specifically, the cover member 19 has the rear plate part 19A welded and joined to the rear end edge 12A of the mounting plate 12, and the left and right inclined plate parts 19B welded and joined to the left and right inclined end edges 12B of the mounting plate 12.

**[0046]** On the other hand, the left and right inclined plate parts 19B of the cover member 19 are formed so that a dimension in the vertical direction increases toward the rear plate part 19A so as to correspond to the projected curved surface 9E of the counterweight 9. That is, the left and right inclined plate parts 19B are formed having a substantially triangular shape which is wider in a width in the vertical direction at a position close to the rear plate part 19A and narrower in the width in the vertical direction at a position away from the rear plate part 19A. As a result, each of the inclined plate parts 19B having a substantially triangular shape can match the gap 18 having a substantially V-shape and can reliably cover this gap 18.

**[0047]** Moreover, in the inclined plate parts 19B, the lower end edge faced with the projected curved surface 9E is an end edge 19B1 having a recessed arc shape (hereinafter referred to as a recessed end edge 19B1) so as to correspond to the projected curved surface 9E. As a result, the recessed end edge 19B1 can be brought into close contact with the projected curved surface 9E of the counterweight 9 and can effectively cover the gap 18 between the cover member 19 and the counterweight 9. The lower end edge of the rear plate part 19A is a linear end edge 19A1 extending linearly in the horizontal direction.

**[0048]** A fringe member 20 is provided on the cover member 19, and this fringe member 20 is formed as a string-like body using a rubber material or a resin material having elasticity and having a U-shaped section. In the cover member 19, the fringe member 20 is mounted so as to cover the linear end edge 19A1 of the rear plate part 19A and the recessed end edges 19B1 of the left and right inclined plate parts 19B faced with the projected curved surface 9E by sandwiching them in the U-shape.

**[0049]** Here, the fringe member 20 can be elastically deformed in accordance with a surface shape of this projected curved surface 9E when being brought into contact with the projected curved surface 9E of the counterweight 9. As a result, the fringe member 20 can surely fill the gap between the cover member 19 and the counterweight 9. Moreover, the fringe member 20 made of an elastic material can elastically bring the cover member 19 into contact with the counterweight 9 and thus, noise or damage caused by a collision can be prevented.

**[0050]** The hydraulic excavator 1 according to this embodiment has the configuration as above, and subsequently, an operation of this hydraulic excavator 1 will be described.

**[0051]** First, the operator gets on the cab 6 and is seated on the operator's seat. By operating a lever for running in this state, the lower traveling structure 2 is driven, and the hydraulic excavator 1 can be traveled forward or backward. On the other hand, the operator can perform the excavating work of earth and sand by operating the working mechanism 4 and the like by operating a lever for work.

**[0052]** In this excavating work, the rear camera device 11 mounted on the counterweight 9 photographs the rear of the counterweight 9 which becomes a dead angle for the operator in the cab 6. The image taken by this rear camera device 11 is displayed on the monitor device arranged in the cab 6. As a result, the operator operating the hydraulic excavator 1 in the cab 6 can check the rear of the counterweight 9 by the image displayed on the monitor device, whereby safety in the excavating work can be improved.

**[0053]** Here, in this embodiment, the rear camera device 11 is directed toward the projected curved surface 9E of the counterweight 9 and arranged in a state protruding to the rear side. Thus, the projected curved surface 9E of the counterweight 9 making an obstruct when the lower side is to be photographed by the rear camera device 11 can be avoided, and a photographing range can be widened downward to a position close to this counterweight 9. As a result, safety of the excavating work and the like can be further improved.

**[0054]** In this case, in the state in which the rear camera device 11 is largely protruded toward the rear side, the gap 18 is formed by the projected curved surface 9E of the counterweight 9 from the mounting plate 12 of the rear camera device 11. Thus, the appearance of the rear camera device 11 deteriorates and moreover, there is a concern that the bolt 16 fixing the camera housing 15 to the mounting plate 12 is exposed to the outside.

**[0055]** However, according to this embodiment, the rear camera device 11 is configured to be arranged on the top plate 10A of the camera device mounting member 10 located on the upper surface 9C of the counterweight 9 in the state protruding toward the projected curved surface 9E of the counterweight 9. Therefore, the rear camera device 11 can photograph the situation in the rear of the vehicle body up to the position in the vicinity of the vehicle body rear part (rear surface 9B of the counterweight 9) without being shielded by the projected curved surface 9E of the counterweight 9 and can provide a wide rear visual field to the operator in the cab 6.

**[0056]** Moreover, the cover member 19 is configured to be provided between the projected curved surface 9E

of the counterweight 9 and the rear part lower surface 12F of the mounting plate 12 of the rear camera device 11. As a result, the cover member 19 can cover the gap 18 formed by protruding the rear camera device 11 toward the projected curved surface 9E.

**[0057]** As a result, even if the rear camera device 11 is largely protruded rearward toward the projected curved surface 9E of the counterweight 9, the gap 18 formed by the projected curved surface 9E from the rear camera device 11 can be covered by the cover member 19. As a result, since the counterweight 9 and the rear camera device 11 can be integrally disposed so as to continue by eliminating the gap 18 between the both, the appearance can be made favorable.

**[0058]** The cover member 19 is configured to be mounted on the rear part lower surface 12F of the mounting plate 12 which becomes a base of the rear camera device 11, this cover member 19 can be easily mounted on the mounting plate 12 by using welding means. Moreover, since the cover member 19 provided on the rear part lower surface 12F of the mounting plate 12 can conceal each of the bolts 16 fixing the camera housing 15 to the mounting plate 12, such a situation that the rear camera device 11 is disassembled and the component is stolen can be prevented.

**[0059]** The accommodating recessed portion 9G located at the center part in the left and right direction is provided on the upper surface 9C of the counterweight 9. On the other hand, the camera device mounting member 10 to be mounted on the upper surface 9C of the counterweight 9 is constituted by the top plate 10A covering the accommodating recessed portion 9G and mounted on the upper surface 9C and the recessed bottom plate 10B mounted on the lower surface of the top plate 10A and accommodated in the accommodating recessed portion 9G. Moreover, the welding nut 10D having the female screw hole at the position faced with the recessed bottom plate 10B is provided on the lower surface of the top plate 10A, while the bolt insertion hole 12C is provided at the position corresponding to the welding nut 10D on the mounting plate 12 of the rear camera device 11.

**[0060]** Therefore, when the camera device mounting member 10 is to be mounted on the upper surface 9C of the counterweight 9, the top plate 10A is mounted on the upper surface 9C of the counterweight 9 in the state in which the recessed bottom plate 10B of the camera device mounting member 10 is accommodated in the accommodating recessed portion 9G. Moreover, the mounting plate 12 of the rear camera device 11 is mounted on the top plate 10A of the camera device mounting member 10 by using the bolt 14. As a result, the rear camera device 11 can be mounted by being located at the center part in the left and right direction on the upper surface 9C of the counterweight 9.

**[0061]** The fringe member 20 made of the elastic material is provided on the cover member 19 over the linear end edge 19A1 of the rear plate part 19A and the recessed end edges 19B1 of the left and right inclined plate parts 19B faced with the projected curved surface 9E and is configured to cover each of the end edges 19A1 and 19B1. As a result, the cover member 19 can be elastically brought into close contact with the projected curved surface 9E through the fringe member 20. As a result, the gap between the cover member 19 and the counterweight 9 can be eliminated so as to improve crime prevention performances, and the appearance can be also made favorable. Moreover, since the fringe member 20 made of the elastic material can prevent occurrence of noise caused by collision of the cover member 19 against the counterweight 9 or damage on the cover member 19 or the counterweight 9, their lives can be prolonged.

**[0062]** On the other hand, the cover member 19 is formed of rear plate part 19A closing the gap between the rear end of the rear part lower surface 12F of the mounting plate 12 constituting the rear camera device 11 and the counterweight 9 and the left and right inclined plate parts 19B extending from the both left and right ends of the rear plate part 19A to the front side along the projected curved surface 9E of the counterweight 9 and closing the left and right gaps from the counterweight 9. As a result, the gap 18 formed between the projected curved surface 9E of the counterweight 9 and the rear part lower surface 12F of the mounting plate 12 can have its rear side covered by the rear plate part 19A and the both left and right sides covered by the left and right inclined plate parts 19B.

**[0063]** Moreover, the end edges 19B1 on the lower side of the left and right inclined plate parts 19B constituting the cover member 19 are formed each having a recessed arc shape along the projected curved surface 9E of the counterweight 9. Therefore, the recessed end edge 19B1 having the recessed arc shape can be brought into close contact with the projected curved surface 9E and can effectively cover a space between the cover member 19 and the counterweight 9 without a gap. As a result, the crime prevention performances by the cover member 19 can be improved, and appearance can be also made favorable.

**[0064]** It should be noted that in the embodiment, the case in which the cover member 19 is configured to be provided separately from the mounting plate 12 of the rear camera device 11 and to be fixed to the mounting plate 12 by using the welding means is described as an example. However, the present invention is not limited thereto, but the mounting plate 12 and the cover member 19 may be configured to be integrally formed by using a press molding machine, for example. Other than that, it may be so configured that a bending margin is provided on the rear side of the mounting plate 12 and the cover member 19 is formed by bending this bending margin.

**[0065]** In the embodiment, the case in which the cover member 19 is formed having a trapezoidal shape by bending a single plate body at two spots in the length direction is exemplified. However, the present invention is not limited thereto, and the cover member 19 may have another shape such as a U-shape, a V-shape and the like.

**[0066]** On the other hand, in the embodiment, the function of preventing theft is configured to be provided by providing the engaging groove 10E in the top plate 10A of the camera device mounting member 10 on the counterweight 9 side, by providing the hook member 13 on the mounting plate 12 of the rear camera device 11, and by engaging the hook member 13 with the engaging groove 10E. However, the present invention is not limited thereto, and it may be so configured that the rear camera device 11 is mounted on the upper surface 9C of the counterweight 9 by using a bolt without providing the theft preventing function, for example. As another theft preventing function, it may be so configured that the rear camera device 11 is mounted on the counterweight 9 by using a bolt having a head part with a special shape, for example.

**[0067]** Moreover, in the embodiment, the crawler-type hydraulic excavator 1 is described as an example of a construction machine. However, the present invention is not limited thereto, and the present invention can be applied to any construction machine as long as it is provided with a counterweight and can be widely applied to other construction machines including a wheel-type hydraulic excavator, a hydraulic crane, and a wheel loader, for example.

DESCRIPTION OF REFERENCE NUMERALS

**[0068]**

| | |
|---|---|
| 1: | Hydraulic excavator (Construction machine) |
| 2: | Lower traveling structure (Vehicle body) |
| 3: | Upper revolving structure (Vehicle body) |
| 4: | Working mechanism |
| 9: | Counterweight |
| 9B: | Rear surface |
| 9B1: | Upper end part |
| 9C: | Upper surface |
| 9C1: | Rear end part |
| 9E: | Projected curved surface |
| 10: | Camera device mounting member |
| 10A: | Top plate |
| 10B: | Recessed bottom plate |
| 10C: | Through hole |
| 10D: | Welding nut |
| 11: | Rear camera device |
| 12: | Mounting plate |
| 12A: | Rear end edge |
| 12B: | inclined end edge |
| 12C, 12D: | Bolt insertion hole |
| 12F: | Rear part lower surface (Rear part lower position) |
| 15: | Camera housing |
| 17: | Camera body |
| 18: | Gap |
| 19: | Cover member |
| 19A: | Rear plate part |
| 19A1: | Linear end edge |
| 19B: | Inclined plate part |
| 19B1: | Recessed end edge |
| 20: | Fringe member |
| A: | Range of projected curved surface (Boundary position between rear surface and upper surface of counterweight) |

## Claims

**1.** A construction machine comprising:

an automotive vehicle body (2, 3);
a working mechanism (4) provided on a front side of said vehicle body (2, 3);
a counterweight (9) provided on a rear side of said vehicle body (2, 3) for taking a weight balance with said working mechanism (4); and
a rear camera device (11) mounted on an upper surface (9C) of said counterweight (9) for obtaining a visual field in the rear, **characterized in that**:

said counterweight (9) is formed as a block body in which a boundary position between a rear surface (9B) and said upper surface (9C) is a projected curved surface (9E) which is curved with a projected arc shape;
said rear camera device (11) is arranged on said upper surface (9C) of said counterweight (9) and in a state protruding toward said projected curved surface (9E) of said counterweight (9); and
a cover member (19) covering a gap (18) formed by said projected curved surface (9E) is provided between said projected curved surface (9E) of said counterweight (9) and a rear part lower position (12F) of said rear camera device (11).

**2.** The construction machine according to claim 1, wherein
said rear camera device (11) is constituted by a mounting plate (12) extending in a front and rear direction and mounted on said upper surface (9C) of said counterweight (9), a camera housing (15) provided on a rear side on said mounting plate (12), and a camera body (17) accommodated in said camera housing (15); and
said cover member (19) is mounted on said rear part lower position (12F) of said mounting plate (12).

**3.** The construction machine according to claim 2, wherein
an accommodating recessed portion (9G) is provided at a center part in a left and right direction on said upper surface (9C) of said counterweight (9);

a camera device mounting member (10) composed of a top plate (10A) covering said accommodating recessed portion (9G) and mounted on said upper surface (9C) and a recessed bottom plate (10B) mounted on a lower surface of said top plate (10A) and accommodated in said accommodating recessed portion (9G) is provided on said upper surface (9C) of said counterweight (9);
a welding nut (10D) having a female screw hole at a position faced with said recessed bottom plate (10B) is provided on the lower surface of said top plate (10A);
a bolt insertion hole (12C) is provided at a position corresponding to said welding nut (10D) on said mounting plate (12) of said rear camera device (11); and
said mounting plate (12) is configured to be mounted on said welding nut (10D) through said bolt insertion hole (12C) using a bolt (14).

**4.** The construction machine according to claim 1, wherein
a fringe member (20) made of an elastic material is provided on said cover member (19) so as to cover an end edge (19A1, 19B1) on a lower side faced with said projected curved surface (9E) of said counterweight (9).

**5.** The construction machine according to claim 1, wherein
said cover member (19) is formed of a rear plate part (19A) closing a gap between a rear end of said rear part lower position (12F) of said rear camera device (11) and said counterweight (9) and left and right inclined plate parts (19B) extending from both left and right ends of said rear plate part (19A) to a front side along said projected curved surface (9E) of said counterweight (9) and closing left and right gaps from said counterweight (9).

**6.** The construction machine according to claim 5, wherein
end edges (19B1) on lower sides of said left and right inclined plate part (19B) of said cover member (19) are formed each having a recessed arc shape along said projected curved surface (9E) of said counterweight (9).

**Amended claims under Art. 19.1 PCT**

**1.** (Amended) A construction machine comprising:

an automotive vehicle body (2, 3);
a working mechanism (4) provided on a front side of said vehicle body (2, 3);
a counterweight (9) provided on a rear side of said vehicle body (2, 3) for taking a weight balance with said working mechanism (4); and
a rear camera device (11) mounted on an upper surface (9C) of said counterweight (9) for obtaining a visual field in the rear, **characterized in that**:

said counterweight (9) is formed as a block body in which a boundary position between a rear surface (9B) and said upper surface (9C) is a projected curved surface (9E) which is curved with a projected arc shape;
said rear camera device (11) is arranged on said upper surface (9C) of said counterweight (9) and in a state protruding toward said projected curved surface (9E) of said counterweight (9); and
a cover member (19) covering a gap (18) formed by said projected curved surface (9E) is provided between said projected curved surface (9E) of said counterweight (9) and a rear part lower position (12F) of said rear camera device (11), wherein

said rear camera device (11) is constituted by a mounting plate (12) extending in a front and rear direction and mounted on said upper surface (9C) of said counterweight (9), a camera housing (15) provided on a rear side on said mounting plate (12), and a camera body (17) accommodated in said camera housing (15); and
said cover member (19) is mounted on said rear part lower position (12F) of said mounting plate (12).

**2.** (Canceled)

**3.** (Amended) The construction machine according to claim 1, wherein
an accommodating recessed portion (9G) is provided at a center part in a left and right direction on said upper surface (9C) of said counterweight (9);
a camera device mounting member (10) composed of a top plate (10A) covering said accommodating recessed portion (9G) and mounted on said upper surface (9C) and a recessed bottom plate (10B) mounted on a lower surface of said top plate (10A) and accommodated in said accommodating recessed portion (9G) is provided on said upper surface (9C) of said counterweight (9);
a welding nut (10D) having a female screw hole at a position faced with said recessed bottom plate (10B) is provided on the lower surface of said top plate (10A);
a bolt insertion hole (12C) is provided at a position corresponding to said welding nut (10D) on said mounting plate (12) of said rear camera device (11); and
said mounting plate (12) is configured to be mounted

on said welding nut (10D) through said bolt insertion hole (12C) using a bolt (14).

**4.** The construction machine according to claim 1, wherein
a fringe member (20) made of an elastic material is provided on said cover member (19) so as to cover an end edge (19A1, 19B1) on a lower side faced with said projected curved surface (9E) of said counterweight (9).

**5.** The construction machine according to claim 1, wherein
said cover member (19) is formed of a rear plate part (19A) closing a gap between a rear end of said rear part lower position (12F) of said rear camera device (11) and said counterweight (9) and left and right inclined plate parts (19B) extending from both left and right ends of said rear plate part (19A) to a front side along said projected curved surface (9E) of said counterweight (9) and closing left and right gaps from said counterweight (9).

**6.** The construction machine according to claim 5, wherein
end edges (19B1) on lower sides of said left and right inclined plate part (19B) of said cover member (19) are formed each having a recessed arc shape along said projected curved surface (9E) of said counterweight (9).

**Statement under Art. 19.1 PCT**

According to the International Search Opinion, it is recognized that the inventions as defined in Claim 1, Claim 5 and Claim 6 do not involve the inventive step by Document 1 (JP 2011-42979 A) and Document 2 (JP 4273336 B2) cited in the International Search Report.

On the other hand, it is recognized that the invention as defined in Claim 2, Claim 3 and Claim 4 is not described in any document cited in the International Search Report, and is not obvious for persons skilled in the art.

Therefore, a new amended Claim 1 is made by combining Claim 1 and Claim 2 as originally filed.

Claim 2 is cancelled according to amendment of Claim 1, and Claim 3 is to be a depended claim to a new Claim 1.

Fig.1

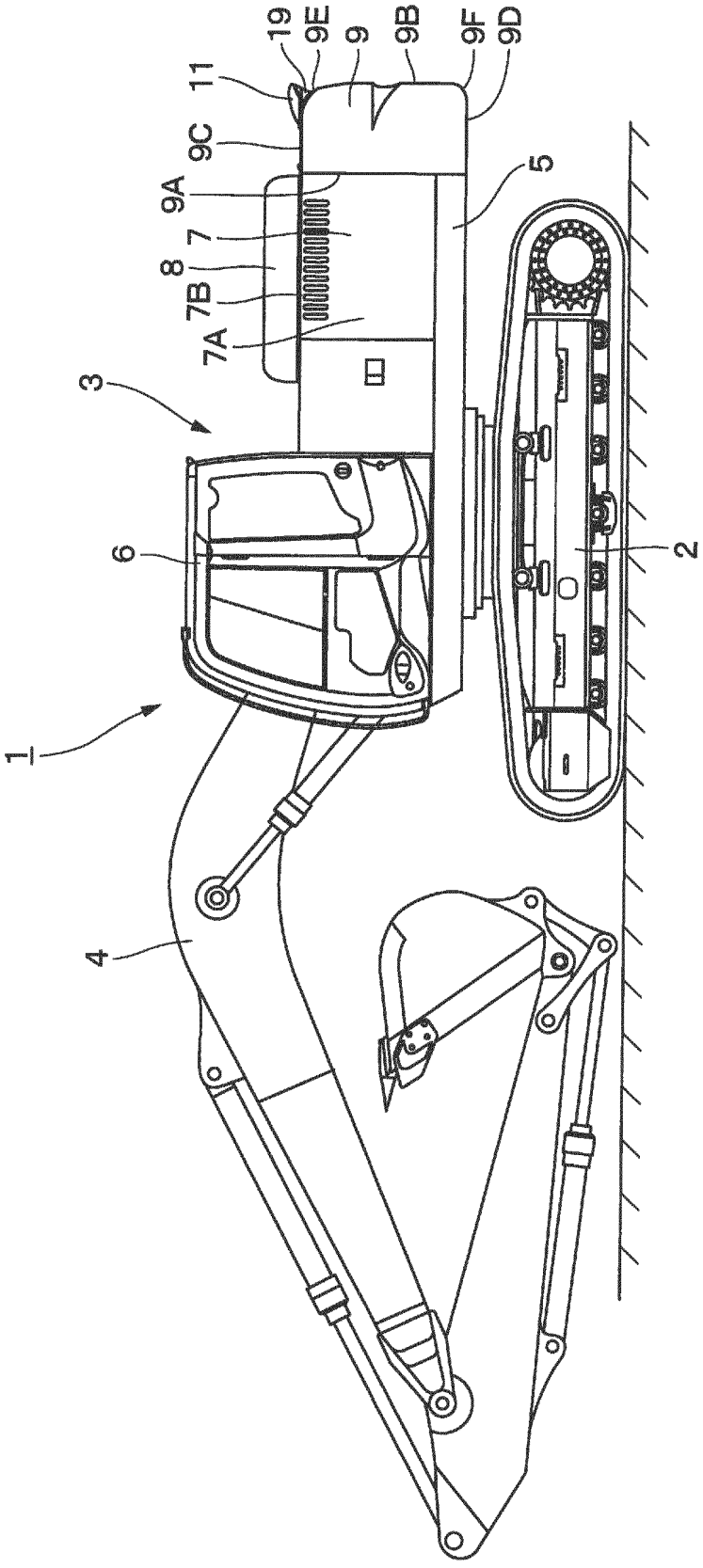


Fig.2

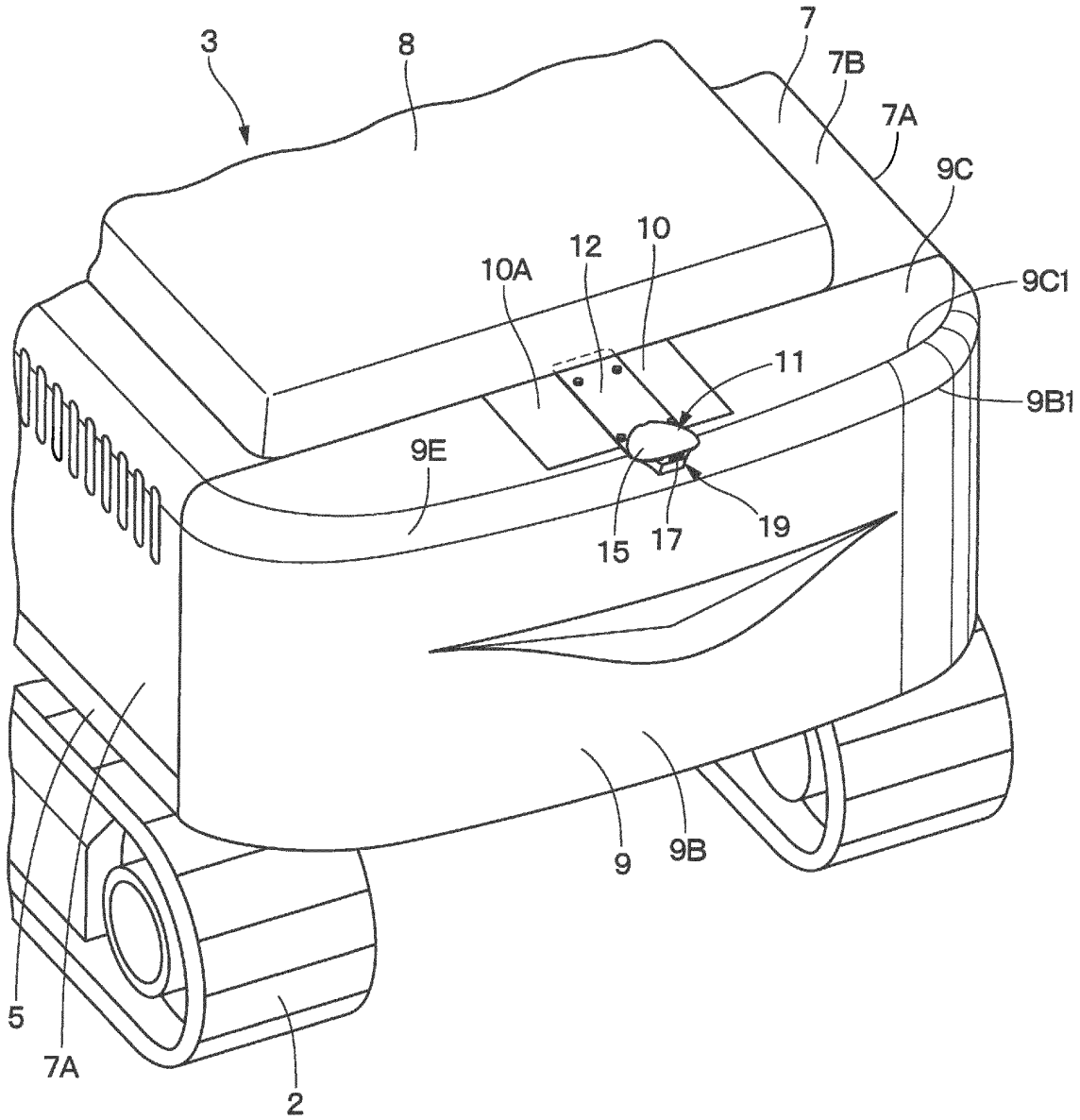
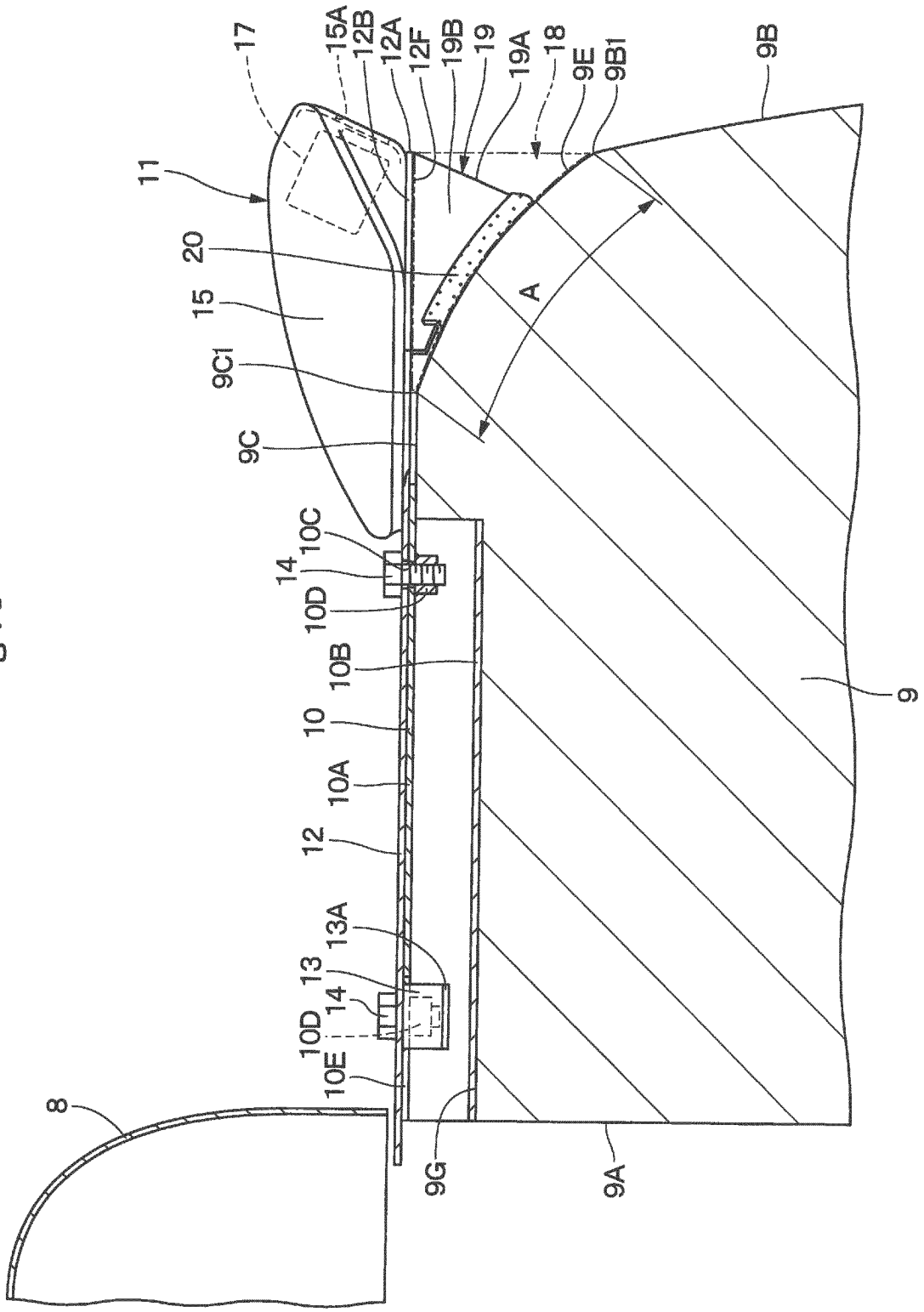


Fig.3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A
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9G
9A
9

Fig.4

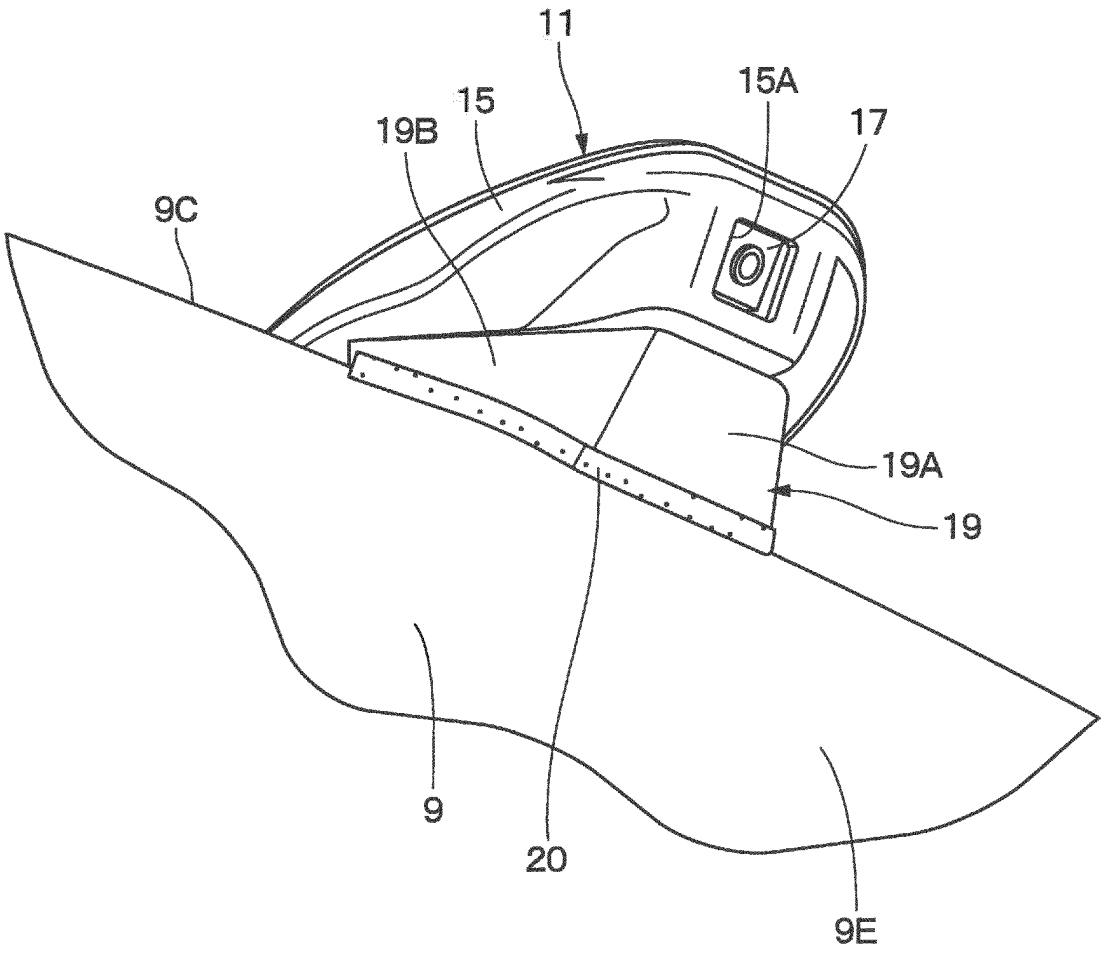

Fig.5

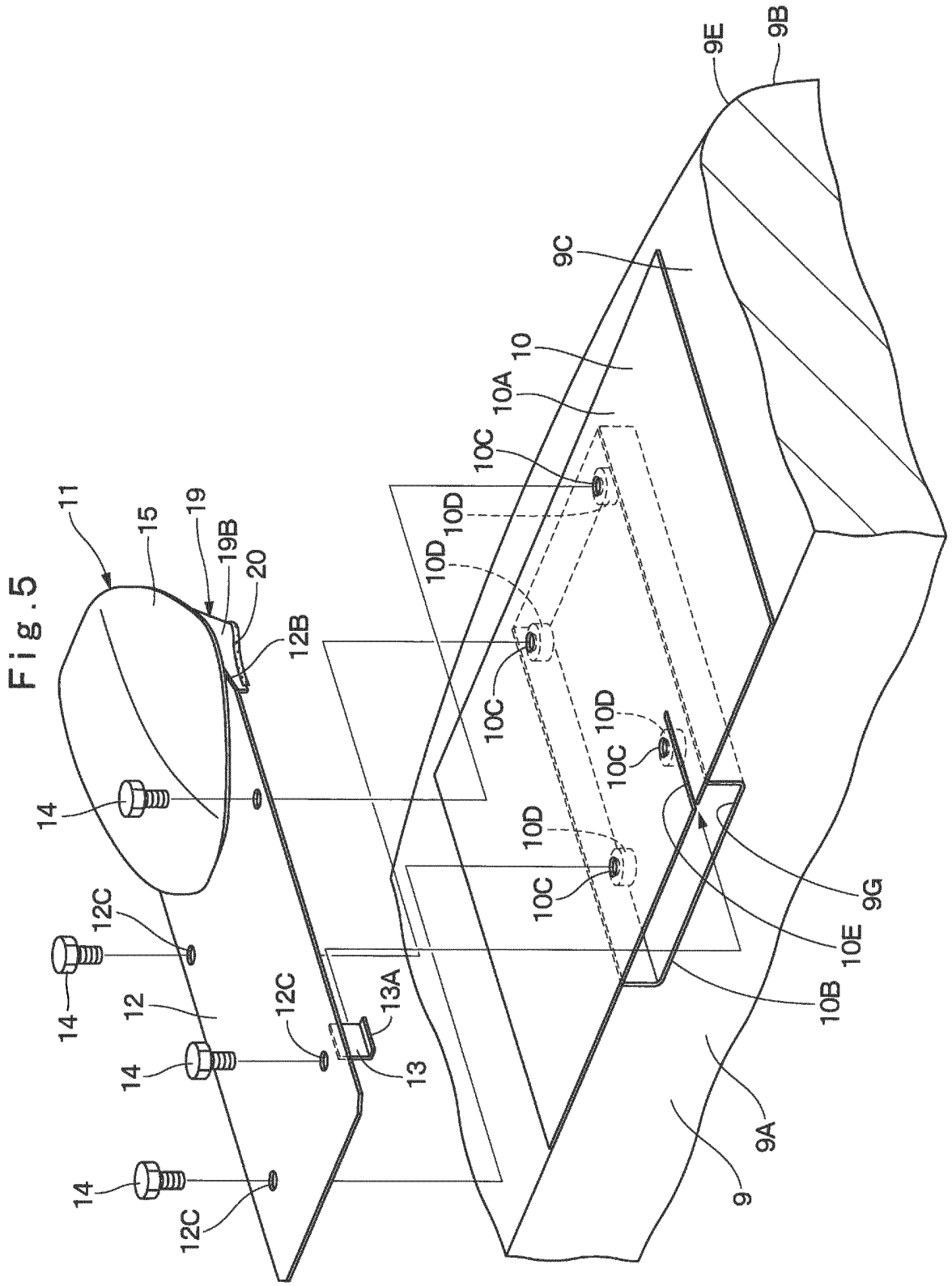
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Fig.6

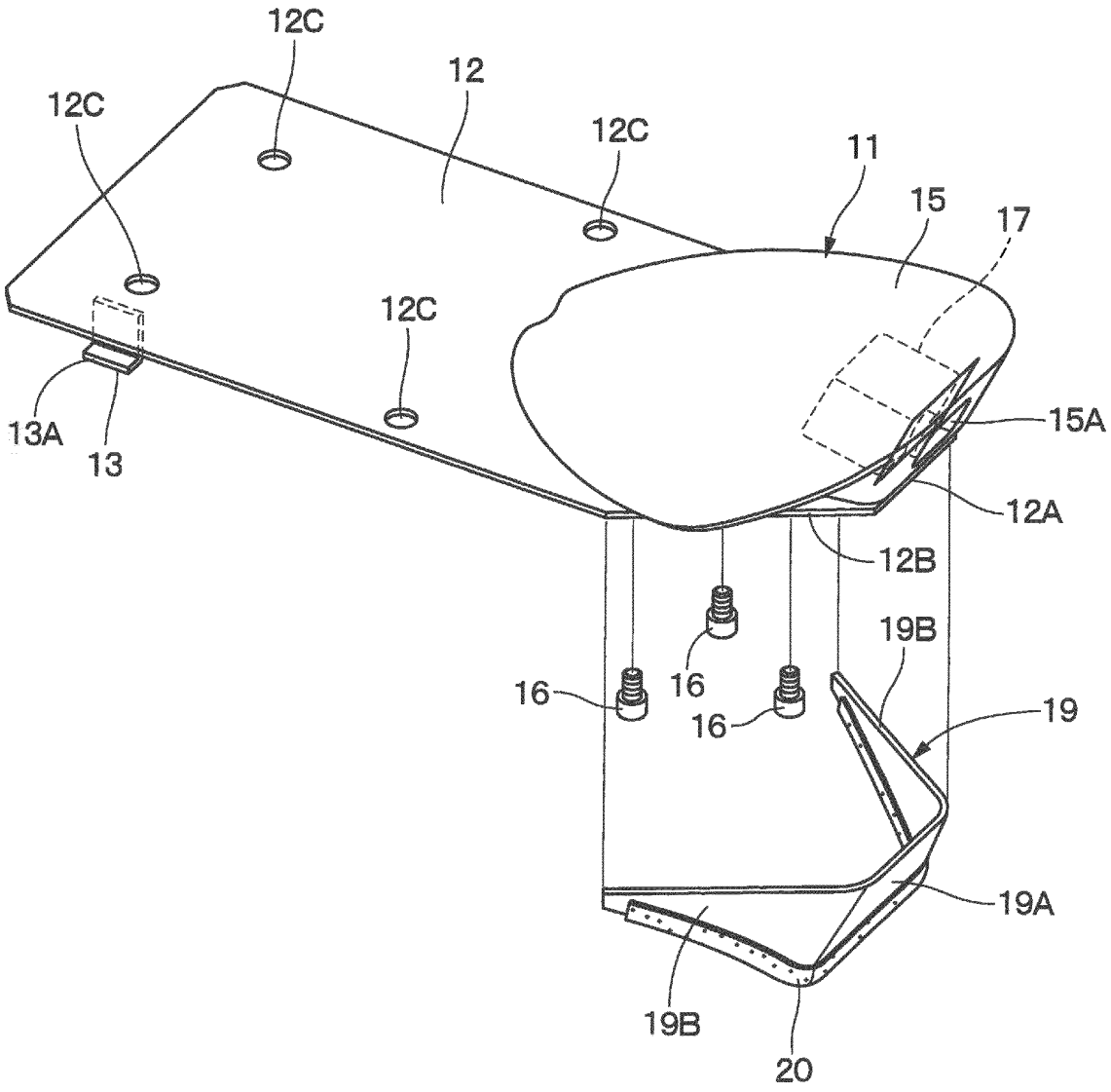
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Fig.7

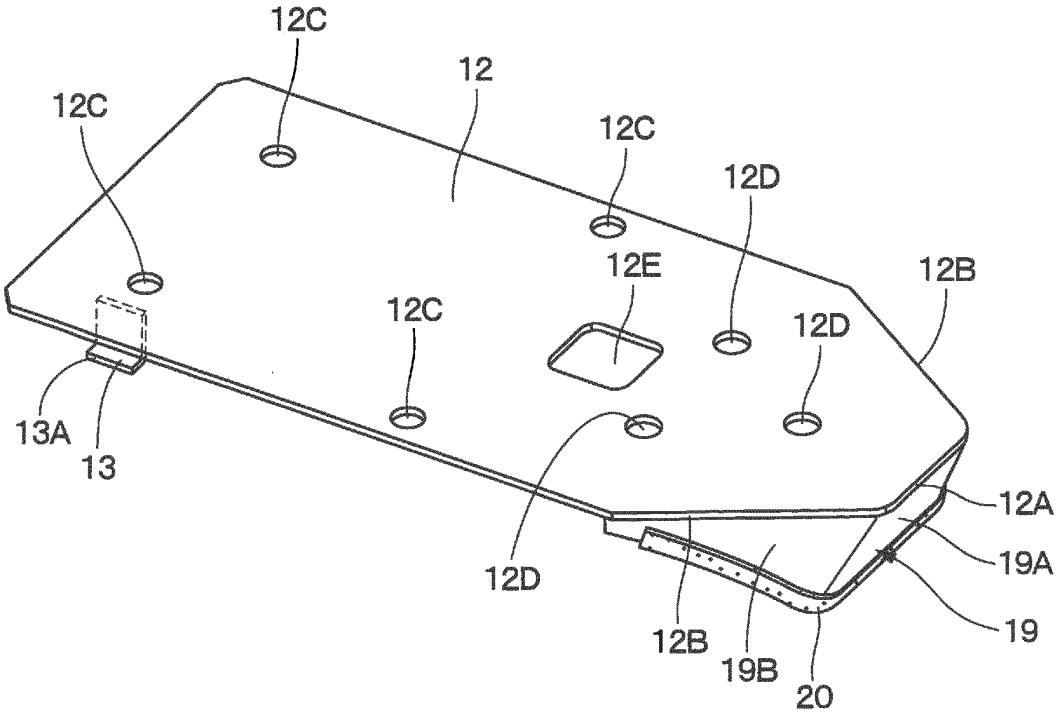
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Fig.8

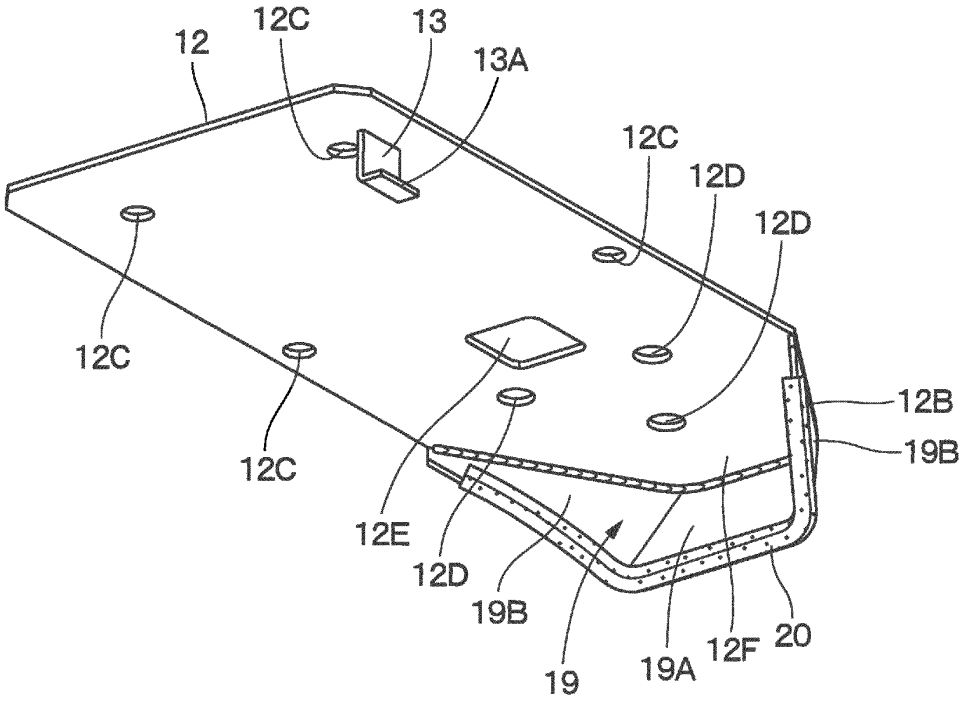
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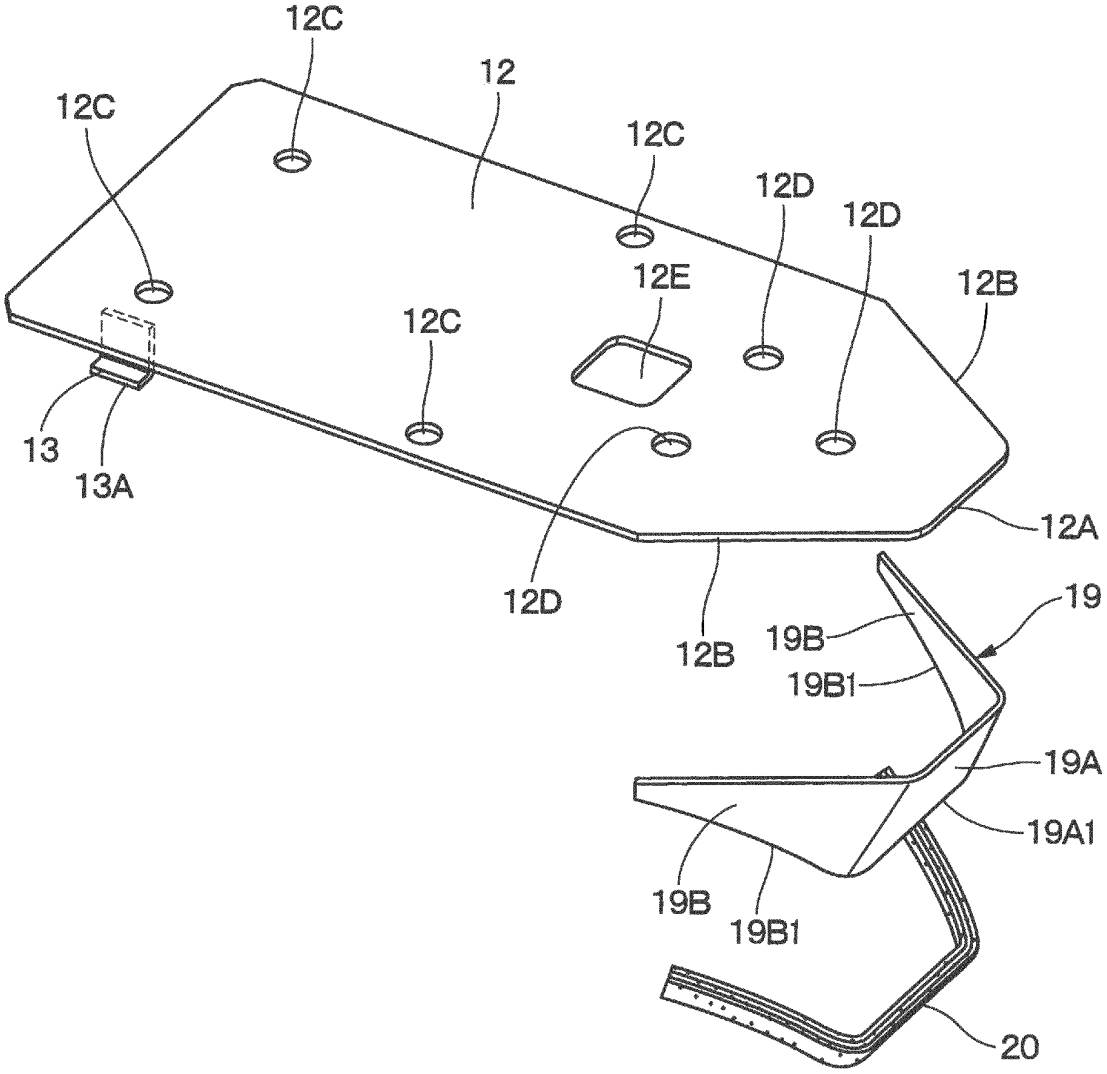
Fig.9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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2013/078318

A. CLASSIFICATION OF SUBJECT MATTER
*E02F9/26*(2006.01)i, *E02F9/18*(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)
E02F9/26, E02F9/18, E02F9/24, B60R1/00, B62D25/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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<br>A | JP 2011-42979 A (Hitachi Construction Machinery Co., Ltd.), 03 March 2011 (03.03.2011), entire text; fig. 1 to 10 (Family: none) | 1,5,6<br>2-4 |
| Y<br>A | JP 4273336 B2 (Hitachi Construction Machinery Co., Ltd.), 03 June 2009 (03.06.2009), paragraphs [0017] to [0025]; fig. 1 to 4 (Family: none) | 1,5,6<br>2-4 |

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

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 25 December, 2013 (25.12.13) | 14 January, 2014 (14.01.14) |
| Name and mailing address of the ISA/<br>Japanese Patent Office<br><br>Facsimile No. | Authorized officer<br><br>Telephone No. |

Form PCT/ISA/210 (second sheet) (July 2009)

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 2008231726 A **[0004]**
- JP 2011042979 A **[0004]**