

## DESCRIPTION

### Title of Invention: FIXTURE

### Technical Field

[0001] The present disclosure relates to a fixture.

### Background Art

[0002] Generally, there are cases where an attachment target object is attached to another attachment target object, such as a case where a part is fixed or arranged at an appropriate position. For example, a process of manufacturing a railcar includes a step of attaching window glass having a curved surface corresponding to the shape of a carbody to the carbody (see PTL 1, for example). When the shapes of the carbody and the window glass are complicated, it is difficult to produce the carbody and the window glass with a high degree of accuracy, and therefore, contact surfaces of these do not necessarily coincide with each other. Therefore, it is necessary to perform such position adjustment that the contact surfaces of these are brought into contact with each other in as wide a range as possible by, for example, inserting a spacer into a gap generated between the carbody and the window glass, the spacer having an angle and a thickness which are the same as those of the gap.

### Citation List

#### Patent Literature

[0003] PTL 1: Japanese Laid-Open Patent Application Publication No. 8-207761

### Summary of Invention

#### Technical Problem

[0004] In the above position adjustment, merely moving an attachment target object in parallel with another attachment target object is inadequate, and there are cases where the attachment target object needs to be moved complicatedly, such as a case where an attachment target object may need to be inclined relative to another attachment target object. In addition, after the position adjustment is performed, relative positions of both attachment target objects need to be fixed. When performing the position adjustment again, the relative positions need to be unfixed.

[0005] The present disclosure was made under these circumstances, and an object of the present disclosure is to provide a fixture which allows complicated relative movements of two attachment target objects and can easily fix or unfix relative positions of the attachment target

objects.

### **Solution to Problem**

[0006] A fixture according to one aspect of the present disclosure includes: a first attaching part fixed to a first attachment target object; a second attaching part fixed to a second attachment target object, an attaching angle of the second attaching part to the first attaching part and the first attachment target object being adjustable; and at least one positioning bolt fixing a position of the second attaching part relative to the first attaching part. The first attaching part includes: a cylindrical portion extending in a z direction and including a first elongated hole which is located on an outer peripheral surface of the cylindrical portion and extends in a circumferential direction and through which the positioning bolt penetrates; a shaft portion that turns inside the cylindrical portion and includes a screw hole corresponding to the positioning bolt; and a first fixing portion to which the first attachment target object is fixed. The second attaching part includes: a movable portion including a second elongated hole which corresponds to the first elongated hole and extends in an x direction perpendicular to the z direction and through which the positioning bolt penetrates; and a second fixing portion to which the second attachment target object is fixed. Position adjustment of the first attaching part relative to the second attaching part about a z-axis extending in the z direction is performed by the positioning bolt and the first elongated hole. Position adjustment of the first attaching part relative to the second attaching part in the x direction is performed by the positioning bolt and the second elongated hole. Position adjustment of the first attaching part relative to the second attaching part about a y-axis perpendicular to the z direction and the x direction is performed by the positioning bolt and the second elongated hole.

[0007] According to this configuration, the second attaching part is complicatedly movable relative to the first attaching part. In addition, the relative positions of the first attaching part and the second attaching part can be fixed only by tightening the positioning bolt and can be unfixed by loosening the positioning bolt. Therefore, according to the above configuration, the second attachment target object to which the second attaching part is fixed is complicatedly movable relative to the first attachment target object to which the first attaching part is fixed, and the relative positions of these attachment target objects can be easily fixed or unfixed.

### **Advantageous Effects of Invention**

[0008] According to the above configuration, the present disclosure can provide a fixture which allows complicated relative movements of two attachment target objects and can easily fix

or unfixed relative positions of the attachment target objects.

### **Brief Description of Drawings**

[0009] FIG. 1 is a perspective view of a fixture when viewed from a direction.

FIG. 2 is an exploded perspective view of the fixture when viewed from the direction.

FIG. 3 is a perspective view of the fixture when viewed from another direction.

FIG. 4 is an exploded perspective view of the fixture when viewed from the another direction.

FIG. 5 is a sectional view showing a third attaching part and its peripheral parts.

FIG. 6 is a sectional view showing the third attaching part and its peripheral parts in Modified Example 1.

FIG. 7 is a sectional view showing the third attaching part and its peripheral parts in Modified Example 2.

### **Description of Embodiments**

[0010] Hereinafter, a fixture 100 according to an embodiment will be described. FIG. 1 is a perspective view of the fixture 100 when viewed from a direction. FIG. 2 is an exploded perspective view of the fixture 100 when viewed from the direction. FIG. 3 is a perspective view of the fixture 100 when viewed from another direction. FIG. 4 is an exploded perspective view of the fixture 100 when viewed from the another direction. An x direction, a y direction, and a z direction described below are directions perpendicular to each other.

[0011] The fixture 100 according to the present embodiment is a part by which a second attachment target object 102 is attached to a first attachment target object 101 (see FIG. 1). As shown in FIG. 2, the fixture 100 includes a first attaching part 10, a second attaching part 20, a third attaching part 30, and positioning bolts 40. Hereinafter, these components will be described in order.

#### **[0012] First Attaching Part**

The first attaching part 10 is a part fixed to the first attachment target object 101. The first attaching part 10 includes a cylindrical portion 11, a shaft portion 12, and a first fixing portion 13.

[0013] The cylindrical portion 11 has a cylindrical shape and extends in the z direction. An outer peripheral surface of the cylindrical portion 11 includes at least one first elongated hole 14 (in the present embodiment, three first elongated holes 14) extending in a circumferential

direction. The first elongated holes 14 are arranged at intervals in the z direction.

[0014] The shaft portion 12 is a member that turns inside the cylindrical portion 11. The shaft portion 12 includes screw holes 15 at positions corresponding to the first elongated holes 14. The screw holes 15 include screw threads therein, and the positioning bolts 40 are fastened to the screw threads.

[0015] The first fixing portion 13 is a plate-shaped portion that is continuous with the cylindrical portion 11. As shown in FIG. 3, the first attachment target object 101 is fixed to the first fixing portion 13. The first fixing portion 13 includes a hole 16 (see FIG. 2), and the first attachment target object 101 is fixed to the first fixing portion 13 by a rivet 17 inserted into the hole 16. The first attachment target object 101 may be fixed to the first fixing portion 13 by a method other than rivet fastening, for example, by using a bolt instead of the rivet 17.

[0016] **Second Attaching Part**

The second attaching part 20 is a part to which the second attachment target object 102 is fixed. An attaching angle of the second attaching part 20 to the first attaching part 10 and the first attachment target object 101 is adjustable. The second attaching part 20 includes a movable portion 21, a second fixing portion 22, and a floating nut 23.

[0017] The movable portion 21 is a portion attached to the first attaching part 10 so as to be turnable relative to the first attaching part 10. The movable portion 21 of the present embodiment has a plate shape and includes second elongated holes 24. The second elongated holes 24 are arranged so as to correspond to the first elongated holes 14 of the first attaching part 10. The second elongated holes 24 extend in the x direction.

[0018] The second fixing portion 22 is a portion to which the second attachment target object 102 is fixed. The second fixing portion 22 of the present embodiment has a plate shape. The second fixing portion 22 is continuous with the movable portion 21 and has an angle of 90 degrees to the movable portion 21. With this, the entire second attaching part 20 has an L shape. The angle between the movable portion 21 and the second fixing portion 22 does not have to be 90 degrees, and the movable portion 21 and the second fixing portion 22 may be located on the same plane.

[0019] The floating nut 23 is a nut disposed at the second fixing portion 22. As shown in FIG. 1, the second attachment target object 102 is fixed to the second fixing portion 22 by using a fixing bolt 25. The fixing bolt 25 penetrates a through hole 26 located at the second fixing portion 22 and is fastened to the floating nut 23. As shown in FIG. 4, the floating nut 23 is accommodated in a casing 27 having an internal space and can move in parallel with the second fixing portion 22. To be specific, the floating nut 23 can move on a plane defined by the y

direction and the z direction. The floating nut 23 is not limited to the above structure as long as the floating nut 23 is movable on the plane defined by the y direction and the z direction.

[0020] Since the floating nut 23 is configured as above, the second attachment target object 102 is turnable relative to the second attaching part 20 about an x-axis extending in the x direction and is movable in the x direction and the z direction. Then, by tightening the fixing bolt 25, the relative positions of the second attaching part 20 and the second attachment target object 102 can be fixed. Moreover, by loosening the fixing bolt 25, the movement of the second attachment target object 102 relative to the second attaching part 20 can be allowed.

[0021] **Third Attaching Part**

The third attaching part 30 is a part located between the cylindrical portion 11 of the first attaching part 10 and the movable portion 21 of the second attaching part 20. The third attaching part 30 includes: a plate-shaped main body portion 31 extending in the z direction; and a pair of leg portions 32 which extend from both x-direction end portions of the main body portion 31 toward the cylindrical portion 11 of the first attaching part 10. The main body portion 31 includes communication holes 33 at positions corresponding to the first elongated holes 14 of the first attaching part 10.

[0022] FIG. 5 is a sectional view showing the third attaching part 30 and its peripheral parts. As shown in FIG. 5, the main body portion 31 of the third attaching part 30 is in surface contact with the movable portion 21, and the pair of leg portions 32 of the third attaching part 30 are in line contact with the outer peripheral surface of the cylindrical portion 11. To be specific, in a sectional view perpendicular to the z direction, the third attaching part 30 is in point contact with the first attaching part 10 at two positions. Since the third attaching part 30 is arranged between the first attaching part 10 and the second attaching part 20, the second attaching part 20 can be held by the first attaching part 10 more stably than when the plate-shaped second attaching part 20 is in direct contact with the cylindrical first attaching part 10. In a sectional view perpendicular to the z direction, the third attaching part 30 may be in point contact with the first attaching part 10 at three or more positions or may have an arc shape and be continuously in contact with the first attaching part 10.

[0023] FIG. 6 is a sectional view showing the third attaching part 30 and its peripheral parts in Modified Example 1. The third attaching part 30 may be configured as shown in FIG. 6. To be specific, the outer peripheral surface of the cylindrical portion 11 of the first attaching part 10 may include outer peripheral grooves 18 extending in the z direction, and a portion of the third attaching part 30 which portion is in contact with an outer peripheral surface of the first attaching part 10 may include inner peripheral grooves 34 corresponding to the outer peripheral

grooves 18. According to this configuration, a positioning error of the second attaching part 20 with respect to the first attaching part 10 can be further suppressed.

[0024] FIG. 7 is a sectional view showing the third attaching part 30 and its peripheral parts in Modified Example 2. The third attaching part 30 may be configured as shown in FIG. 7. To be specific, the portion of the third attaching part 30 which portion is in contact with the outer peripheral surface of the first attaching part 10 may have a curved shape, and in a sectional view perpendicular to the z direction, the third attaching part 30 may be in line contact with the first attaching part 10. In other words, the third attaching part 30 may be in surface contact with the first attaching part 10.

[0025] **Positioning Bolt**

The positioning bolt 40 is a bolt that fixes the relative position of the second attaching part 20 relative to the first attaching part 10. The positioning bolt 40 includes: a head portion 41 having an outer diameter larger than a dimension of the second elongated hole 24 in the z direction; and a screw portion 42 having an outer diameter smaller than the dimension of the second elongated hole 24 in the z direction. The positioning bolt 40 penetrates the second elongated hole 24, the communication hole 33, and the first elongated hole 14 and is fastened to the screw hole 15 of the shaft portion 12.

[0026] By tightening the positioning bolt 40, the second attaching part 20 is pressed toward the first attaching part 10, and the relative positions of the first attaching part 10 and the second attaching part 20 are fixed. In contrast, by loosening the positioning bolt 40, the second attaching part 20 is movable relative to the first attaching part 10.

[0027] Specifically, when the shaft portion 12 turns inside the cylindrical portion 11 of the first attaching part 10, the positioning bolt 40 turns along the first elongated hole 14. With this, the second attaching part 20 turns relative to the first attaching part 10 about a z-axis. Herein, the z-axis is an axis that extends in the z direction and passes through a center axis of the shaft portion 12.

[0028] Moreover, since the second elongated hole 24 through which the positioning bolt 40 penetrates extends in the x direction, the second attaching part 20 is movable in the x direction relative to the positioning bolt 40. Therefore, the second attaching part 20 is movable relative to the first attaching part 10 in the x direction. Furthermore, in the present embodiment, a dimension of the second elongated hole 24 in the z direction is much larger than the outer diameter of the screw portion 42 of the positioning bolt 40. Therefore, the second attaching part 20 is turnable relative to the first attaching part 10 about a y-axis extending in the y direction.

[0029] The fixture 100 according to the present embodiment includes three positioning bolts 40, but the number of positioning bolts 40 is not limited. For example, the fixture 100 may include only one positioning bolt 40. Moreover, each of the number of first elongated holes 14, the number of second elongated holes 24, and the number of communication holes 33 coincides with the number of positioning bolts 40. Therefore, for example, when the fixture 100 includes only one positioning bolt 40, each of the number of first elongated holes 14, the number of second elongated holes 24, and the number of communication holes 33 is one.

[0030] **Operational Advantages, etc.**

As above, the fixture 100 according to the present embodiment includes: the first attaching part 10 fixed to the first attachment target object 101; the second attaching part 20 fixed to the second attachment target object 102, an attaching angle of the second attaching part 20 to the first attaching part 10 and the first attachment target object 101 being adjustable; and at least one positioning bolt 40 fixing the position of the second attaching part 20 relative to the first attaching part 10. The first attaching part 10 includes: the cylindrical portion 11 extending in the z direction and including the first elongated hole 14 which is located on an outer peripheral surface of the cylindrical portion 11 and extends in the circumferential direction and through which the positioning bolt 40 penetrates; the shaft portion 12 that turns inside the cylindrical portion 11 and includes the screw hole 15 corresponding to the positioning bolt 40; and the first fixing portion 13 to which the first attachment target object 101 is fixed. The second attaching part 20 includes: the movable portion 21 including the second elongated hole 24 which corresponds to the first elongated hole 14 and extends in the x direction perpendicular to the z direction and through which the positioning bolt 40 penetrates; and the second fixing portion 22 to which the second attachment target object 102 is fixed. The position adjustment of the first attaching part 10 relative to the second attaching part 20 about the z-axis extending in the z direction is performed by the positioning bolt 40 and the first elongated hole 14. The position adjustment of the first attaching part 10 relative to the second attaching part 20 in the x direction is performed by the positioning bolt 40 and the second elongated hole 24. The position adjustment of the first attaching part 10 relative to the second attaching part 20 about the y-axis perpendicular to the z direction and the x direction is performed by the positioning bolt 40 and the second elongated hole 24.

[0031] As above, in the fixture 100 according to the present embodiment, the second attaching part 20 is complicatedly movable relative to the first attaching part 10. In addition, the relative positions of the first attaching part 10 and the second attaching part 20 can be fixed only by tightening the positioning bolt 40 and can be unfixed by loosening the positioning bolt

40. Therefore, in the fixture 100 according to the present embodiment, the second attachment target object 102 to which the second attaching part 20 is fixed is complicatedly movable relative to the first attachment target object 101 to which the first attaching part 10 is fixed, and the relative positions of the attachment target objects 101 and 102 can be easily fixed or unfixed.

[0032] Moreover, in the fixture 100 according to the present embodiment, the second attaching part 20 further includes the floating nut 23 to which the fixing bolt 25 is fastened, the fixing bolt 25 fixing the second fixing portion 22 to the second attaching part 20. The position adjustment of the second attaching part 20 relative to the second attachment target object 102 about the x-axis extending in the x direction, the position adjustment of the second attaching part 20 relative to the second attachment target object 102 in the y direction, and the position adjustment of the second attaching part 20 relative to the second attachment target object 102 in the z direction are performed by the fixing bolt 25 and the floating nut 23.

[0033] As above, since the fixture 100 according to the present embodiment includes the floating nut 23, the second attachment target object 102 is further complicatedly movable relative to the first attachment target object 101.

[0034] Moreover, in the fixture 100 according to the present embodiment, the at least one positioning bolt 40 includes the positioning bolts 40. The cylindrical portion 11 includes the first elongated holes 14 at intervals in the z direction. The movable portion 21 includes the second elongated holes 24 corresponding to the first elongated holes 14. The positioning bolts 40 penetrate the corresponding first elongated holes 14 and the corresponding second elongated holes 24 and are fastened to the corresponding screw holes 15 of the shaft portion 12.

[0035] As above, since the fixture 100 according to the present embodiment includes the positioning bolts 40, the position adjustment of the second attaching part 20 relative to the first attaching part 10 can be performed more stably than when the fixture 100 includes only one positioning bolt 40. To be specific, the position adjustment of the second attachment target object 102 relative to the first attachment target object 101 can be more stably performed.

[0036] Moreover, the fixture 100 according to the present embodiment further includes the third attaching part 30 located between the cylindrical portion 11 and the movable portion 21 and extending in the z direction. The third attaching part 30 includes at least one communication hole 33 through which the positioning bolt 40 penetrates. In a sectional view perpendicular to the z direction, the third attaching part 30 is in line contact with the outer peripheral surface of the cylindrical portion 11 or in point contact with the outer peripheral surface of the cylindrical portion 11 at at least two positions (see FIG. 5 to FIG. 7).

[0037] Therefore, in the fixture 100 according to the present embodiment, the second

attaching part 20 can be held by the first attaching part 10 more stably than when the second attaching part 20 is in direct contact with the first attaching part 10.

[0038] Moreover, in the present embodiment, the third attaching part 30 includes: the main body portion 31 including the communication hole 33; and the pair of leg portions 32 extending from the main body portion 31 toward the cylindrical portion 11. The pair of leg portions 32 are in contact with the outer peripheral surface of the cylindrical portion 11.

[0039] According to this configuration, the third attaching part 30 can be easily formed.

[0040] Moreover, in the present embodiment, an angle between the second fixing portion 22 and the movable portion 21 is a predetermined angle, and the entire second attaching part 20 has an L-shaped section.

[0041] According to this configuration, the second attachment target object 102 fixed to the second fixing portion 22 can be prevented from interfering with the positioning bolt 40. Therefore, the positioning bolt 40 can be easily tightened.

### Reference Signs List

|        |     |                                |
|--------|-----|--------------------------------|
| [0042] | 10  | first attaching part           |
|        | 11  | cylindrical portion            |
|        | 12  | shaft portion                  |
|        | 13  | first fixing portion           |
|        | 14  | first elongated hole           |
|        | 15  | screw hole                     |
|        | 20  | second attaching part          |
|        | 21  | movable portion                |
|        | 22  | second fixing portion          |
|        | 23  | floating nut                   |
|        | 24  | second elongated hole          |
|        | 25  | fixing bolt                    |
|        | 30  | third attaching part           |
|        | 31  | main body portion              |
|        | 32  | leg portion                    |
|        | 33  | communication hole             |
|        | 40  | positioning bolt               |
|        | 100 | fixture                        |
|        | 101 | first attachment target object |

102    second attachment target object

## CLAIMS

1. A fixture comprising:
  - a first attaching part fixed to a first attachment target object;
  - a second attaching part fixed to a second attachment target object, an attaching angle of the second attaching part to the first attaching part and the first attachment target object being adjustable; and
  - at least one positioning bolt fixing a position of the second attaching part relative to the first attaching part, wherein:
    - the first attaching part includes
      - a cylindrical portion extending in a z direction and including a first elongated hole which is located on an outer peripheral surface of the cylindrical portion and extends in a circumferential direction and through which the positioning bolt penetrates,
      - a shaft portion that turns inside the cylindrical portion and includes a screw hole corresponding to the positioning bolt, and
      - a first fixing portion to which the first attachment target object is fixed;
    - the second attaching part includes
      - a movable portion including a second elongated hole which corresponds to the first elongated hole and extends in an x direction perpendicular to the z direction and through which the positioning bolt penetrates and
      - a second fixing portion to which the second attachment target object is fixed;
  - position adjustment of the first attaching part relative to the second attaching part about a z-axis extending in the z direction is performed by the positioning bolt and the first elongated hole;
  - position adjustment of the first attaching part relative to the second attaching part in the x direction is performed by the positioning bolt and the second elongated hole; and
  - position adjustment of the first attaching part relative to the second attaching part about a y-axis perpendicular to the z direction and the x direction is performed by the positioning bolt and the second elongated hole.
2. The fixture according to claim 1, wherein:
  - the second attaching part further includes a floating nut to which a fixing bolt is fastened, the fixing bolt fixing the second fixing portion to the second attaching part; and
  - position adjustment of the second attaching part relative to the second attachment target object about an x-axis extending in the x direction, position adjustment of the second

attaching part relative to the second attachment target object in a y direction, and position adjustment of the second attaching part relative to the second attachment target object in the z direction are performed by the fixing bolt and the floating nut.

3. The fixture according to claim 1, wherein:

the at least one positioning bolt comprises positioning bolts;

the cylindrical portion includes first elongated holes at intervals in the z direction;

the movable portion includes second elongated holes corresponding to the first elongated holes; and

the positioning bolts penetrate the corresponding first elongated holes and the corresponding second elongated holes and are fastened to corresponding screw holes of the shaft portion.

4. The fixture according to claim 1, further comprising a third attaching part located between the cylindrical portion and the movable portion and extending in the z direction, wherein:

the third attaching part includes at least one communication hole through which the positioning bolt penetrates; and

in a sectional view perpendicular to the z direction, the third attaching part is in line contact with an outer peripheral surface of the cylindrical portion or in point contact with the outer peripheral surface of the cylindrical portion at at least two positions.

5. The fixture according to claim 4, wherein:

the third attaching part includes

a main body portion including the communication hole and

a pair of leg portions extending from the main body portion toward the cylindrical portion; and

the pair of leg portions are in contact with the outer peripheral surface of the cylindrical portion.

6. The fixture according to any one of claims 1 to 5, wherein:

an angle between the second fixing portion and the movable portion is a predetermined angle; and

the entire second attaching part has an L-shaped section.