

PASSENGER BOARDING BRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present disclosure relates to a passenger boarding bridge.

2. Description of the Related Art

[0002] For example, Patent Literature 1 (Japanese Laid-Open Utility Model Application Publication No. S62-145800) and Patent Literature 2 (Japanese Examined Utility Model Application Publication No. H03-11119) each disclose a passenger boarding bridge that serves as a passenger walkway between an aircraft and a terminal building of an airport.

[0003] The passenger boarding bridge includes: a rotunda connected to the terminal building and supported in a turnable manner; a tunnel unit whose proximal end is connected to the rotunda, the tunnel unit including a plurality of tunnels that are fitted together in a telescopic manner, such that the tunnel unit is extendable and retractable; and a turnable cab provided at the distal end of the tunnel unit. The passenger boarding bridge further includes drive columns that are provided at the distal side of the tunnel unit. The drive columns serve as support legs.

[0004] The drive columns include: a lifting/lowering device configured to support the tunnel unit and move the tunnel unit upward/downward; and a travel device including a plurality of travel wheels, the travel device being positioned below the lifting/lowering device. By moving the tunnel unit upward/downward by the lifting/lowering device, the tunnel unit can be swung vertically with respect to the rotunda. By causing the drive columns to travel on the apron by means of the travel device, the tunnel unit can be extended and retracted in the front-back direction and/or swung horizontally with respect to the rotunda. The tunnel unit is moved by the travel device of the drive columns thus configured, and thereby the cab at the distal end of the tunnel unit is connected to the aircraft, or the aircraft and the cab are disconnected from each other. Hereinafter, for the sake of convenience of the description, such an operation of disconnecting the aircraft and the cab from each other is referred to as a “normal cab undocking operation”.

SUMMARY OF THE INVENTION

[0005] However, the conventional art has not addressed problems that arise in a case where the normal cab undocking operation cannot be performed. Therefore, a problem to be solved by the present disclosure is, for example, to provide a passenger boarding bridge that is capable of retreating the cab from the aircraft more properly than the conventional art even in a case where the normal cab undocking operation cannot be performed.

[0006] In order to solve the above-described problems, a passenger boarding bridge according to one aspect of the present disclosure includes: a rotunda connected to a terminal building; a tunnel unit whose proximal end is connected to the rotunda; a cab provided at a distal end of the tunnel unit; and a travel device supporting the tunnel unit. The cab includes: a first floor configured to serve as a walkway that communicates with the tunnel unit; a second floor provided on the first floor; and a moving mechanism configured to move the second floor to a stop position at which the second floor is close to, or in contact with, an aircraft. The moving mechanism includes: a driver configured to apply driving force to the second floor; and a control device configured to control driving of the driver. The control device controls the driver to retreat the second floor stopped at the stop position to a retreat position away from the aircraft either in a case where a travel wheel of the travel device is unable to rotate or in a case where rotation of the travel wheel of the travel device for undocking the cab from the aircraft is prohibited.

[0007] A passenger boarding bridge according to another aspect of the present disclosure includes: a rotunda connected to a terminal building; a tunnel unit whose proximal end is connected to the rotunda; a cab provided at a distal end of the tunnel unit; a travel device supporting the tunnel unit; and a first control device configured to control an operation of the travel device. The cab includes: a first floor configured to serve as a walkway that communicates with the tunnel unit; a second floor provided on the first floor; and a moving mechanism configured to move the second floor to a stop position at which the second floor is close to, or in contact with, an aircraft. The moving mechanism includes: a driver configured to apply driving force to the second floor; and a second control device configured to control driving of the driver. Wiring used for the second control device is provided independently of wiring used for the first control device. The second control device controls the driver to retreat the second floor stopped at the stop position to a retreat

position away from the aircraft.

[0008] A passenger boarding bridge according to yet another aspect of the present disclosure includes: a rotunda connected to a terminal building; a tunnel unit whose proximal end is connected to the rotunda; and a cab provided at a distal end of the tunnel unit. The cab includes: a first floor configured to serve as a walkway that communicates with the tunnel unit; a second floor provided on the first floor; and a moving mechanism configured to move the second floor between a stop position at which the second floor is close to, or in contact with, an aircraft and a retreat position at which the second floor is located away from the aircraft. The second floor is fixed to the retreat position and/or the stop position by a stopper member of the moving mechanism.

[0009] The passenger boarding bridge of each of the above aspects of the present disclosure has an advantage of being able to retreat the cab from the aircraft more properly than the conventional art even in a case where the normal cab undocking operation cannot be performed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 shows one example of a passenger boarding bridge of Embodiment 1.

[0011] FIG. 2 shows one example of a cab of the passenger boarding bridge of Embodiment 1.

[0012] FIG. 3 shows one example of the cab of the passenger boarding bridge of Embodiment 1.

[0013] FIG. 4 shows one example of the cab of the passenger boarding bridge of Embodiment 1.

[0014] FIG. 5A is a sectional view of the cab of FIG. 2 taken along line A-A of FIG. 2 as viewed in the direction of arrows of line A-A.

[0015] FIG. 5B is a sectional view of the cab of FIG. 2 taken along line B-B of FIG. 2 as viewed in the direction of arrows of line B-B, the view showing a movable floor that has been retreated backward from the state of the cab shown in FIG. 5A.

[0016] FIG. 6 is a flowchart showing one example of operations for retreating the cab from the fuselage of an aircraft and fixing the cab to a retreat position in a case where a normal cab undocking operation cannot be performed.

[0017] FIG. 7 shows one example of the cab of the passenger boarding bridge of Embodiment 2.

[0018] FIG. 8A is a sectional view of the cab of FIG. 7 taken along line A-A of FIG. 7 as viewed in the direction of arrows of line A-A.

[0019] FIG. 8B is a sectional view of the cab of FIG. 7 taken along line A-A of FIG. 7 as viewed in the direction of arrows of line A-A, the view showing the movable floor that has been retreated backward from the state of the cab shown in FIG. 8A.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] The inventors of the present disclosure have conducted diligent studies regarding the problems that arise in a case where the normal cab undocking operation cannot be performed. As a result of the diligent studies, findings as described below have been obtained.

[0021] As described above, normally, by moving the tunnel unit by the travel device of the drive columns, the cab provided at the distal end of the tunnel unit can be retreated from the aircraft. However, in some situations as described below, it is possible that the cab cannot be retreated from the aircraft by the normal cab undocking operation.

[0022] The first situation is that electric power supply from a commercial power source to the passenger boarding bridge is stopped, and for this reason, a driver (a travel motor) of the travel device cannot be operated. Therefore, the cab cannot be retreated from the aircraft by the normal cab undocking operation (hereinafter, “the First Case”). In this case, as one example of conventional measures, it is necessary to wait for the restoration of the electric power supply from the commercial power source to the passenger boarding bridge. As another example of conventional measures, the brake of the travel motor of the travel device is released, and the passenger boarding bridge needs to be towed away from the aircraft by a pushback truck or the like.

[0023] The second situation is that a failure has occurred in the control system of the passenger boarding bridge, and for this reason, the driver (the travel motor) of the travel device cannot be operated. Therefore, the cab cannot be retreated from the aircraft by the normal cab undocking operation (hereinafter, “the Second Case”). In this case, as one example of conventional measures, it is necessary to wait for the restoration of the control

system. As another example of conventional measures, the brake of the travel motor of the travel device is released, and the passenger boarding bridge needs to be towed away from the aircraft by a pushback truck or the like.

[0024] The third situation is that the cab is docked with the aircraft in such a manner that the travel wheels of the travel device cannot be rotated in a direction for retreating the cab from the aircraft.

[0025] In general, the passenger boarding bridge is configured on the assumption that an operator operates a travel lever to an operation position for forward traveling of the travel device to rotate the travel wheels of the travel device in the forward direction, thereby docking the cab with the fuselage of the aircraft (hereinafter, docking performed in such a manner may be simply referred to as “forward docking” of the cab). Therefore, normally, when docking the cab with the fuselage of the aircraft, the operator is prohibited from operating the travel lever to an operation position for backward traveling of the travel device to rotate the travel wheels of the travel device in the reverse direction (hereinafter, docking performed in such a normally prohibited manner may be simply referred to as “backward docking” of the cab). Specifically, generally speaking, the operator operates the travel lever to the operation position for backward traveling of the travel device to rotate the travel wheels of the travel device in the reverse direction, thereby retreating the cab from the aircraft, which is a normal retreating operation.

[0026] However, for example, if an operator who is unfamiliar with operating the passenger boarding bridge carelessly turns the travel wheels of the travel device, it may result in a situation where the cab is inadvertently docked with the aircraft by backward docking. Then, in this case, the operator cannot retreat the cab from the aircraft by operating the travel lever to the operation position for forward traveling of the travel device, i.e., cannot retreat the cab from the aircraft by rotating the travel wheels of the travel device in the forward direction. The reason for this is as follows. When the cab is docked with the fuselage of the aircraft, in the passenger boarding bridge that is configured on the assumption that the cab is docked with the fuselage of the aircraft by forward docking, a limit switch of the travel device is turned ON in order to prohibit further forward traveling of the travel device after the completion of the forward docking of the cab. It should be noted that, at the time, if the operator is unaware that the cab has

already been docked with the fuselage of the aircraft by backward docking, and operates the travel lever to the operation position for backward traveling of the travel device, it will cause the cab to be pressed against the fuselage of the aircraft.

[0027] For the above reasons, when the cab is docked with the aircraft by backward docking, the cab cannot be retreated from the aircraft by the normal cab undocking operation (hereinafter, “Third Case”). In this case, as one example of conventional measures, the brake of the travel motor of the travel device is released, and the passenger boarding bridge needs to be towed away from the aircraft by a pushback truck or the like. As another example of conventional measures, forward traveling of the travel device needs to be enabled by releasing the limit switch of the travel device (i.e., by forcibly turning OFF the limit switch).

[0028] The work of retreating the cab from the aircraft by taking any of the above-described conventional measures in the First to Third Cases is considered labor- and time-consuming. For example, in order to tow the passenger boarding bridge by a pushback truck, various requirements need to be met in advance of the towing work, such as, it is necessary to secure a sufficient space for arranging the pushback truck around the passenger boarding bridge. As another example, in order to release the limit switch of the travel device, there are various preparations to be done, such as preparing a vehicle for high lift work.

[0029] The applicant of the present application has proposed, in their prior patent (WO2018055980), a moving mechanism configured to move a movable member in the passage direction of the passengers relative to the floor of the cab.

[0030] In view of the above, the inventors of the present disclosure have found that by utilizing such a moving mechanism, the cab can be properly retreated from the aircraft even in a case where the normal cab undocking operation cannot be performed. Based on the finding, the inventors of the present disclosure have come up with the following aspects of the present disclosure.

[0031] Specifically, a passenger boarding bridge according to a first aspect of the present disclosure includes: a rotunda connected to a terminal building; a tunnel unit whose proximal end is connected to the rotunda; a cab provided at a distal end of the tunnel unit; and a travel device supporting the tunnel unit. The cab includes: a first floor configured

to serve as a walkway that communicates with the tunnel unit; a second floor provided on the first floor; and a moving mechanism configured to move the second floor to a stop position at which the second floor is close to, or in contact with, an aircraft. The moving mechanism includes: a driver configured to apply driving force to the second floor; and a control device configured to control driving of the driver. The control device controls the driver to retreat the second floor stopped at the stop position to a retreat position away from the aircraft either in a case where a travel wheel of the travel device is unable to rotate or in a case where rotation of the travel wheel of the travel device for undocking the cab from the aircraft is prohibited.

[0032] A passenger boarding bridge according to a second aspect of the present disclosure includes: a rotunda connected to a terminal building; a tunnel unit whose proximal end is connected to the rotunda; a cab provided at a distal end of the tunnel unit; a travel device supporting the tunnel unit; and a first control device configured to control an operation of the travel device. The cab includes: a first floor configured to serve as a walkway that communicates with the tunnel unit; a second floor provided on the first floor; and a moving mechanism configured to move the second floor to a stop position at which the second floor is close to, or in contact with, an aircraft. The moving mechanism includes: a driver configured to apply driving force to the second floor; and a second control device configured to control driving of the driver. Wiring used for the second control device is provided independently of wiring used for the first control device. The second control device controls the driver to retreat the second floor stopped at the stop position to a retreat position away from the aircraft.

[0033] A passenger boarding bridge according to a third aspect of the present disclosure may be configured such that, in the passenger boarding bridge according to the first or second aspect, the second floor is fixed to the retreat position by a brake of the driver. A passenger boarding bridge according to a fourth aspect of the present disclosure may be configured such that, in the passenger boarding bridge according to any one of the first to third aspects, the moving mechanism includes a power supplying device.

[0034] The passenger boarding bridge of each of the above aspects with the above-described configurations is capable of retreating the cab from the aircraft more properly than the conventional art even in a case where the normal cab undocking operation cannot

be performed.

[0035] It should be noted that examples of the case where the travel wheel of the travel device is unable to rotate include the above-described First Case and Second Case. Also, examples of the case where rotation of the travel wheel of the travel device for undocking the cab from the aircraft is prohibited include the above-described Third Case.

[0036] Specifically, in the passenger boarding bridge of each of the above aspects, as one example, even when electric power supply from a commercial power source to the passenger boarding bridge is stopped as in the First Case, since electric power is supplied from the power supplying device, the control device or the second control device can control the driver to retreat the second floor to the retreat position away from the aircraft, and also, the control device or the second control device can control the driver to fix the second floor to the retreat position by the brake of the driver. Thus, the passenger boarding bridge of each of the above aspects can readily and speedily secure a desired clearance between the cab and the aircraft. Then, for example, the aircraft can be moved as necessary by using a pushback truck or the like. Specifically, when the second floor of the cab is close to, or in contact with, the fuselage of the aircraft, if the aircraft is towed by a pushback truck or the like, it may cause the second floor of the cab and the fuselage of the aircraft to rub against each other, and thereby the fuselage of the aircraft may get damaged. However, the passenger boarding bridge of each of the above aspects with the above-described configurations can reduce such a risk. For example, assume that the distance between the second floor of the cab and the fuselage of the aircraft is about 70 mm. In this case, even if the aircraft is towed by a pushback truck or the like, the second floor of the cab and the fuselage of the aircraft are less likely to rub against each other.

[0037] Further, in the passenger boarding bridge of each of the above aspects, as one example, even when a failure has occurred in the control system of the passenger boarding bridge as in the Second Case, the second control device provided independently of the control system can control the driver to retreat the second floor to the retreat position away from the aircraft, and also, the second control device can control the driver to fix the second floor to the retreat position by the brake of the driver. Thus, the passenger boarding bridge of each of the above aspects can readily and speedily secure a desired clearance between the cab and the aircraft. Then, for example, the aircraft can be moved

as necessary by using a pushback truck or the like. Specifically, when the second floor of the cab is close to, or in contact with, the fuselage of the aircraft, if the aircraft is towed by a pushback truck or the like, it may cause the second floor of the cab and the fuselage of the aircraft to rub against each other, and thereby the fuselage of the aircraft may get damaged. However, the passenger boarding bridge of each of the above aspects with the above-described configurations can reduce such a risk.

[0038] Further, in the passenger boarding bridge of each of the above aspects, as one example, even in a case where the travel wheel of the travel device is rotated in the reverse direction and thereby the cab is docked with the fuselage of the aircraft as in the Third Case, the control device or the second control device can control the driver to retreat the second floor to the retreat position away from the aircraft, and also, the control device or the second control device can control the driver to fix the second floor to the retreat position by the brake of the driver. Thus, the passenger boarding bridge of each of the above aspects can readily and speedily secure a desired clearance between the cab and the aircraft. Then, for example, the aircraft can be moved as necessary by using a pushback truck or the like. Moreover, since the limit switch for prohibiting the forward rotation of the travel wheel of the travel device is turned OFF, an operator may operate the travel lever to the operation position for forward traveling of the travel device to rotate the travel wheel of the travel device in the forward direction, and thereby the cab can be moved further away from the aircraft. Specifically, when the second floor of the cab is close to, or in contact with, the fuselage of the aircraft, if the aircraft is towed by a pushback truck or the like, it may cause the second floor of the cab and the fuselage of the aircraft to rub against each other, and thereby the fuselage of the aircraft may get damaged. However, the passenger boarding bridge of each of the above aspects with the above-described configurations can reduce such a risk.

[0039] A passenger boarding bridge according to a fifth aspect of the present disclosure includes: a rotunda connected to a terminal building; a tunnel unit whose proximal end is connected to the rotunda; and a cab provided at a distal end of the tunnel unit. The cab includes: a first floor configured to serve as a walkway that communicates with the tunnel unit; a second floor provided on the first floor; and a moving mechanism configured to move the second floor between a stop position at which the second floor is close to, or in

contact with, an aircraft and a retreat position at which the second floor is located away from the aircraft. The second floor is fixed to the retreat position and/or the stop position by a stopper member of the moving mechanism.

[0040] A passenger boarding bridge according to a sixth aspect of the present disclosure may be configured such that, in the passenger boarding bridge according to the fifth aspect, the second floor stopped at the stop position is moved to the retreat position by compression of a stretchable and compressible member of the moving mechanism.

[0041] The passenger boarding bridge of each of the above fifth and sixth aspects with the above-described configurations is capable of retreating the cab from the aircraft more properly than the conventional art even in a case where the normal cab undocking operation cannot be performed.

[0042] Specifically, in the passenger boarding bridge of each of the above fifth and sixth aspects, as one example, even when electric power supply from a commercial power source to the passenger boarding bridge is stopped as in the First Case, if the stretchable and compressible member is, for example, an urging member that acts in response to a compressive load, the compressive action of the stretchable and compressible member allows the second floor to be moved manually and properly, and the second floor thus moved can be fixed to the retreat position by the stopper member. Also, if the stretchable and compressible member is, for example, an urging member that acts in response to a tensile load, the tensile action of the stretchable and compressible member allows the second floor to be moved manually and properly, and the second floor thus moved can be fixed to the stop position by the stopper member. Thus, the passenger boarding bridge of each of the above fifth and sixth aspects can readily and speedily secure a desired clearance between the cab and the aircraft by the compression of the stretchable and compressible member of the moving mechanism. Then, for example, the aircraft can be moved as necessary by using a pushback truck or the like. Specifically, when the second floor of the cab is close to, or in contact with, the fuselage of the aircraft, if the aircraft is towed by a pushback truck or the like, it may cause the second floor of the cab and the fuselage of the aircraft to rub against each other, and thereby the fuselage of the aircraft may get damaged. However, the passenger boarding bridge of each of the above fifth and sixth aspects with the above-described configurations can reduce such a risk.

[0043] Further, in the passenger boarding bridge of each of the above fifth and sixth aspects, as one example, even when a failure has occurred in the control system of the passenger boarding bridge as in the Second Case, if the stretchable and compressible member is, for example, an urging member that acts in response to a compressive load, the compressive action of the stretchable and compressible member allows the second floor to be moved manually and properly, and the second floor thus moved can be fixed to the retreat position by the stopper member. Also, if the stretchable and compressible member is, for example, an urging member that acts in response to a tensile load, the tensile action of the stretchable and compressible member allows the second floor to be moved manually and properly, and the second floor thus moved can be fixed to the stop position by the stopper member. Thus, the passenger boarding bridge of each of the above fifth and sixth aspects can readily and speedily secure a desired clearance between the cab and the aircraft by the compression of the stretchable and compressible member of the moving mechanism. Then, for example, the aircraft can be moved as necessary by using a pushback truck or the like. Specifically, when the second floor of the cab is close to, or in contact with, the fuselage of the aircraft, if the aircraft is towed by a pushback truck or the like, it may cause the second floor of the cab and the fuselage of the aircraft to rub against each other, and thereby the fuselage of the aircraft may get damaged. However, the passenger boarding bridge of each of the above fifth and sixth aspects with the above-described configurations can reduce such a risk.

[0044] Further, in the passenger boarding bridge of each of the above fifth and sixth aspects, as one example, even in a case where the travel wheel of the travel device is rotated in the reverse direction and thereby the cab is docked with the fuselage of the aircraft as in the Third Case, if the stretchable and compressible member is, for example, an urging member that acts in response to a compressive load, the compressive action of the stretchable and compressible member allows the second floor to be moved manually and properly, and the second floor thus moved can be fixed to the retreat position by the stopper member. Also, if the stretchable and compressible member is, for example, an urging member that acts in response to a tensile load, the tensile action of the stretchable and compressible member allows the second floor to be moved manually and properly, and the second floor thus moved can be fixed to the stop position by the stopper member.

Thus, the passenger boarding bridge of each of the above fifth and sixth aspects can readily and speedily secure a desired clearance between the cab and the aircraft by the compression of the stretchable and compressible member of the moving mechanism. Then, for example, the aircraft can be moved as necessary by using a pushback truck or the like. Moreover, since the limit switch for prohibiting the forward rotation of the travel wheel of the travel device is turned OFF, an operator may operate the travel lever to the operation position for forward traveling of the travel device to rotate the travel wheel of the travel device in the forward direction, and thereby the cab can be moved further away from the aircraft. Specifically, when the second floor of the cab is close to, or in contact with, the fuselage of the aircraft, if the aircraft is towed by a pushback truck or the like, it may cause the second floor of the cab and the fuselage of the aircraft to rub against each other, and thereby the fuselage of the aircraft may get damaged. However, the passenger boarding bridge of each of the above fifth and sixth aspects with the above-described configurations can reduce such a risk.

[0045] Hereinafter, embodiments of the present disclosure are described with reference to the accompanying drawings. The embodiments described below show specific examples of the above-described aspects of the present disclosure. Therefore, numerical values, shapes, materials, components, the arrangement and the manner of connection of the components, etc., indicated in the embodiments below are mere examples, and do not limit the above-described aspects of the present disclosure. Moreover, among the components in the embodiments below, components that are not recited in any of the independent claims defining the most generic concept of the present disclosure are described as optional components. In the description below, in some cases, the description of components that are denoted by the same reference signs in the drawings may be omitted. The drawings show each component schematically in order to facilitate the understanding thereof. Therefore, in some cases, the drawings may not display precise shapes, dimensional ratios, etc.

(Embodiment 1)

[0046] [Overall Apparatus Configuration]

[0047] FIG. 1 shows one example of a passenger boarding bridge according to Embodiment 1. FIG. 1 is a side view of a passenger boarding bridge 100, showing a state

where the overall length of a tunnel unit 10 is extended.

[0048] Hereinafter, for the sake of convenience of the description, the direction in which the overall length of the tunnel unit 10 of the passenger boarding bridge 100 is extended and retracted is referred to as a front-back direction; the direction in which the gravitational force is exerted on the passenger boarding bridge 100 is referred to as a vertical direction; and the width direction of the passenger boarding bridge 100 (i.e., the direction orthogonal to the front-back direction and the vertical direction) is referred to as a right-left direction. In addition, as shown in Fig. 1, the aircraft 200 side of the passenger boarding bridge 100 is referred to as a “front” side, and the terminal building side of the passenger boarding bridge 100 is referred to as a “back” side in the description below.

[0049] The passenger boarding bridge 100 of the present embodiment includes: a rotunda (a back round room) 12 connected to an entrance of the terminal building and supported such that the rotunda 12 is turnable about a vertical axis; the tunnel unit 10 whose proximal end is connected to the rotunda 12, the tunnel unit 10 being swingable vertically such that the distal end of the tunnel unit 10 is lifted and lowered; a cab (a front round room) 20 turnably provided at the distal end of the tunnel unit 10; drive columns 15 configured to support the tunnel unit 10 at the distal side of the tunnel unit 10; auxiliary stairs 16; and a control device 50A.

[0050] The tunnel unit 10 forms a passenger walkway, and includes a plurality of tubular tunnels 10A and 10B, which are fitted together in a telescopic manner (nested manner), such that the tunnel unit 10 is extendable and retractable.

[0051] The distal-side portion of the tunnel unit 10 (i.e., the tunnel 10B, which is the frontmost tunnel) is provided with the drive columns 15, which serve as support legs. The drive columns 15 are provided with a lifting/lowering device 15A configured to move the tunnel unit 10 upward/downward. By moving the tunnel unit 10 upward/downward by means of the lifting/lowering device 15A, the tunnel unit 10 and the cab 20 can be swung vertically with respect to the rotunda 12.

[0052] The drive columns 15 are further provided with a travel device 15B positioned below the lifting/lowering device 15A. The travel device 15B is a device that supports the tunnel unit 10. The travel device 15B is configured to be able to travel forward and backward, and the traveling direction thereof is changeable. By causing the drive

columns 15 to travel on an apron ground 18 by means of the travel device 15B, the tunnel unit 10 can be extended and retracted in the front-back direction and/or swung horizontally with respect to the rotunda 12.

[0053] Specifically, the travel device 15B includes a pair of right and left travel wheels 14 configured to be rotatable in a forward direction and a reverse direction. In the passenger boarding bridge 100 of FIG. 1, for example, when the right and left travel wheels 14 rotate in the forward direction at the same speed, the travel device 15B travels forward, and the tunnel unit 10 extends forward, accordingly. Also, in the passenger boarding bridge 100 of FIG. 1, for example, when the right and left travel wheels 14 rotate in the reverse direction at the same speed, the travel device 15B travels backward, and the tunnel unit 10 retracts backward, accordingly. Further, in the passenger boarding bridge 100 of FIG. 1, for example, when the right and left travel wheels 14 rotate in opposite directions each other, the travel direction of the travel device 15B changes.

[0054] The cab 20 is turnably disposed at the front end of the tunnel unit 10. A control board (not shown) is installed in the cab 20, and an operator can operate equipment (e.g., drive columns 15) of the passenger boarding bridge 100 by using, for example, a joystick of the control board. The configuration of the cab 20 will be described below in detail.

[0055] The auxiliary stairs 16 are provided on the side of the tunnel unit 10 in a manner to connect between the inside of the tunnel unit 10 and the apron ground 18. The auxiliary stairs 16 are used, for example, to allow the operator to get in and out of the cab 20.

[0056] The control device 50A is, for example, provided in the control board of the passenger boarding bridge 100. The control device 50A controls, for example, the rotation operation of the travel device 15B (travel wheels 14) of the drive columns 15 and the lifting/lowering operation of the lifting/lowering device 15A of the drive columns 15. It should be noted that the control device 50A may control not only the operations of these devices, but also the operations of all the controllable equipment of the passenger boarding bridge 100.

[0057] The control device 50A includes, for example, an arithmetic circuit (not shown) and a storage circuit (not shown) storing control programs. Examples of the arithmetic circuit include an MPU and CPU. Examples of the storage unit include a memory. The

control device 50A may be configured as a single controller performing centralized control, or may be configured as a plurality of controllers performing distributed control in cooperation with each other.

[0058] [Configuration of Cab]

[0059] Hereinafter, one example of the cab of Embodiment 1 is described with reference to the drawings.

[0060] FIG. 2, FIG. 3, and FIG. 4 each show one example of the cab of the passenger boarding bridge of Embodiment 1. FIG. 2 is a plan view of the front end portion of the cab 20 of FIG. 1 as seen in the vertical direction, and FIG. 3 is a front view of the cab 20 of FIG. 1. FIG. 4 is a side view showing one example of a state where the cab is docked with the aircraft.

[0061] FIG. 5A is a sectional view of the cab of FIG. 2 taken along line A-A of FIG. 2 as viewed in the direction of arrows of line A-A. FIG. 5B is a sectional view of the cab of FIG. 2 taken along line B-B of FIG. 2 as viewed in the direction of arrows of line B-B, the view showing a movable floor that has been retreated backward from the state of the cab shown in FIG. 5A. It should be noted that FIGS. 5A and 5B do not show distal end limit switches LSf for the sake of convenience of the illustration.

[0062] In the passenger boarding bridge 100 of Embodiment 1, the cab 20 is provided at the distal end of the tunnel unit 10 (see FIG. 1). The cab 20 includes a walkway 21, a closure 24, a movable floor 30, and a moving mechanism 45.

[0063] The walkway 21 includes a fixed floor 21A and a floor 21B. The fixed floor 21A is configured to serve as a walkway that communicates with the tunnel unit 10. The floor 21B is provided on the fixed floor 21A and configured to be inclinable in a width direction 300 relative to the fixed floor 21A (hereinafter, the floor 21B is referred to as “inclinable floor 21B”).

[0064] It should be noted that since the inclination mechanism of the inclinable floor 21B is known, the inclination mechanism is not described in detail herein, but is described below briefly. For example, the fixed floor 21A and the inclinable floor 21B are coupled to each other via a coupling hinge portion or the like that is not shown. The right end portion or left end portion of the inclinable floor 21B is vertically moved by motive force generated by an unshown motive force generator, such as a power cylinder or an electric

motor. At the time, the front end portion of the inclinable floor 21B can swing about the coupling hinge portion. In this manner, the inclinable floor 21B can be inclined in the width direction 300.

[0065] However, the above-described configuration of the walkway 21 is merely a non-limiting example. Alternatively, as one example, the entire floor serving as the walkway 21 of the cab 20, including the part configured as the inclinable floor 21B, may be configured as a fixed floor.

[0066] The movable floor 30 is provided at the front of the inclinable floor 21B. FIG. 4 shows a state where the movable floor 30 has moved to a stop position at which the movable floor 30 is in contact with the fuselage of the aircraft 200. However, this is merely a non-limiting example. The cab 20 can be docked with the aircraft 200 even in a state where the movable floor 30 has moved to a stop position at which the movable floor 30 is not in contact with, but is close to the fuselage of the aircraft 200.

[0067] In the passenger boarding bridge 100 of the present embodiment, the movable floor 30 includes, for example, a slide plate 31 and a bumper 32. The slide plate 31 is slidable in a direction parallel to the main surface of the inclinable floor 21B. The bumper 32 is provided on the slide plate 31. The slide plate 31 and the bumper 32 of the movable floor 30 will be described below in detail.

[0068] The closure 24 includes: a bellows portion 24A (see FIG. 4) expandable and contractable in the front-back direction; a gate-shaped contacting portion 24B provided at the front end of the bellows portion 24A and configured to come into contact with the aircraft 200; and an accommodating portion 24C configured to accommodate the bellows portion 24A when the bellows portion 24A contracts, the accommodating portion 24C being coupled to and integrated with the aforementioned fixed floor or the cab frame. Accordingly, when the cab 20 is brought into connection with (i.e., docked with) the aircraft 200, the contacting portion 24B can come into contact with the aircraft 200 around an entrance 201 thereof (see FIG. 1) by inclining forward.

[0069] A level detection device 25 is disposed on a side wall (specifically, on the accommodating portion 24C) of the cab 20. The level detection device 25 is a device configured to detect the amount of upward/downward movement of the aircraft 200 relative to the cab 20 when the aircraft 200 moves upward/downward due to, for example,

boarding/disembarking of passengers or loading/unloading of cargo after the cab 20 is connected to the entrance 201 of the aircraft 200.

[0070] The level detection device 25 includes, for example, a wheel 25A and a contact limit switch (not shown) intended for when the wheel 25A moves forward.

[0071] The contact limit switch is pre-adjusted such that the pressure of the wheel 25A applied to the surface of the fuselage of the aircraft 200 is optimal. In a case where the wheel 25A moves forward, the forward movement of the wheel 25A can be stopped at a desired moving amount as a result of the contact limit switch being turned ON. This allows the level detection device 25 to press the wheel 25A against the surface of the fuselage of the aircraft 200 with an optimal pressure. The wheel 25A of the level detection device 25 rotates when the aircraft 200 moves upward or downward. The level detection device 25 includes a detector configured to detect the amount of upward/downward movement of the aircraft 200 relative to the cab 20 based on the rotation direction and rotation angle of the wheel 25A (hereinafter, the amount of upward/downward movement of the aircraft 200 relative to the cab 20 is also simply referred to as an “upward/downward moving amount of the aircraft 200”). When the upward/downward moving amount of the aircraft 200 detected by the detector is greater than or equal to a predetermined amount, the level detection device 25 outputs the detected upward/downward moving amount of the aircraft 200 to the control device 50A. The control device 50A controls the lifting/lowering device 15A of the drive columns 15, such that the cab 20 follows the upward/downward movement of the aircraft 200.

[0072] Next, configurations of the movable floor 30 and the moving mechanism 45 provided at the front of the inclinable floor 21B of the cab 20 are described with reference to FIG. 2, FIG. 5A, and FIG. 5B.

[0073] As described above, the movable floor 30 includes the slide plate 31 and the bumper 32.

[0074] The bumper 32 is disposed on the distal end of the cab 20 at a position that is away from the inclinable floor 21B in a passage direction 400 of the walkway. The cab 20 is docked with the aircraft 200 when the movable floor 30 has moved to the stop position at which the movable floor 30 is close to, or in contact with, the aircraft 200. At the time, the front surface portion of the bumper 32 is close to, or in contact with, the

aircraft 200. The bumper 32 is made of synthetic rubber, and is a buffer member that has a function of reducing an impact shock when the cab 20 comes into contact with the aircraft 200. It should be noted that the passage direction 400 is a direction in which the passengers on the walkway 21 walk, and is a direction perpendicular to the width direction 300 (see FIG. 2) of the inclinable floor 21B. In FIG. 1, the passage direction 400 is the front-back direction.

[0075] The slide plate 31 is made of a rectangular plate-shaped member, and has two edge portions 31a and 31b. The two edge portions 31a and 31b are opposite edge portions that are away from each other in the passage direction 400. The front edge portion 31a, which is one of the two edge portions 31a and 31b, is mounted along the upper end of the bumper 32. The back edge portion 31b, which is the other one of the two edge portions 31a and 31b, is placed and supported on the surface of the inclinable floor 21B, such that the back edge portion 31b is slidable along the surface of the inclinable floor 21B in accordance with movement of the bumper 32. The passengers can walk on the slide plate 31.

[0076] A connecting member 33 is fixed to the lower surface of the front end portion of the slide plate 31. The bumper 32 is mounted to the front surface of the connecting member 33.

[0077] In the passenger boarding bridge 100 of the present embodiment, at the time of docking the cab 20 with the aircraft 200, the moving mechanism 45 can move the movable floor 30 relative to the inclinable floor 21B in the passage direction 400 to the stop position at which the movable floor 30 is close to, or in contact with, the aircraft 200 (see FIG. 5A). Also, at the time of undocking the cab 20 from the aircraft 200, the moving mechanism 45 can retreat the movable floor 30 stopped at the stop position to a retreat position away from the aircraft 200, and also, the moving mechanism 45 can fix the movable floor 30 to the retreat position (see FIG. 5B).

[0078] Hereinafter, one example of a specific configuration of the moving mechanism 45 is described in detail with reference to the drawings.

[0079] The moving mechanism 45 includes, for example, a rack mounting member 36, racks 37A, pinions 37B, a shaft 39, a motor 40, a motor support member 41, a control device 50B, and a power supplying device 51. The rack mounting member 36, which

extends in the passage direction 400, is fixed to the back surface of the connecting member 33. The racks 37A are fixed to the rack mounting member 36. It should be noted that examples of the power supplying device 51 include an uninterruptible power supply (UPS), a secondary battery, and a power generator.

[0080] The pinions 37B, which form a rack-and-pinion mechanism together with the racks 37A, are fixed to the shaft 39. The shaft 39 is supported by suitably provided bearings 42 (see FIG. 2). As shown in FIG. 2, two sets of the rack 37A and the pinion 37B are provided, such that one set of the rack 37A and the pinion 37B is provided on one end, and the other set of the rack 37A and the pinion 37B is provided on the other end, of the shaft 39 extending in the width direction 300 of the inclinable floor 21B. The motor 40 is fixed below the inclinable floor 21B by the motor support member 41 and the like, and the rotational force of the motor 40 is transmitted to the shaft 39 via, for example, a coupling.

[0081] Specifically, when the motor 40 rotates, the shaft 39 and the pinions 37B rotate. The rotation of the pinions 37B causes the racks 37A to move in the passage direction 400 parallel to the surface of the inclinable floor 21B. At the time, the connecting member 33 and the rack mounting member 36 move together with the racks 37. It should be noted that suitable guide members (not shown) are provided so that these components can move in the passage direction 400. In this manner, the motor 40 applies driving force to the movable floor 30.

[0082] The control device 50B controls the driving of the motor 40. Although not illustrated, wiring used for the control device 50B is provided independently of wiring used for the control device 50A. Specifically, wiring (e.g., communication line or power supply line) for connecting control target equipment (in this example, the motor 40) to be controlled by the control device 50B is independent of wiring for connecting control target equipment (in this example, the drive columns 15) to be controlled by the control device 50A (see FIG. 1). Also, wiring (e.g., communication line or power supply line) for connecting detectors (in this example, back limit switches LSb) that transmit signals to the control device 50B is independent of wiring for connecting detectors (in this example, distal end limit switches LSf) that transmit signals to the control device 50A.

[0083] According to the above configuration, in the passenger boarding bridge 100 of the

present embodiment, in a case where the travel wheels 14 of the travel device 15B are unable to rotate, or in a case where the rotation of the travel wheels 14 of the travel device 15B for undocking the cab 20 from the aircraft 200 is prohibited, the control device 50B can retreat the movable floor 30 to the retreat position and also fix the movable floor 30 to the retreat position with the brake of the motor 40 by controlling the motor 40. It should be noted that the case where the travel wheels 14 of the travel device 15B are unable to rotate is, for example, the above-described First Case or Second Case. Also, the case where the rotation of the travel wheels 14 of the travel device 15B for undocking the cab 20 from the aircraft 200 is prohibited is, for example, the above-described Third Case.

[0084] It should be noted that the above-described control system configuration is merely a non-limiting example. Alternatively, for example, in a case where the passenger boarding bridge 100 operates normally, the connection of these equipment may be configured based on detection signals from the back limit switches LSb, such that the control device 50A controls the motor 40. On the other hand, in a case where the normal undocking operation of the cab 20 cannot be performed, the connection of these equipment may be re-configured based on detection signals from the back limit switches LSb, such that the control device 50B controls the motor 40.

[0085] Further, in the passenger boarding bridge 100 of the present embodiment, the moving mechanism 45 is provided with the power supplying device 51. Accordingly, for example, even if electric power supply from a commercial power source to the passenger boarding bridge 100 is stopped, electric power can be supplied to the control device 50B and the motor 40 by using the power supplying device 51.

[0086] It should be noted that the control device 50B includes, for example, an arithmetic circuit (not shown) and a storage circuit (not shown) storing control programs. Examples of the arithmetic circuit include an MPU and CPU. Examples of the storage unit include a memory. The control device 50B may be configured as a single controller performing centralized control, or may be configured as a plurality of controllers performing distributed control in cooperation with each other.

[0087] In the passenger boarding bridge 100 of the present embodiment, as shown in FIG. 2, FIG. 5A, and FIG. 5B, a plurality of (in the cab 20 of FIG 2, three) distal end limit switches LSf and a plurality of (in the cab 20 of FIG 2, two) back limit switches LSb are

provided for use in, for example, the control of the moving mechanism 45.

[0088] The distal end limit switches LSf, which are mounted to the lower end of the connecting member 33, are detectors for detecting that the bumper 32 has come close to, or into contact with, the fuselage of the aircraft 200. Specifically, when the bumper 32 comes close to, or into contact with, the fuselage of the aircraft 200, the distal end limit switches LSf are turned ON, whereas when the bumper 32 moves away from the fuselage of the aircraft 200, the distal end limit switches LSf are turned OFF. At the time, state signals of the respective distal end limit switches LSf (i.e., an ON signal or OFF signal of each of the distal end limit switches LSf) are transmitted to the control device 50A in the control board of the passenger boarding bridge 100. As a result, the control device 50A controls the rotation of the travel wheels 14 of the travel device 15B based on the state signals of the respective distal end limit switches LSf. Specifically, after the cab 20 has been docked with the fuselage of the aircraft 200, the control device 50A prohibits forward rotation of the travel wheels 14 of the travel device 15B so as not to excessively press the cab 20 against the fuselage of the aircraft 200 with a pressing force that exceeds a certain level. That is, when the distal end limit switches LSf are turned ON, the travel wheels 14 of the travel device 15B cannot be rotated in the forward direction.

[0089] As thus described, the plurality of distal end limit switches LSf are provided. However, not necessarily all the distal end limit switches LSf are turned ON when the bumper 32 comes into contact with the fuselage of the aircraft 200, depending on the shape and so forth of the fuselage of the aircraft 200. Therefore, state signals of all the distal end limit switches LSf (i.e., an ON signal or OFF signal of each of the distal end limit switches LSf) are inputted to the control device 50A (see FIG. 1), and if the state signals indicate that at least one of the distal end limit switches LSf is ON, the control device 50A determines that the distal end limit switches LSf are ON, whereas if the state signals indicate that all the distal end limit switches LSf are OFF, the control device 50A determines that the distal end limit switches LSf are OFF.

[0090] As shown in FIG. 5A and FIG. 5B, the back limit switches LSB are mounted to the front end portion of the inclinable floor 21B. Contact flat plates 38, which are each strip-shaped when seen in a plan view and which are intended for turning ON the respective back limit switches LSB, are mounted to the rack mounting member 36.

[0091] The back limit switches LSb are turned ON when the movable floor 30 has moved to the retreat position. Specifically, when the contact flat plates 38 come into contact with the respective back limit switches LSb as shown in FIG. 5B, the back limit switches LSb are turned ON, whereas when the contact flat plates 38 move away from the respective back limit switches LSb as shown in FIG. 5A, the back limit switches LSb are turned OFF. At the time, state signals of the respective back limit switches LSb (i.e., an ON signal or OFF signal of each of the back limit switches LSb) are transmitted to the control device 50B, which controls the driving of the motor 40. As a result, the control device 50B controls the driving of the motor 40 based on the state signals of the respective back limit switches LSb. Specifically, when the back limit switches LSb are turned ON, the rotation of the motor 40 is stopped so that the movable floor 30 will not move further backward.

[0092] [Operations]

[0093] Hereinafter, one example of operations of the passenger boarding bridge 100 is described. It should be noted that, among the operations described below, the operations in steps S1, S3, and S4 may be performed as a result of the arithmetic circuit of the control device 50B reading out a control program stored in the storage circuit of the control device 50B. However, these operations need not be performed by the control device 50B. Instead, part of the operations may be performed by the operator.

[0094] FIG. 6 is a flowchart showing one example of operations for retreating the cab from the fuselage of the aircraft and fixing the cab to the retreat position in a case where the normal cab undocking operation cannot be performed.

[0095] First, when the normal cab undocking operation cannot be performed, in step S1, the motor 40 is rotated and it is determined whether or not the movable floor 30 is movable backward. For example, if the back limit switches LSb are OFF, it is determined that the movable floor 30 is movable backward. On the other hand, if the back limit switches LSb are ON, it is determined that the movable floor 30 is not movable backward.

[0096] If the movable floor 30 is not movable backward (“No” in step S1), the passenger boarding bridge 100 is towed away from the aircraft 200 by a pushback truck (step S2). Thereafter, when it becomes possible to perform the normal cab undocking operation, then in step S5, the passenger boarding bridge 100 is moved to a suitable standby position. Since the operations performed to move the passenger boarding bridge 100 to the standby

position are known, the description thereof is omitted.

[0097] If the movable floor 30 is movable backward (“Yes” in step S1), the motor 40 is rotated and thereby the movable floor 30 is retreated to the retreat position away from the fuselage of the aircraft 200 (step S3). Then, the movable floor 30 is fixed to the retreat position by the brake of the motor 40 (step S4).

[0098] It should be noted that the above retreat position may be, for example as shown in FIG. 5B, the position of the movable floor 30 when the back limit switches LSb are ON. As one example, when the movable floor 30 is at the retreat position, the front end portion of the bumper 32 of the movable floor 30 is away from the fuselage of the aircraft 200 by about 70 mm. However, this is merely a non-limiting example of the retreat position.

[0099] Thereafter, when it becomes possible to perform the normal cab undocking operation, then in step S5, the passenger boarding bridge 100 is moved to a suitable standby position.

[0100] As described above, the passenger boarding bridge 100 of the present embodiment is capable of retreating the cab 20 from the aircraft 200 more properly than the conventional art even in a case where the normal undocking operation of the cab 20 cannot be performed.

[0101] Specifically, in the passenger boarding bridge 100 of the present embodiment, as one example, even when electric power supply from a commercial power source to the passenger boarding bridge 100 is stopped as in the First Case, electric power supplied from the power supplying device 51 allows the control device 50B to control the motor 40 to retreat the movable floor 30 to the retreat position away from the aircraft 200 and fix the movable floor 30 to the retreat position by the brake of the motor 40. Thus, the passenger boarding bridge 100 of the present embodiment can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200. Then, for example, the aircraft 200 can be moved as necessary by using a pushback truck or the like. Specifically, when the movable floor 30 of the cab 20 is close to, or in contact with, the fuselage of the aircraft 200, if the aircraft 200 is towed by a pushback truck or the like, it may cause the movable floor 30 of the cab 20 and the fuselage of the aircraft 200 to rub against each other, and thereby the fuselage of the aircraft 200 may get damaged. However, the passenger boarding bridge 100 of the present embodiment with the above-described configurations

can reduce such a risk.

[0102] Further, in the passenger boarding bridge 100 of the present embodiment, as one example, even when a failure has occurred in the control device 50A of the passenger boarding bridge 100 as in the Second Case, the control device 50B provided independently of the control device 50A can control the motor 40 to retreat the movable floor 30 to the retreat position away from the aircraft 200, and fix the movable floor 30 to the retreat position by the brake of the motor 40. Thus, the passenger boarding bridge 100 of the present embodiment can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200. Then, for example, the aircraft 200 can be moved as necessary by using a pushback truck or the like. Specifically, when the movable floor 30 of the cab 20 is close to, or in contact with, the fuselage of the aircraft 200, if the aircraft 200 is towed by a pushback truck or the like, it may cause the movable floor 30 of the cab 20 and the fuselage of the aircraft 200 to rub against each other, and thereby the fuselage of the aircraft 200 may get damaged. However, the passenger boarding bridge 100 of the present embodiment with the above-described configurations can reduce such a risk.

[0103] Still further, in the passenger boarding bridge 100 of the present embodiment, as one example, even in a case where the travel wheels 14 of the travel device 15B are rotated in the reverse direction and thereby the cab 20 is docked with the fuselage of the aircraft 200 as in the Third Case, the control device 50B can control the motor 40 to retreat the movable floor 30 to the retreat position away from the aircraft 200, and fix the movable floor 30 to the retreat position by the brake of the motor 40. Thus, the passenger boarding bridge 100 of the present embodiment can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200. Then, for example, the aircraft 200 can be moved as necessary by using a pushback truck or the like. Moreover, since the distal end limit switches LSf for prohibiting the forward rotation of the travel wheels 14 of the travel device 15B are turned OFF, the operator may operate the travel lever to the operation position for forward traveling of the travel device 15B to rotate the travel wheels 14 of the travel device 15B in the forward direction, and thereby the cab 20 can be moved further away from the aircraft 200. Specifically, when the movable floor 30 of the cab 20 is close to, or in contact with, the fuselage of the aircraft 200, if the aircraft 200 is towed by a pushback truck or the like, it may cause the movable floor 30 of the cab 20 and the

fuselage of the aircraft 200 to rub against each other, and thereby the fuselage of the aircraft 200 may get damaged. However, the passenger boarding bridge 100 of the present embodiment with the above-described configurations can reduce such a risk.

(Variation of Embodiment 1)

[0104] The above description of the passenger boarding bridge 100 of Embodiment 1 has given an example in which the movable floor 30 includes the slide plate 31. However, this is merely a non-limiting example.

[0105] Alternatively, for example, although not illustrated, the movable floor may include a tiltable plate that is coupled to the front end portion of the inclinable floor 21B via, for example, a coupling hinge portion that extends in the width direction. The movable floor may be configured to move between the stop position, at which the movable floor is close to or in contact with the aircraft 200, and the retreat position, at which the movable floor is located away from the aircraft 200, by tilting the tiltable plate about the coupling hinge portion. Thus, the passenger boarding bridge 100 of the present variation can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by the tilting of the tiltable plate.

[0106] Except the above-described additional features, the passenger boarding bridge 100 of the present variation may be the same as the passenger boarding bridge 100 of Embodiment 1.

(Embodiment 2)

[0107] The passenger boarding bridge 100 of Embodiment 2 is the same as the passenger boarding bridge 100 of Embodiment 1, except additional features of the cab 20 that are described below.

[0108] FIG. 7 shows one example of the cab of the passenger boarding bridge of Embodiment 2. FIG. 7 is a plan view of the front end portion of the cab 20 of FIG. 1 as seen in the vertical direction.

[0109] FIG. 8A is a sectional view of the cab of FIG. 7 taken along line A-A of FIG. 7 as viewed in the direction of arrows of line A-A. FIG. 8B is also a sectional view of the cab of FIG. 7 taken along line A-A of FIG. 7 as viewed in the direction of arrows of line A-A, the view showing the movable floor that has been retreated backward from the state of the cab shown in FIG. 8A. It should be noted that FIG. 8A and FIG. 8B do not show the distal

end limit switches LSf for the sake of convenience of the illustration.

[0110] In the passenger boarding bridge 100 of Embodiment 2, the cab 20 is provided at the distal end of the tunnel unit 10 (see FIG. 1). The cab 20 includes the walkway 21, the closure 24, the movable floor 30, and a moving mechanism 65.

[0111] Since the walkway 21, the closure 24, and the movable floor 30 are the same as those of the passenger boarding bridge 100 of Embodiment 1, a detailed description thereof is omitted.

[0112] In the passenger boarding bridge 100 of the present embodiment, at the time of undocking the cab 20 from the aircraft 200, the moving mechanism 65 can move the movable floor 30 stopped at the stop position (see FIG. 8A), at which the movable floor 30 is close to or in contact with the aircraft 200, to the retreat position (see FIG. 8B) away from the aircraft 200, and also, the moving mechanism 65 can fix the movable floor 30 to the retreat position.

[0113] Hereinafter, one example of a specific configuration of the moving mechanism 65 is described in detail with reference to the drawings.

[0114] As described above, the moving mechanism 65 is a mechanism configured to move the movable floor 30 between the stop position, at which the movable floor 30 is close to or in contact with the aircraft 200, and the retreat position, at which the movable floor 30 is located away from the aircraft 200.

[0115] In the passenger boarding bridge 100 of the present embodiment, the moving mechanism 65 includes stretchable and compressible members 60 and stopper members 63.

[0116] A plurality of (in the cab 20 of FIG. 7, three) stretchable and compressible members 60 are disposed between the front end portion of the inclinable floor 21B and the back surface of the connecting member 33, such that the stretchable and compressible members 60 are spaced apart from each other at predetermined intervals in the width direction 300 (right-left direction) and are stretchable and compressible in the passage direction 400 (front-back direction). With this configuration, as a result of the stretchable and compressible members 60 stretching or compressing, the movable floor 30 can move in the passage direction 400 relative to the inclinable floor 21B. Each of the stretchable and compressible members 60 may be, for example, an urging member that acts in response to a compressive load. For example, a compression coil spring or the like can be

used as the urging member.

[0117] Specifically, for example as shown in FIG. 8A, an auxiliary tool 64 is inserted in insertion openings 62, which are provided in the slide plate 31 at suitable positions (in the cab 20 of FIG. 7, two positions such that the insertion openings 62 are arranged at regular intervals in the width direction 300 of the slide plate 31). Then, the auxiliary tool 64 is pulled backward manually, and as a result, the stretchable and compressible members 60 are compressed. In this manner, as shown in FIG. 8B, the movable floor 30 can be readily moved to the retreat position (see FIG. 8B) away from the aircraft 200.

[0118] The stopper members 63 are members for fixing the movable floor 30 to the retreat position when the movable floor 30 has been moved to the retreat position away from the aircraft 200. For example, lock pins or the like can be used as the stopper members 63.

[0119] Specifically, for example as shown in FIG. 8A, pairs of lock pin holes 61A and 61B are provided in the slide plate 31 and the inclinable floor 21B at suitable positions such that, in each pair, the lock pin holes 61A and 61B are arranged side by side in the passage direction 400 (in the cab 20 of FIG. 7, both the lock pin holes 61A and the lock pin holes 61B are provided at three positions that are arranged at predetermined intervals in the width direction 300 (right-left direction)). As shown in FIG. 8B, when the movable floor 30 is moved to the retreat position away from the aircraft 200 by compressing the stretchable and compressible members 60, the lock pin holes 61A and the lock pin holes 61B are aligned. In this state, the stopper members 63 (lock pins) can be inserted into the lock pin holes 61A and 61B. Consequently, even though the movable floor 30, which has moved from the stop position to the retreat position by the compression of the stretchable and compressible members 60, receives the urging force (restoring force) of the stretchable and compressible members 60, the movable floor 30 can be kept fixed to the retreat position.

[0120] As described above, the passenger boarding bridge 100 of the present embodiment is capable of retreating the cab 20 from the aircraft 200 more properly than the conventional art even in a case where the normal undocking operation of the cab 20 cannot be performed.

[0121] Specifically, in the passenger boarding bridge 100 of the present embodiment, as

one example, even when electric power supply from a commercial power source to the passenger boarding bridge 100 is stopped as in the First Case, the compressive action of the stretchable and compressible members 60 allows the movable floor 30 to be moved manually and properly, and the movable floor 30 thus moved can be fixed to the retreat position by the stopper members 63. Thus, the passenger boarding bridge 100 of the present embodiment can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by the compression of the stretchable and compressible members 60. Then, for example, the aircraft 200 can be moved as necessary by using a pushback truck or the like. Specifically, when the movable floor 30 of the cab 20 is close to, or in contact with, the fuselage of the aircraft 200, if the aircraft 200 is towed by a pushback truck or the like, it may cause the movable floor 30 of the cab 20 and the fuselage of the aircraft 200 to rub against each other, and thereby the fuselage of the aircraft 200 may get damaged. However, the passenger boarding bridge 100 of the present embodiment with the above-described configurations can reduce such a risk.

[0122] Further, in the passenger boarding bridge 100 of the present embodiment, as one example, even when a failure has occurred in the control system of the passenger boarding bridge 100 as in the Second Case, the compressive action of the stretchable and compressible members 60 allows the movable floor 30 to be moved manually and properly, and the movable floor 30 thus moved can be fixed to the retreat position by the stopper members 63. Thus, the passenger boarding bridge 100 of the present embodiment can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by the compression of the stretchable and compressible members 60. Then, for example, the aircraft 200 can be moved as necessary by using a pushback truck or the like.

Specifically, when the movable floor 30 of the cab 20 is close to, or in contact with, the fuselage of the aircraft 200, if the aircraft 200 is towed by a pushback truck or the like, it may cause the movable floor 30 of the cab 20 and the fuselage of the aircraft 200 to rub against each other, and thereby the fuselage of the aircraft 200 may get damaged. However, the passenger boarding bridge 100 of the present embodiment with the above-described configurations can reduce such a risk.

[0123] Still further, in the passenger boarding bridge 100 of the present embodiment, as one example, even in a case where the travel wheels 14 of the travel device 15B are rotated

in the reverse direction and thereby the cab 20 is docked with the fuselage of the aircraft 200 as in the Third Case, the compressive action of the stretchable and compressible members 60 allows the movable floor 30 to be moved manually and properly, and the movable floor 30 thus moved can be fixed to the retreat position by the stopper members 63. Thus, the passenger boarding bridge 100 of the present embodiment can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by the compression of the stretchable and compressible members 60. Then, for example, the aircraft 200 can be moved as necessary by using a pushback truck or the like. Moreover, since the distal end limit switches LSf for prohibiting the forward rotation of the travel wheels 14 of the travel device 15B are turned OFF, the operator may operate the travel lever to the operation position for forward traveling of the travel device 15B to rotate the travel wheels 14 of the travel device 15B in the forward direction, and thereby the cab 20 can be moved further away from the aircraft 200. Specifically, when the movable floor 30 of the cab 20 is close to, or in contact with, the fuselage of the aircraft 200, if the aircraft 200 is towed by a pushback truck or the like, it may cause the movable floor 30 of the cab 20 and the fuselage of the aircraft 200 to rub against each other, and thereby the fuselage of the aircraft 200 may get damaged. However, the passenger boarding bridge 100 of the present embodiment with the above-described configurations can reduce such a risk.

[0124] Except the above-described additional features, the passenger boarding bridge 100 of the present embodiment may be the same as the passenger boarding bridge 100 of Embodiment 1.

(First Variation of Embodiment 2)

[0125] The above description of the passenger boarding bridge 100 of Embodiment 2 has given an example in which the movable floor 30 includes the slide plate 31, and the moving mechanism 65 includes the stretchable and compressible members 60. However, this is merely a non-limiting example.

[0126] Alternatively, for example, although not illustrated, the movable floor may include a tiltable plate that is coupled to the front end portion of the inclinable floor 21B via, for example, a coupling hinge portion that extends in the width direction. The movable floor may be configured to move between the stop position, at which the movable floor is close

to or in contact with the aircraft 200, and the retreat position, at which the movable floor is located away from the aircraft 200, by tilting the tiltable plate about the coupling hinge portion. Thus, the passenger boarding bridge 100 of the present variation can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by the tilting of the tiltable plate.

[0127] Except the above-described additional features, the passenger boarding bridge 100 of the present variation may be the same as the passenger boarding bridge 100 of Embodiment 2.

(Second Variation of Embodiment 2)

[0128] The above description of the passenger boarding bridge 100 of Embodiment 2 has given an example in which the urging members each acting in response to a compressive load (e.g., compression coil springs) serve as the stretchable and compressible members 60. However, this is merely a non-limiting example.

[0129] For example, although not illustrated, each of the stretchable and compressible members may be an urging member that acts in response to a tensile load (e.g., a tension coil spring). In this case, even when the urging force (tensile force) of the stretchable and compressible members 60, which is generated by the tensile action of the stretchable and compressible members 60, is applied to the movable floor 30 having moved from the retreat position to the stop position, the movable floor 30 can be fixed to the stop position by using suitable stopper members (not shown). Then, by removing the stopper members at a suitable timing, the movable floor 30 can be automatically moved to the retreat position. Thus, the passenger boarding bridge 100 of the present variation can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by the compression of the stretchable and compressible members.

[0130] Except the above-described additional features, the passenger boarding bridge 100 of the present variation may be the same as the passenger boarding bridge 100 of Embodiment 2.

(Third Variation of Embodiment 2)

[0131] The above descriptions of the passenger boarding bridge 100 of Embodiment 2 and the passenger boarding bridge 100 of the second variation of Embodiment 2 have given examples in which the moving mechanism 65 includes urging members as the

stretchable and compressible members 60. However, these are merely non-limiting examples.

[0132] For example, although not illustrated, the moving mechanism need not include urging members, so long as the moving mechanism includes a mechanism configured to move the movable floor 30 between the stop position, at which the movable floor 30 is close to or in contact with the aircraft 200, and the retreat position, at which the movable floor 30 is located away from the aircraft 200. In this case, the movable floor 30 is fixed to both the retreat position and the stop position by suitable stopper members (not shown). Thus, the passenger boarding bridge 100 of the present variation can readily and speedily secure a desired clearance between the cab 20 and the aircraft 200 by a moving operation of the moving mechanism.

[0133] Except the above-described additional features, the passenger boarding bridge 100 of the present variation may be the same as the passenger boarding bridge 100 of Embodiment 2.

[0134] It should be noted that any of Embodiment 1, the variation of Embodiment 1, Embodiment 2, and the first to third variations of Embodiment 2 may be combined with each other, so long as the combined embodiments and variations do not contradict with each other.

[0135] From the foregoing description, numerous modifications and other embodiments of the present disclosure are obvious to a person skilled in the art. Therefore, the foregoing description should be interpreted only as an example and is provided for the purpose of teaching the best mode for carrying out the present disclosure to a person skilled in the art. The structural and/or functional details may be substantially modified without departing from the spirit of the present disclosure.

What is claimed is:

1. A passenger boarding bridge comprising:
 - a rotunda connected to a terminal building;
 - a tunnel unit whose proximal end is connected to the rotunda;
 - a cab provided at a distal end of the tunnel unit; and
 - a travel device supporting the tunnel unit, wherein the cab includes:
 - a first floor configured to serve as a walkway that communicates with the tunnel unit;
 - a second floor provided on the first floor; and
 - a moving mechanism configured to move the second floor to a stop position at which the second floor is close to, or in contact with, an aircraft,

the moving mechanism includes:

 - a driver configured to apply driving force to the second floor; and
 - a control device configured to control driving of the driver, and

the control device controls the driver to retreat the second floor stopped at the stop position to a retreat position away from the aircraft either in a case where a travel wheel of the travel device is unable to rotate or in a case where rotation of the travel wheel of the travel device for undocking the cab from the aircraft is prohibited.

2. A passenger boarding bridge comprising:
 - a rotunda connected to a terminal building;
 - a tunnel unit whose proximal end is connected to the rotunda;
 - a cab provided at a distal end of the tunnel unit;
 - a travel device supporting the tunnel unit; and
 - a first control device configured to control an operation of the travel device,

wherein

the cab includes:

 - a first floor configured to serve as a walkway that communicates with the tunnel unit;
 - a second floor provided on the first floor; and

a moving mechanism configured to move the second floor to a stop position at which the second floor is close to, or in contact with, an aircraft,

the moving mechanism includes:

a driver configured to apply driving force to the second floor; and

a second control device configured to control driving of the driver,

wiring used for the second control device is provided independently of wiring used for the first control device, and

the second control device controls the driver to retreat the second floor stopped at the stop position to a retreat position away from the aircraft.

3. The passenger boarding bridge according to claim 1 or 2, wherein the second floor is fixed to the retreat position by a brake of the driver.
4. The passenger boarding bridge according to any one of claims 1 to 3, wherein the moving mechanism includes a power supplying device.
5. A passenger boarding bridge comprising:
 - a rotunda connected to a terminal building;
 - a tunnel unit whose proximal end is connected to the rotunda; and
 - a cab provided at a distal end of the tunnel unit, wherein the cab includes:
 - a first floor configured to serve as a walkway that communicates with the tunnel unit;
 - a second floor provided on the first floor; and
 - a moving mechanism configured to move the second floor between a stop position at which the second floor is close to, or in contact with, an aircraft and a retreat position at which the second floor is located away from the aircraft, and
 - the second floor is fixed to the retreat position and/or the stop position by a stopper member of the moving mechanism.
6. The passenger boarding bridge according to claim 5, wherein

the second floor stopped at the stop position is moved to the retreat position by compression of a stretchable and compressible member of the moving mechanism.