DESCRIPTION

Title of Invention: PASSENGER BOARDING BRIDGE

Technical Field

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

Background Art

[0002] At an airport, there are cases where a passenger boarding bridge that connects a terminal building and an aircraft is used for boarding onto and disembarking from the aircraft.

[0003] The passenger boarding bridge includes: a rotunda connected to an entrance of the terminal building; a tunnel unit with its proximal end connected to the rotunda, the tunnel unit being extendable and retractable; and a cab (a head) provided at the distal end of the tunnel unit, the cab being connected to the aircraft.

[0004] The tunnel unit includes a plurality of tunnels that are fitted together in a nested manner, and the tunnel unit is configured to be extendable and retractable in a front-rear direction (longitudinal direction). This enables the tunnel unit to appropriately accommodate changes in a distance between the terminal building and the aircraft. Floor members of the tunnels form a passenger walkway between the entrance of the terminal building of the airport and an entrance of the aircraft.

[0005] Here, in the tunnel unit of the above passenger boarding bridge, an inner tunnel and an outer tunnel that are adjacent to each other are fitted together in such a manner that the inner tunnel is nested in the outer tunnel. Therefore, various drainage structures have conventionally been proposed so as to prevent rainwater from entering the walkway of the tunnel unit through a gap between the outer tunnel and the inner tunnel. For example, Patent Literature 1 discloses providing a drainage gutter extending in the aforementioned front-rear direction along an end portion of the tunnel walkway.

[0006] For the tunnel unit of the above passenger boarding bridge, various slide mechanisms have conventionally been proposed so as to enable the adjacent tunnels to move relative to each other in the front-rear direction smoothly. For example, Patent Literature 2 discloses providing, along an end portion of the tunnel walkway, a roller surface for guiding tunnel rollers.

Citation List

Patent Literature

[0007] PTL 1: Japanese Laid-Open Patent Application Publication No. 2005-193830

PTL 2: Japanese Laid-Open Patent Application Publication No. 2007-216908

Summary of Invention

Technical Problem

[0008] One aspect of the present disclosure aims, as one example, to provide a passenger boarding bridge that makes it possible to improve the appearance of an end region of a tunnel walkway as compared with the conventional art.

Solution to Problem

[0009] One aspect of the present disclosure is a passenger boarding bridge including: a tunnel unit including a plurality of tunnels that are fitted together in a nested manner, the tunnel unit being extendable and retractable in a front-rear direction; a floor member that forms a walkway of an outer tunnel of the tunnels that are adjacent to each other; and a partitioning member coupled to an inner tunnel of the tunnels that are adjacent to each other. The partitioning member partitions a tunnel space and an end region of the outer tunnel from each other, the tunnel space being a space through which a passenger passes on the floor member, the end region of the outer tunnel extending along an end portion of the floor member in the front-rear direction, and the partitioning member moves to follow extension and retraction of the tunnel unit.

Advantageous Effects of Invention

[0010] The passenger boarding bridge of the one aspect of the present disclosure provides an advantage of making it possible to improve the appearance of the end region of the tunnel walkway as compared with the conventional art.

Brief Description of Drawings

[0011] FIG. 1 shows one example of a passenger boarding bridge of one embodiment.

FIG. 2A is a sectional view of a tunnel unit of FIG. 1 taken along line A-A of FIG. 1 as viewed in the direction of arrows of line A-A.

FIG. 2B is a sectional view of the tunnel unit of FIG. 1 taken along line B-B of FIG. 1 as viewed in the direction of arrows of line B-B.

FIG. 3 is a plan view of one example of a moving mechanism of a partitioning member in the passenger boarding bridge of the embodiment.

FIG. 4 is a right side view of a sprocket and its vicinity in the moving mechanism of

the partitioning member of FIG. 3.

FIG. 5A shows one example of a coupling in the passenger boarding bridge of the embodiment.

FIG. 5B shows one example of the coupling in the passenger boarding bridge of the embodiment.

FIG. 6A shows one example of an elastic mechanism in the passenger boarding bridge of the embodiment.

FIG. 6B shows the elastic mechanism of FIG. 6A as viewed in the direction of arrows of line B-B of FIG. 6A.

FIG. 6C is a sectional view of the elastic mechanism of FIG. 6A taken along line C-C of FIG. 6A.

Description of Embodiments

[0012] Generally, a passenger boarding bridge is, as described in Patent Literature 1, provided with a drainage gutter along an end portion of the tunnel walkway so as to drain rainwater. In this case, the appearance of an end region of the tunnel walkway tends to be impaired due to exposure of the drainage gutter. Moreover, if a passenger steps on the drainage gutter and, for example, drainage water in the drainage gutter adheres to the passenger, carpet on the tunnel walkway may become dirty due to the drainage water.

[0013] Also, generally, a passenger boarding bridge is, as described in Patent Literature 2, provided with a roller surface for guiding tunnel rollers, the roller surface extending along the end portion of the tunnel walkway. In this case, the appearance of the end region of the tunnel walkway tends to be impaired due to exposure of the roller surface. Moreover, if a passenger steps on the roller surface and, for example, oil on the roller surface adheres to the passenger, carpet on the tunnel walkway may become dirty due to the oil.

[0014] In view of the above, the inventors of the present disclosure have conducted diligent studies to devise measures for improving the appearance of the end region of the tunnel walkway, and as a result, they have arrived at one aspect of the present disclosure as described below.

[0015] Specifically, a first aspect of the present disclosure is a passenger boarding bridge including: a tunnel unit including a plurality of tunnels that are fitted together in a nested manner, the tunnel unit being extendable and retractable in a front-rear direction; a floor member that forms a walkway of an outer tunnel of the tunnels that are adjacent to each other; and a partitioning member coupled to an inner tunnel of the tunnels that are adjacent to each other.

The partitioning member partitions a tunnel space and an end region of the outer tunnel from each other, the tunnel space being a space through which a passenger passes on the floor member, the end region of the outer tunnel extending along an end portion of the floor member in the front-rear direction, and the partitioning member moves to follow extension and retraction of the tunnel unit.

[0016] According to the above configuration, in the passenger boarding bridge of the first aspect, the appearance of the end region of the tunnel walkway can be improved as compared with the conventional art.

[0017] It should be noted that, in the present disclosure, the term “coupled” encompasses both of the following cases: a case where two components are directly coupled to each other; and a case where two components are coupled to each other via a suitable coupling member.

[0018] As one example, a passenger boarding bridge of a second aspect of the present disclosure may be configured such that, in the passenger boarding bridge of the first aspect, the end region of the outer tunnel is provided with a drainage gutter to drain rainwater.

[0019] Generally, a passenger boarding bridge is provided with the above drainage gutter along the end portion of the tunnel walkway. The appearance of the end region of the tunnel walkway tends to be impaired due to exposure of the drainage gutter. However, in the passenger boarding bridge of the second aspect, the drainage gutter can be made less visible from the tunnel space by the partitioning member, which follows extension and retraction of the tunnel unit. Moreover, if a passenger steps on the drainage gutter and, for example, drainage water in the drainage gutter adheres to the passenger, carpet on the tunnel walkway may become dirty due to the drainage water. However, in the passenger boarding bridge of the second aspect, the partitioning member, which follows extension and retraction of the tunnel unit, can appropriately prevent passengers from stepping on the drainage gutter.

[0020] As one example, a passenger boarding bridge of a third aspect of the present disclosure may be configured such that the passenger boarding bridge of the first or second aspect includes a tunnel roller provided on the inner tunnel of the tunnels that are adjacent to each other, wherein the end region of the outer tunnel is provided with a roller surface on which the tunnel roller rolls.

[0021] Generally, a passenger boarding bridge is provided with the roller surface for guiding the tunnel roller, the roller surface extending along the end portion of the tunnel walkway. The appearance of the end region of the tunnel walkway tends to be impaired due to exposure of the roller surface. However, in the passenger boarding bridge of the third aspect, the roller surface can be made less visible from the tunnel space by the partitioning member,

which follows extension and retraction of the tunnel unit. Moreover, if a passenger steps on the roller surface and, for example, oil of the roller surface adheres to the passenger, carpet on the tunnel walkway may become dirty due to the oil. However, in the passenger boarding bridge of the third aspect, the partitioning member, which follows extension and retraction of the tunnel unit, can appropriately prevent passengers from stepping on the roller surface.

[0022] A passenger boarding bridge of a fourth aspect of the present disclosure may be configured such that, in the passenger boarding bridge of any one of the first to third aspects, the partitioning member includes a plurality of plate members, a chain coupled to the plate members, and a sprocket around which the chain is wound; one end of the chain is coupled to an opening end of the inner tunnel; the sprocket is mounted to the outer tunnel near an opening end of the outer tunnel; and the chain is turned back via the sprocket.

[0023] According to the above configuration, the passenger boarding bridge of the fourth aspect can properly move the plate members forming the partitioning member so as to be able to follow extension and retraction of the tunnel unit. Specifically, in a state where the tunnel unit is extended, the end region of the outer tunnel can be made difficult to visually recognize from the tunnel space, over a range from the opening end of the inner tunnel to the opening end of the outer tunnel, owing to the arrangement of the plurality of plate members held vertically by the chain. Further, in a state where the tunnel unit is retracted, the plurality of plate members held vertically by the chain can be properly accommodated on the side of the outer tunnel as a result of the chain being turned back via the sprocket.

[0024] A passenger boarding bridge of a fifth aspect of the present disclosure may be configured such that the passenger boarding bridge of the fourth aspect includes: a first member that contacts or is in proximity to the plate members so as to cover the end region of the outer tunnel from below; and a second member that contacts or is in proximity to the plate members so as to cover the end region of the outer tunnel from above, wherein: the first member is fixed to the floor member of the outer tunnel; the second member is fixed to a side wall of the outer tunnel; and movement of each of the plate members in a direction orthogonal to the front-rear direction is restricted by the first member and the second member.

[0025] According to the above configuration, in the passenger boarding bridge of the fifth aspect, the plate members forming the partitioning member can be properly guided, by the first member and the second member, in the front-rear direction in which the tunnel unit extends and retracts.

[0026] A passenger boarding bridge of a sixth aspect of the present disclosure may be configured such that, in the passenger boarding bridge of the fifth aspect, each of the plate

members includes: a first plate member that stands vertically from the first member; and a second plate member that is inclined upward from the first plate member toward the second member.

[0027] According to the above configuration, in the passenger boarding bridge of the sixth aspect, as each of the plate members forming the partitioning member, a bent plate that is bent so as to cover the end region of the outer tunnel from above is used. Accordingly, as compared with a case where a straight plate or the like is used, the width of the tunnel unit can be reduced, and the strength of the plate members can be improved.

[0028] A passenger boarding bridge of a seventh aspect of the present disclosure may be configured such that the passenger boarding bridge of the fifth aspect includes a travel roller provided between the first member and the plate members.

[0029] According to the above configuration, the passenger boarding bridge of the seventh aspect includes the travel roller provided between the first member and the plate members forming the partitioning member. Accordingly, with the travel roller, the plate members on the first member can be moved smoothly in the front-rear direction in which the tunnel unit extends and retracts.

[0030] A passenger boarding bridge of an eighth aspect of the present disclosure may be configured such that the passenger boarding bridge of the fifth aspect includes a coupling to connect the chain and the inner tunnel, wherein the coupling moves in accordance with a change in a relative position between the inner tunnel and the outer tunnel in a direction orthogonal to the front-rear direction.

[0031] When the tunnel unit of the passenger boarding bridge extends or retracts, the inner tunnel and the outer tunnel also swing in a direction orthogonal to the front-rear direction in which the tunnel unit extends and retracts (e.g., the width direction of the tunnel unit or the up-down direction in which gravitational force is exerted). Accordingly, it is often the case that a change in the relative position between the inner tunnel and the outer tunnel occurs.

[0032] Here, movement of the plate members forming the partitioning member is, as described above, restricted by the first member and the second member, which are fixed to the outer tunnel. Accordingly, in a case where the partitioning member and the inner tunnel are fixed together by bolting, when the relative position between the inner tunnel and the outer tunnel changes, external force due to the change in the relative position between the inner tunnel and the outer tunnel is applied to the fixing portion between the partitioning member and the inner tunnel. This may cause damage to the fixing portion.

[0033] In this respect, in the passenger boarding bridge of the eighth aspect, the coupling to

connect the chain of the partitioning member and the inner tunnel moves in accordance with a change in the relative position between the inner tunnel and the outer tunnel. Consequently, as compared with a case where the partitioning member and the inner tunnel are fixed together by bolting, when the tunnel unit extends or retracts, external force due to the change in the relative position between the inner tunnel and the outer tunnel can be made less likely to be applied to the coupling.

[0034] A passenger boarding bridge of a ninth aspect of the present disclosure may be configured such that, in the passenger boarding bridge of the eighth aspect, the coupling includes a rail coupled to one of the inner tunnel and the partitioning member and a carriage coupled to the other of the inner tunnel and the partitioning member; and the carriage moves linearly relative to the rail in a first direction orthogonal to the front-rear direction.

The phrase "a rail coupled to one of the inner tunnel and the partitioning member" means that one of the inner tunnel and the partitioning member is coupled to the rail while being in contact with the rail, or while being positioned closer to the rail than the other of the inner tunnel and the partitioning member. The phrase "a carriage coupled to the other of the inner tunnel and the partitioning member" means that the other of the inner tunnel and the partitioning member, which is different from the one of the inner tunnel and the partitioning member, is coupled to the carriage while being in contact with the carriage, or while being positioned closer to the carriage than the one of the inner tunnel and the partitioning member.

[0035] According to the above configuration, in the passenger boarding bridge of the ninth aspect, the coupling includes the rail and the carriage. Accordingly, as compared with a case where the partitioning member and the inner tunnel are fixed together by bolting, when the tunnel unit extends or retracts, external force due to a change in the relative position between the inner tunnel and the outer tunnel in the first direction can be made less likely to be applied to the coupling.

[0036] A passenger boarding bridge of a tenth aspect of the present disclosure may be configured such that, in the passenger boarding bridge of the eighth aspect, the coupling includes a bracket coupled to one of the inner tunnel and the partitioning member and a block coupled to the other of the inner tunnel and the partitioning member; a pin fixed to the bracket is inserted into the block; and the block linearly moves relative to the pin in a second direction orthogonal to the front-rear direction.

The phrase "a bracket coupled to one of the inner tunnel and the partitioning member" means that one of the inner tunnel and the partitioning member is coupled to the bracket while being in contact with the bracket, or while being positioned closer to the bracket

than the other of the inner tunnel and the partitioning member. The phrase "a block coupled to the other of the inner tunnel and the partitioning member" means that the other of the inner tunnel and the partitioning member, which is different from the one of the inner tunnel and the partitioning member, is coupled to the block while being in contact with the block, or while being positioned closer to the block than the one of the inner tunnel and the partitioning member.

[0037] According to the above configuration, in the passenger boarding bridge of the tenth aspect, the coupling includes the bracket with the pin and the block. Accordingly, as compared with a case where the partitioning member and the inner tunnel are fixed together by bolting, when the tunnel unit extends or retracts, external force due to a change in the relative position between the inner tunnel and the outer tunnel in the second direction can be made less likely to be applied to the coupling.

[0038] A passenger boarding bridge of an eleventh aspect of the present disclosure may be configured such that the passenger boarding bridge of the fourth aspect includes an elastic mechanism coupled to the chain via a wire.

[0039] According to the above configuration, in the passenger boarding bridge of the eleventh aspect, the elastic force of the elastic mechanism is imparted as the tension in the chain coupled to the plate members forming the partitioning member.

[0040] A passenger boarding bridge of a twelfth aspect of the present disclosure may be configured such that, in the passenger boarding bridge of the eleventh aspect, the elastic mechanism includes: a compression coil spring; a plate that is in contact with one end of the compression coil spring; a bracket that is in contact with the other end of the compression coil spring; and a pressing member that compresses the compression coil spring via the bracket. The plate may be fixed to the inner tunnel, and the pressing member may be coupled to the wire.

[0041] According to the above configuration, in the passenger boarding bridge of the twelfth aspect, when the compression coil spring between the plate and the bracket is compressed by the pressing member, the compression reaction force of the compression coil spring is applied to the pressing member in a direction to pull the wire. Accordingly, in the passenger boarding bridge of the twelfth aspect, the compressive force applied to the compression coil spring can be imparted as the tension in the chain coupled to the plate members forming the partitioning member.

[0042] A passenger boarding bridge of a thirteenth aspect of the present disclosure may be configured such that, in the passenger boarding bridge of the eleventh aspect, the elastic mechanism includes a detector that detects an amount of compression of the compression coil spring.

[0043] According to the above configuration, in the passenger boarding bridge of the thirteenth aspect, the elastic mechanism includes the detector, which detects the amount of compression of the compression coil spring. This configuration, as compared with a configuration that does not include the detector, makes it possible to readily recognize that the tension in the chain coupled to the plate members forming the partitioning member has deviated from a predetermined range.

[0044] Hereinafter, one embodiment of the present disclosure is described with reference to the accompanying drawings. The embodiment described below shows 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 embodiment below are mere examples, and do not limit the above-described aspects of the present disclosure. Moreover, among the components in the embodiment below, components that are not recited in the independent claim 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, precise dimensional ratios, etc.

[0045] (Embodiment)

FIG. 1 shows one example of a passenger boarding bridge of one embodiment. FIG. 1 shows a portion of the overall length of a tunnel unit 10.

[0046] It should be noted that, in the present disclosure, for the sake of convenience of the following description of the configuration of a passenger boarding bridge 100, the direction in which the tunnel unit 10 extends and retracts is referred to as the front-rear direction; the direction in which gravitational force acts on the passenger boarding bridge 100 is referred to as the up-down direction; and the width direction of the passenger boarding bridge 100 (i.e., the direction orthogonal to the front-rear direction and the up-down direction) is referred to as the left-right direction.

[0047] Further, in the following description of the configuration of the passenger boarding bridge 100, the side on which a cab 20 is positioned is defined as “front” and the side opposite the cab 20 is defined as “rear”.

[0048] As shown in FIG. 1, the passenger boarding bridge 100 includes an unshown rotunda (rear circular room), the tunnel unit 10, the cab (front circular room) 20, drive columns 15, and auxiliary stairs 16.

[0049] The rotunda is connected to an entrance of a terminal building. The tunnel unit 10 is connected to the rotunda. The cab 20 is connected to the front end portion of the tunnel unit 10.

[0050] The tunnel unit 10 includes an inner tunnel and an outer tunnel that are adjacent to each other. The inner and outer tunnels are fitted together such that the inner tunnel is nested in the outer tunnel. The tunnel unit 10 is configured to be extendable and retractable in the front-rear direction. Specifically, the drive columns 15 are coupled to suitable portions of the tunnel unit 10 such that the tunnel unit 10 is sandwiched between the drive columns 15. Accordingly, when drive wheels provided at the lower end of the drive columns 15 travel on an apron 18, power for extension or retraction in the front-rear direction is transmitted to the tunnel unit 10. When the overall length of the tunnel unit 10 is extended by the transmitted power and the cab 20 reaches an entrance of an aircraft, a passenger walkway is formed between the entrance of the terminal building of the airport and the entrance of the aircraft.

[0051] An unshown operating panel is installed in the cab 20. Accordingly, an operator can perform an operation using the operating panel to control relative movement of the tunnel unit 10 in the front-rear direction. It should be noted that the passenger boarding bridge 100 may be operated not only by the operating panel in the cab 20, but also by remote equipment located outside the passenger boarding bridge 100.

[0052] The auxiliary stairs 16 are provided on the side of the tunnel unit 10 so as to connect the inside of the tunnel unit 10 and the apron 18. The installation of the auxiliary stairs 16 is optional, and the auxiliary stairs 16 are used, for example, by an operator to get in and out of the cab 20.

[0053] Next, an internal configuration of the tunnel unit 10 of the passenger boarding bridge 100 of the present embodiment is described.

[0054] FIG. 2A is a sectional view of the tunnel unit of FIG. 1 taken along line A-A of FIG. 1 as viewed in the direction of arrows of line A-A. FIG. 2B is a sectional view of the tunnel unit of FIG. 1 taken along line B-B of FIG. 1 as viewed in the direction of arrows of line B-B.

[0055] As shown FIG. 1, the passenger boarding bridge 100 includes a partitioning member 30. The partitioning member 30 is coupled to an inner tunnel 10A of the adjacent inner and outer tunnels, by a below-described coupling mechanism.

[0056] As shown in FIG. 2A, the passenger boarding bridge 100 of the present embodiment includes: a floor member 11, which forms a walkway of an outer tunnel 10B of the adjacent inner and outer tunnels; and a tunnel roller 12, which is provided on the inner tunnel 10A of the adjacent inner and outer tunnels. In the example shown in FIG. 2A and FIG. 2B, the tunnel

roller 12 is mounted, via a bracket, to a back surface of a horizontal plate of a structural beam of the inner tunnel 10A.

[0057] As shown in FIG. 2B, the partitioning member 30 partitions a tunnel space S1 and an end region S2 of the outer tunnel 10B from each other. The tunnel space S1 is a space through which passengers pass over the floor member 11. The end region S2 of the outer tunnel 10B extends along an end portion of the floor member 11 in the front-rear direction (the direction perpendicular to the plane of FIG. 2B). The partitioning member 30 moves to follow extension and retraction of the tunnel unit 10. A moving mechanism of the partitioning member 30 will be described below in detail.

[0058] The end region S2 of the outer tunnel 10B is provided with a drainage gutter 41 to drain rainwater. The drainage gutter 41 extends along the end portion of the floor member 11 in the front-rear direction. In the example shown in FIG. 2A and FIG. 2B, the end portion of the floor member 11 is provided with a step. A vertical plate of a structural beam of the outer tunnel 10B and the step form a recess that extends in the front-rear direction. The recess serves as the drainage gutter 41.

[0059] The end region S2 of the outer tunnel 10B is provided with a roller surface 42, on which the tunnel roller 12 rolls. The roller surface 42 extends along the end portion of the floor member 11 in the front-rear direction. In the example shown in FIG. 2A and FIG. 2B, a surface (specifically, upper surface) of a horizontal plate of the structural beam of the outer tunnel 10B serves as the roller surface 42.

[0060] The above-described configuration makes it possible to improve the appearance of the end region of the tunnel walkway of the passenger boarding bridge 100 of the present embodiment as compared with the conventional art.

[0061] As one example, the passenger boarding bridge 100 is generally provided with the drainage gutter 41 along the end portion of the tunnel walkway, and the appearance of the end region of the tunnel walkway tends to be impaired due to exposure of the drainage gutter 41. However, in the passenger boarding bridge 100 of the present embodiment, the drainage gutter 41 can be made less visible from the tunnel space S1 by the partitioning member 30, which follows extension and retraction of the tunnel unit 10. Moreover, if a passenger steps on the drainage gutter 41 and, for example, drainage water in the drainage gutter 41 adheres to the passenger, carpet on the tunnel walkway may become dirty due to the drainage water. However, in the passenger boarding bridge 100 of the present embodiment, the partitioning member 30, which follows extension and retraction of the tunnel unit 10, can appropriately prevent passengers from stepping on the drainage gutter 41.

[0062] Further, as one example, the passenger boarding bridge 100 is generally provided with the roller surface 42 for guiding the tunnel roller 12, the roller surface 42 extending along the end portion of the tunnel walkway, and the appearance of the end region of the tunnel walkway tends to be impaired due to exposure of the roller surface 42. However, in the passenger boarding bridge 100 of the present embodiment, the roller surface 42 can be made less visible from the tunnel space S1 by the partitioning member 30, which follows extension and retraction of the tunnel unit 10. Moreover, if a passenger steps on the roller surface 42 and, for example, oil of the roller surface 42 adheres to the passenger, carpet on the tunnel walkway may become dirty due to the oil. However, in the passenger boarding bridge 100 of the present embodiment, the partitioning member 30, which follows extension and retraction of the tunnel unit 10, can appropriately prevent passengers from stepping on the roller surface 42.

[0063] <Moving Mechanism of Partitioning Member 30>

FIG. 3 is a plan view of one example of the moving mechanism of the partitioning member in the passenger boarding bridge of the embodiment. FIG. 4 is a right side view of a sprocket and its vicinity in the moving mechanism of the partitioning member of FIG. 3.

[0064] It should be noted that FIG. 3 shows the moving mechanism of the partitioning member 30 in a right-side end region in the tunnel unit 10. Also in a left-side end region of the tunnel unit 10, the moving mechanism of the partitioning member 30 is configured in the same manner as that shown in FIG. 3. In FIG. 3, for the sake of convenience, the inner tunnel 10A and the outer tunnel 10B of the tunnel unit 10 of the passenger boarding bridge 100 are represented by two-dot chain lines.

[0065] As shown in FIG. 3 and FIG. 4, the partitioning member 30 includes a plurality of plate members 31, a chain 32 coupled to the plate members 31, and a sprocket 35, around which the chain 32 is wound.

[0066] One end of the chain 32 is coupled to an opening end (front end) of the inner tunnel 10A via a coupling 50, and the sprocket 35 is mounted to the outer tunnel 10B near an opening end (front end) of the outer tunnel 10B. The other end of the chain 32 is turned back via the sprocket 35, and is coupled to one end of a wire 60. That is, the chain 32 pulled by the wire 60 is bent by approximately 180° by the sprocket 35 fixed at the opening end of the outer tunnel 10B. It should be noted that the position at which the chain 32 and the wire 60 are coupled may be any position. However, when the tunnel unit 10 is in a state in which the overall length thereof is maximized, it is necessary for the end region S2 of the outer tunnel 10B to be hidden by an arrangement of the plurality of plate members 31 held vertically by the chain 32, as shown in FIG. 3.

[0067] A pulley 62 is mounted to the outer tunnel 10B near the rear end of the outer tunnel 10B. The other end of the wire 60 is turned back via the pulley 62, and is coupled to an elastic mechanism 70. That is, the wire 60 pulled by the elastic mechanism 70 is bent by approximately 180° by the pulley 62 fixed near the rear end of the outer tunnel 10B. The configuration of the elastic mechanism 70 will be described below in detail.

[0068] As shown in FIG. 2B, FIG. 3, and FIG. 4, the passenger boarding bridge 100 of the present embodiment includes: a first guide member 43, which contacts or is in proximity to the plate members 31 so as to cover the end region S2 of the outer tunnel 10B from below; and a second guide member 44, which contacts or is in proximity to the plate members 31 so as to cover the end region S2 of the outer tunnel 10B from above. The first guide member 43 is fixed to the floor member 11 of the outer tunnel 10B, and the second guide member 44 is fixed to a side wall of the outer tunnel 10B. Movement of each of the plurality of plate members 31 in a direction orthogonal to the front-rear direction in which the tunnel unit 10 extends and retracts is restricted by the first guide member 43 and the second guide member 44.

[0069] Further, as shown in FIG. 2B and FIG. 4, each of the plurality of plate members 31 includes: a first plate member 31A, which stands vertically from the upper surface of the first guide member 43; and a second plate member 31B, which is inclined upward from the first plate member 31A toward the second guide member 44. That is, as each plate member 31, a bent plate that is bent so as to cover the end region S2 of the outer tunnel 10B from above is used. It should be noted that, in this example, the chain 32 is coupled to each plate member 31 near the upper end of its first plate member 31A.

[0070] As one example, as shown in the enlarged view of FIG. 2B, the first guide member 43 includes: a vertical plate 43A, which forms the drainage gutter 41 (the recess); and a roller receiver 43B provided on the upper surface of the vertical plate 43A. The roller receiver 43B surrounds a travel roller 40, which is provided at the lower end of the first plate member 31A, so as to properly guide the travel roller 40 in the front-rear direction in which the tunnel unit 10 extends and retracts. It should be noted that it is not essential to provide all of the plate members 31 with the travel roller 40. For example, as shown in FIG. 4, the travel roller 40 may be provided on every other plate member 31.

[0071] As one example, as shown in the enlarged view of FIG. 2B, the second guide member 44 includes a pair of inclined plates 44A fixed to a structural beam (a rectangular pipe) that forms the side wall of the outer tunnel 10B. There is a gap between end portions of the respective inclined plates 44A, and an end portion of the second plate member 31B is sandwiched in the gap. In this manner, the inclined plates 44A are configured to properly guide

the second plate member 31B in the front-rear direction in which the tunnel unit 10 extends and retracts.

[0072] As described above, the passenger boarding bridge 100 of the present embodiment can properly move the plate members 31 so as to be able to follow extension and retraction of the tunnel unit 10. Specifically, in a state where the tunnel unit 10 is extended, the end region S2 of the outer tunnel 10B can be made difficult to visually recognize from the tunnel space S1, over a range from the opening end of the inner tunnel 10A to the opening end of the outer tunnel 10B, owing to the arrangement of the plurality of plate members 31 held vertically by the chain 32. Further, in a state where the tunnel unit 10 is retracted, the plurality of plate members 31 held vertically by the chain 32 can be properly accommodated on the side of the outer tunnel 10B as a result of the chain 32 being turned back via the sprocket 35.

[0073] Further, in the passenger boarding bridge 100 of the present embodiment, the plate members 31 can be properly guided, by the first guide member 43 and the second guide member 44, in the front-rear direction in which the tunnel unit 10 extends and retracts.

[0074] Still further, in the passenger boarding bridge 100 of the present embodiment, as each plate member 31, a bent plate that is bent so as to cover the end region S2 of the outer tunnel 10B from above is used. Accordingly, as compared with a case where a straight plate or the like is used, the width of the tunnel unit can be reduced, and the strength of the plate members 31 can be improved.

[0075] Still further, the passenger boarding bridge 100 of the present embodiment includes the travel rollers 40 provided between the first guide member 43 and the plate members 31. Accordingly, with the travel rollers 40, the plate members 31 on the first guide member 43 can be moved smoothly in the front-rear direction in which the tunnel unit 10 extends and retracts.

[0076] <Coupling Mechanism between Inner Tunnel 10A and Partitioning Member 30>

As shown in FIG. 3, the passenger boarding bridge 100 includes the coupling 50 to connect the chain 32 of the partitioning member 30 and the inner tunnel 10A. As described above, the coupling 50 is provided at a suitable position at the opening end (front end) of the inner tunnel 10A, and is coupled to one end of the chain 32 of the partitioning member 30.

[0077] The coupling 50 is configured to move in accordance with a change, in a direction orthogonal to the front-rear direction in which the tunnel unit 10 extends and retracts, in the relative position between the inner tunnel 10A and the outer tunnel 10B.

[0078] FIG. 5A and FIG. 5B show one example of the coupling in the passenger boarding bridge of the embodiment.

[0079] The coupling 50 includes: a rail 51 coupled to the opening end of the inner tunnel

10A; and a carriage 52 coupled to the one end of the chain 32 of the partitioning member 30. In the example shown in FIG. 5A and FIG. 5B, the carriage 52 is coupled to the one end of the chain 32 via a bracket 53 and a block 54. The bracket 53 is provided with a pin and positioned on the inner tunnel 10A side, whereas the block 54 is positioned on the partitioning member 30 side.

However, the above configuration of the coupling 50 is a non-limiting example. Although not illustrated, the coupling 50 may include: a carriage coupled to the opening end of the inner tunnel 10A; and a rail coupled to the one end of the chain 32 of the partitioning member 30.

That is, the "rail" of the present disclosure is coupled to one of the inner tunnel 10 and the partitioning member 30, and the "carriage" of the present disclosure is coupled to the other of the inner tunnel 10 and the partitioning member 30.

[0080] The carriage 52 moves linearly relative to the rail 51 in the left-right direction orthogonal to the front-rear direction in which the tunnel unit 10 extends and retracts. A linear motion guide is one example of a mechanical element including the rail 51 and the carriage 52.

[0081] The coupling 50 includes: the bracket 53 coupled to the opening end of the inner tunnel 10A; and the block 54 coupled to the one end of the chain 32 of the partitioning member 30. In the example shown in FIG. 5A and FIG. 5B, the bracket 53 is coupled to the opening end of the inner tunnel 10A via the rail 51 and the carriage 52. The rail 51 is positioned on the inner tunnel 10A side, whereas the carriage 52 is positioned on the partitioning member 30 side.

However, the above configuration of the coupling 50 is a non-limiting example. Although not illustrated, the coupling 50 may include: a block coupled to the opening end of the inner tunnel 10A; and a bracket coupled to the one end of the chain 32 of the partitioning member 30.

That is, the "bracket" of the present disclosure is coupled to one of the inner tunnel 10 and the partitioning member 30, and the "block" of the present disclosure is coupled to the other of the inner tunnel 10 and the partitioning member 30.

[0082] A bushing that is not shown is press-fitted into the block 54, and a pin 55 fixed to the bracket 53 is inserted into the bushing of the block 54. Accordingly, the block 54 moves linearly relative to the pin 55 in the up-down direction orthogonal to the front-rear direction in which the tunnel unit 10 extends and retracts.

[0083] When the tunnel unit 10 of the passenger boarding bridge 100 extends or retracts, the inner tunnel 10A and the outer tunnel 10B also swing in a direction orthogonal to the front-rear direction in which the tunnel unit 10 extends and retracts (e.g., the width direction of the tunnel

unit 10 or the up-down direction in which gravitational force is exerted). Accordingly, it is often the case that a change in the relative position between the inner tunnel 10A and the outer tunnel 10B occurs.

[0084] Here, movement of the plate members 31 forming the partitioning member 30 is, as described above, restricted by the first guide member 43 and the second guide member 44, which are fixed to the outer tunnel 10B. Accordingly, in a case where the partitioning member 30 and the inner tunnel 10A are fixed together by bolting, when the relative position between the inner tunnel 10A and the outer tunnel 10B changes, external force due to the change in the relative position between the inner tunnel 10A and the outer tunnel 10B is applied to the fixing portion between the partitioning member 30 and the inner tunnel 10A. This may cause damage to the fixing portion.

[0085] In this respect, in the passenger boarding bridge 100 of the present embodiment, the coupling 50 to connect the chain 32 of the partitioning member 30 and the inner tunnel 10A moves in accordance with a change in the relative position between the inner tunnel 10A and the outer tunnel 10B. Consequently, as compared with a case where the partitioning member 30 and the inner tunnel 10A are fixed together by bolting, when the tunnel unit 10 extends or retracts, external force due to a change in the relative position between the inner tunnel 10A and the outer tunnel 10B can be made less likely to be applied to the coupling 50.

[0086] Specifically, in the passenger boarding bridge 100 of the present embodiment, the coupling 50 includes the rail 51 and the carriage 52. Accordingly, as compared with a case where the partitioning member 30 and the inner tunnel 10A are fixed together by bolting, when the tunnel unit 10 extends or retracts, external force due to a change in the relative position between the inner tunnel 10A and the outer tunnel 10B in the left-right direction can be made less likely to be applied to the coupling 50.

[0087] Further, in the passenger boarding bridge 100 of the present embodiment, the coupling 50 includes the bracket 53 with the pin and the block 54. Accordingly, as compared with a case where the partitioning member 30 and the inner tunnel 10A are fixed together by bolting, when the tunnel unit 10 extends or retracts, external force due to a change in the relative position between the inner tunnel 10A and the outer tunnel 10B in the up-down direction can be made less likely to be applied to the coupling 50.

[0088] <Detailed Configuration of Elastic Mechanism>

As shown in FIG. 3, the passenger boarding bridge 100 includes the elastic mechanism 70 to apply tension to the chain 32. As previously described, the elastic mechanism 70 is coupled to the other end of the chain 32 via the wire 60.

[0089] FIG. 6A shows one example of the elastic mechanism in the passenger boarding bridge of the embodiment. FIG. 6B shows the elastic mechanism of FIG. 6A as viewed in the direction of arrows of line B-B of FIG. 6A. It should be noted that, in FIG. 6B, the illustration of the inner tunnel 10A is omitted. FIG. 6C is a sectional view of the elastic mechanism of FIG. 6A taken along line C-C of FIG. 6A.

[0090] The elastic mechanism 70 includes: a compression coil spring 71; a plate 72, which is in contact with one end of the compression coil spring 71; a bracket 73, which is in contact with the other end of the compression coil spring 71; a pressing member 74, which compresses the compression coil spring 71 via the bracket 73; and a limit switch 75, which detects the amount of compression of the compression coil spring 71.

[0091] Here, the plate 72 is fixed to the inner tunnel 10A, and the pressing member 74 is coupled to the wire 60.

[0092] In the example shown in FIG. 6A and FIG. 6B, the bracket 73 includes: a horizontal portion 73A provided with an elongated hole; a receiver 73B, which is bent vertically upward from the front end of the horizontal portion 73A; and a toggle operating portion 73C provided on a back surface of the horizontal portion 73A. It should be noted that the horizontal portion 73A is provided with the elongated hole at a portion thereof that does not interfere with the compression coil spring 71. The pressing member 74 includes a bolt 74A and a nut 74B.

[0093] Here, the bolt 74A penetrates the plate 72, the compression coil spring 71, and the receiver 73B of the bracket 73, such that one end of the bolt 74A is coupled to the other end of the wire 60.

[0094] A first main surface of the receiver 73B is in contact with the other end of the compression coil spring 71, and a second main surface (opposite the first main surface) of the receiver 73B is in contact with the nut 74B coupled to the bolt 74A.

[0095] Further, as shown in FIG. 6A and FIG. 6C, a pair of cylindrical collars 78 and a pair of bolts 77 are provided in the elongated hole of the horizontal portion 73A, such that the collars 78 are spaced apart from each other by a predetermined distance in the longitudinal direction of the elongated hole, and such that the bolts 77 are spaced apart from each other by the predetermined distance in the longitudinal direction of the elongated hole. The diameter of each collar 78 is substantially equal to the minor diameter of the elongated hole, and the length (height) of each collar 78 is greater than the thickness of the horizontal portion 73A. The shafts of the bolts 77 are inserted into the respective collars 78. In this manner, the bolts 77 are fixed to the inner tunnel 10A in a state where there is a gap between the horizontal portion 73A and the heads of the bolts 77.

[0096] Further, as shown in FIG. 6B, the toggle operating portion 73C of the bracket 73 is configured to, when the amount of compression of the compression coil spring 71 reaches a predetermined threshold, operate an actuator 75A (toggle) provided on a body 75B of the limit switch 75. Specifically, the distal end of the toggle operating portion 73C is provided with a pair of operating pieces configured to operate the actuator 75A when the amount of compression of the compression coil spring 71 reaches a predetermined threshold. Accordingly, the amount of compression of the compression coil spring 71 is detected by the limit switch 75. Specifically, when the amount of compression of the compression coil spring 71 becomes a predetermined value or greater, the actuator 75A is operated by the front operating piece to tilt rearward. In this manner, an operator can be notified that the tension of the chain 32 has increased. On the other hand, when the amount of compression of the compression coil spring 71 becomes a predetermined value or less, the actuator 75A is operated by the rear operating piece to tilt forward. In this manner, the operator can be notified that the tension of the chain 32 has decreased. It should be noted that the body 75B of the limit switch 75 is fixed to the inner tunnel 10A via a bracket that is not shown.

[0097] Thus, the bracket 73 and the pressing member 74 are configured to be movable in the longitudinal direction of the elongated hole of the bracket 73 (i.e., the front-rear direction) against the compressive force applied to the compression coil spring 71 by an amount corresponding to the amount of compression of the compression coil spring 71. Movement of the bracket 73 and the pressing member 74 in the left-right direction and the up-down direction is restricted by the two bolts 77, which are inserted into the elongated hole of the bracket 73.

[0098] That is, by changing the degree of tightening of the nut 74B on the bolt 74A, the amount of compression of the compression coil spring 71 is controlled by the pressing member 74 via the bracket 73. Consequently, the tension in the chain 32 pulled by the wire 60 can be changed.

[0099] As described above, in the passenger boarding bridge 100 of the present embodiment, the elastic force of the elastic mechanism 70 is imparted as the tension in the chain 32 coupled to the plate members 31 forming the partitioning member 30.

[0100] Specifically, in the passenger boarding bridge 100 of the present embodiment, when the compression coil spring 71 between the plate 72 and the bracket 73 is compressed by the pressing member 74, the compression reaction force of the compression coil spring 71 is applied to the pressing member 74 in a direction to pull the wire 60 as indicated by an arrow in FIG. 6A and FIG. 6B. Accordingly, in the passenger boarding bridge 100 of the present embodiment, the compressive force applied to the compression coil spring 71 can be imparted as the tension in

the chain 32 coupled to the plate members 31 forming the partitioning member 30.

[0101] Further, in the passenger boarding bridge 100 of the present embodiment, the elastic mechanism 70 includes the limit switch 75, which detects the amount of compression of the compression coil spring 71. This configuration, as compared with a configuration that does not include the limit switch, makes it possible to readily recognize that the tension in the chain 32 coupled to the plate members 31 forming the partitioning member 30 has deviated from a predetermined range.

[0102] For example, when the wire 60 elongates after many years of its use, the amount of compression of the compression coil spring 71 decreases, and as a result, the tension in the chain 32 may become a predetermined value or less. However, in the passenger boarding bridge 100 of the present embodiment, since such a state of compression of the compression coil spring 71 is detected by the limit switch 75, an operator can promptly take appropriate measures to restore the tension in the chain 32 to a desired value.

[0103] For example, in a case where smooth movement between the plate members 31 and the first guide member 43 or the second guide member 44 in the front-rear direction in which the tunnel unit 10 extends and retracts is hindered by some factor, the amount of compression of the compression coil spring 71 changes, and the tension in the chain 32 may become a predetermined value or greater, or may become a predetermined value or less. However, in the passenger boarding bridge 100 of the present embodiment, since such a state of compression of the compression coil spring 71 is detected by the limit switch 75, an operator can promptly take appropriate measures to restore the tension in the chain 32 to a desired value.

[0104] From the foregoing description, numerous modifications and other embodiments of the present disclosure are obvious to those skilled in the art. Accordingly, the foregoing description is to be construed as illustrative only, and is provided for the purpose of teaching those skilled in the art the best mode for carrying out the present disclosure. The structural and/or functional details may be substantially modified without departing from the spirit of the present disclosure.

[0105] For example, the above description has described a case where the tunnel unit 10 includes two tunnels, specifically the inner tunnel 10A and the outer tunnel 10B. However, the present disclosure is applicable also to a passenger boarding bridge including three or more tunnels.

Industrial Applicability

[0106] One aspect of the present disclosure is applicable to a passenger boarding bridge and

makes it possible to improve the appearance of an end region of a tunnel walkway as compared with the conventional art.

Reference Signs List

[0107] 10: tunnel unit
10A: inner tunnel
10B: outer tunnel
11: floor member
12: tunnel roller
15: drive column
16: auxiliary stairs
18: apron
20: cab
30: partitioning member
31: plate member
31A :first plate member
31B :second plate member
32: chain
35: sprocket
40: travel roller
41: drainage gutter
42: roller surface
43: first guide member
43A :vertical plate
43B :roller receiver
44: second guide member
44A :inclined plate
50: coupling
51: rail
52: carriage
53: bracket
54: block
55: pin
60: wire

62: pulley

70: elastic mechanism

71: compression coil spring

72: plate

73: bracket

73A :horizontal portion

73B :receiver

73C :toggle operating portion

74: pressing member

74A :bolt

74B :nut

75: limit switch

75A :actuator

75B :body

77: bolt

78: collar

100 :passenger boarding bridge

S1: tunnel space

S2: end region

CLAIMS

[Claim 1] A passenger boarding bridge comprising:

a tunnel unit including a plurality of tunnels that are fitted together in a nested manner, the tunnel unit being extendable and retractable in a front-rear direction;

a floor member that forms a walkway of an outer tunnel of the tunnels that are adjacent to each other; and

a partitioning member coupled to an inner tunnel of the tunnels that are adjacent to each other, wherein

the partitioning member partitions a tunnel space and an end region of the outer tunnel from each other, the tunnel space being a space through which a passenger passes on the floor member, the end region of the outer tunnel extending along an end portion of the floor member in the front-rear direction, and the partitioning member moves to follow extension and retraction of the tunnel unit.

[Claim 2] The passenger boarding bridge according to claim 1, wherein

the end region is provided with a drainage gutter to drain rainwater.

[Claim 3] The passenger boarding bridge according to claim 1 or 2, comprising a tunnel roller provided on the inner tunnel of the tunnels that are adjacent to each other, wherein

the end region is provided with a roller surface on which the tunnel roller rolls.

[Claim 4] The passenger boarding bridge according to any one of claims 1 to 3, wherein:

the partitioning member includes a plurality of plate members, a chain coupled to the plate members, and a sprocket around which the chain is wound;

one end of the chain is coupled to an opening end of the inner tunnel;

the sprocket is mounted to the outer tunnel near an opening end of the outer tunnel; and

the chain is turned back via the sprocket.

[Claim 5] The passenger boarding bridge according to claim 4, comprising:

a first member that contacts or is in proximity to the plate members so as to cover the end region from below; and

a second member that contacts or is in proximity to the plate members so as to cover the end region from above, wherein:

the first member is fixed to the floor member of the outer tunnel;

the second member is fixed to a side wall of the outer tunnel; and

movement of each of the plate members in a direction orthogonal to the front-rear direction is restricted by the first member and the second member.

[Claim 6] The passenger boarding bridge according to claim 5, wherein

each of the plate members includes:

a first plate member that stands vertically from the first member; and

a second plate member that is inclined upward from the first plate member toward the second member.

[Claim 7] The passenger boarding bridge according to claim 5, comprising a travel roller provided between the first member and the plate members.

[Claim 8] The passenger boarding bridge according to claim 5, comprising a coupling to connect the chain and the inner tunnel, wherein

the coupling moves in accordance with a change in a relative position between the inner tunnel and the outer tunnel in a direction orthogonal to the front-rear direction.

[Claim 9] The passenger boarding bridge according to claim 8, wherein:

the coupling includes a rail coupled to one of the inner tunnel and the partitioning member and a carriage coupled to the other of the inner tunnel and the partitioning member; and

the carriage moves linearly relative to the rail in a first direction orthogonal to the front-rear direction.

[Claim 10] The passenger boarding bridge according to claim 8, wherein:

the coupling includes a bracket coupled to one of the inner tunnel and the partitioning member and a block coupled to the other of the inner tunnel and the partitioning member;

a pin fixed to the bracket is inserted into the block; and

the block linearly moves relative to the pin in a second direction orthogonal to the front-rear direction.

[Claim 11] The passenger boarding bridge according to claim 4, comprising an elastic

mechanism coupled to the chain via a wire.

[Claim 12] The passenger boarding bridge according to claim 11, wherein
the elastic mechanism includes:
a compression coil spring;
a plate that is in contact with one end of the compression coil spring;
a bracket that is in contact with the other end of the compression coil spring; and
a pressing member that compresses the compression coil spring via the bracket,
the plate is fixed to the inner tunnel, and
the pressing member is coupled to the wire.

[Claim 13] The passenger boarding bridge according to claim 11, wherein
the elastic mechanism includes a detector that detects an amount of compression of the compression coil spring.