

BOARDING BRIDGE INCLUDING A STAIRWAY, AND A BOARDING BRIDGE
SYSTEM INCLUDING SUCH A BOARDING BRIDGE

BACKGROUND OF THE INVENTION

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1. FIELD OF THE INVENTION:

The present invention relates to a boarding bridge including a stairway, and a boarding bridge system including such a boarding bridge.

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2. DESCRIPTION OF THE RELATED ART:

Conventionally, boarding bridges are often used as boarding and disembarking equipment for aircrafts. A boarding bridge is a tunnel-like passageway for connecting
15 a terminal building of an airport and an aircraft, and allows passengers to directly board or disembark the aircraft from or to the terminal building.

In general, a boarding bridge includes a rotatable rotunda connected to a boarding gate of the terminal
20 building, an extendable tunnel section fixed to the rotunda, and a rotatable cab connected to a tip of the tunnel section. The tunnel section is provided with, at a position relatively close to the tip thereof, a pair of (right and left) drive columns extending in the vertical direction

as support legs including an elevation mechanism.

One type of boarding bridge includes a stairway for allowing mechanics, boarding bridge operators or the like to go up and down. This type of stairway is usually
5 attached to the extendable tunnel section at a position closer to the cab, and descends straight toward the rotunda while keeping a gradient thereof equal to or smaller than a predetermined angle (see, for example, Japanese Laid-Open Patent Publication No. 2003-291896).

10 Such a boarding bridge connects the aircraft and the terminal building by the cab being connected to an entrance/exit of the aircraft, so as to allow passengers to board or disembark the aircraft. However, the height of the entrance/exit of the aircraft is different among
15 different types of aircrafts. In order to make the boarding bridge to be attachable to many types of aircrafts, the drive columns for supporting the tunnel section of the boarding bridge includes an elevation mechanism. Owing to the elevation mechanism, the cab of the boarding
20 bridge can move up and down in accordance with the height of the entrance/exit of each aircraft. As a result, the boarding bridge is made attachable to many types of aircrafts.

An upper part of the stairway is connected to the

tunnel section in the vicinity of the cab so as to be
pivotal around a horizontal axis. When the cab is moved
up and down, the stairway pivots around the connection
position as a support. At this point, a top end of the
5 stairway moves up and down in accordance with the movement
of the tunnel section while a bottom end thereof is in
constant contact with the ground. Thus, the stairway acts
to connect the ground and the tunnel section. When the
cab is moved up and down in this manner, the gradient of
10 the stairway changes in accordance with the level of the
cab. Specifically, when the cab is at a lower level, the
gradient of the stairway is smaller; whereas when the cab
is at a higher level, the gradient of the stairway is larger.

In the case where footboards of the stairway are
15 unpivotably fixed to a girder thereof, the gradient of
the footboards changes in accordance with the gradient
of the stairway. When the gradient of the stairway is
increased, the gradient of the footboards is also increased,
which makes it difficult for the mechanics or the like
20 to smoothly go up and down the stairway. In order to prevent
the gradient of the footboards from being increased even
when the gradient of the stairway is increased, the
conventional stairway adopts a link structure in which
a plurality of footboards are pin-jointed to a pair of

girders.

Recently, large-size aircrafts and aircrafts having an entrance/exit for the second floor seats, for example, have appeared. Such aircrafts may have an entrance/exit at a higher level than the conventional aircrafts. In order to attach the boarding bridge to such an aircraft, the cab needs to be raised to a higher level than for conventional aircrafts. This requires the conventional stairway to be used at a larger gradient. It is usually preferable that a stairway to be attached to a boarding bridge is designed to be used at a gradient equal to or smaller than a predetermined angle defined as guaranteeing safe ascent and descent (for example, 40 degrees). In order to make the stairway attachable to an aircraft having an entrance/exit at a higher level and also usable at a gradient equal to or smaller than the above-defined angle, it is conceivable to increase the size of the stairway in a longitudinal direction of the girder.

However, a stairway merely having an increased size in the longitudinal direction of the girder (such an increase will be referred to as "extension of the stairway") involves a risk of hitting the foundations of the terminal building, facilities around the terminal

building or the like when the tunnel section is in the most retracted state.

5 An aircraft having many seats on the second floor may have a second floor entrance/exit in addition to the standard first floor entrance/exit. In such a case, the distance between the boarding bridges attached to the plurality of entrances/exits (especially, the distance between the boarding bridges attached to the first floor entrance/exit and the second floor entrance/exit) is
10 expected to be shorter than in the conventional art. Therefore, the boarding bridge operators need to pay attention such that the adjacent boarding bridges do not hit each other, which increases the load on the operators.

15 SUMMARY OF THE INVENTION

 The present invention made in light of the above problems has an object of providing a boarding bridge attachable to various types of aircrafts and providing a high level of safety, and a boarding bridge system
20 including such a boarding bridge.

 A boarding bridge according to the present invention comprises a rotunda connectable to a boarding gate of a terminal building; an extendable tunnel section connectable to the rotunda at one end thereof so as to

be swingable up and down, the tunnel section including a plurality of cylindrical bodies; a cab connectable to the other end of the tunnel section, the cab being attachable to an entrance/exit of an aircraft; an elevation device
5 for moving the cab up and down, directly or by moving the tunnel section up and down; and a stairway attached to the tunnel section for connecting the tunnel section and the ground. The stairway is attached to a base-side cylindrical body connected to the rotunda, among the
10 plurality of cylindrical bodies included in the tunnel section.

The stairway of the boarding bridge is attached to the base-side cylindrical body, which does not move much in an up-and-down direction in accordance with the
15 up-and-down movement of the cab. Therefore, even when the cab is moved upward significantly, the position at which the stairway is attached (to the tunnel section) is not raised much. The gradient of the stairway does not become excessively steep even without the extension
20 of the stairway. For this reason, the boarding bridge can be attached to an aircraft having an entrance/exit at a high level while the gradient of the stairway is kept equal to or smaller than a defined angle. Since the stairway has a gradient kept in this manner, or is prevented

from hitting the other facilities or the like, the safety is improved.

The stairway is preferably attached to a position closer to the rotunda than a central part of the base-side cylindrical body in a longitudinal direction thereof.

According to the above boarding bridge, the distance of the up-and-down movement of the attaching position of the stairway in accordance with the up-and-down movement of the cab is shorter. Therefore, the boarding bridge can be attached to an aircraft having an entrance/exit at a high level while the gradient of the stairway is kept equal to or smaller than a defined angle with no need for extension of the stairway.

It is preferable that the stairway preferably include at least a plurality of footboard members and a pair of girders for supporting the footboard members; and the plurality of footboard members are integrally formed with, or unpivotably fixed to, the pair of girders.

Since the gradient of the stairway does not change much, the stairway does not need to have a link structure of the footboard members and the girders, unlike the conventional art. Therefore, the stairway can have a simpler structure in which, for example, the footboard members and the girders are welded together, and so can

be produced relatively easily.

The stairway preferably include a first stairway part inclining downward in a first direction, and a second stairway part inclining downward in a second direction which is different from the first direction.

The stairway is of a so-called foldable type, and so can be shortened in the longitudinal direction of the boarding bridge. Therefore, the stairway can be prevented from hitting the other facilities or the like with more certainty and thus improves the safety. Since the gradient of each footboard can be smaller, the mechanics or the like can go up and down the stairway more smoothly.

It is preferable that the stairway includes the first stairway part and the second stairway part; a top end of the first stairway part is attached to a side surface of the base-side cylindrical body; a top end of the second stairway part is connected to a bottom end of the first stairway part; the first direction is parallel to a direction in which the tunnel section extends when seen in a planar direction; and the second direction is parallel to a direction in which the tunnel section retracts, or crosses the direction in which the tunnel section retracts at an angle equal to or smaller than 90 degrees, when seen in the planar direction.

The stairway of the above boarding bridge can be shortened in the longitudinal direction of the boarding bridge.

5 It is preferable that the boarding bridge preferably further comprises a drive column for directly or indirectly supporting the tunnel section, the drive column being provided with a wheel at a bottom end thereof; and when the tunnel section is in a most retracted state, an end of the stairway closer to the cab is closer to the
10 rotunda than the drive column is, in the direction parallel to the direction in which the tunnel section extends or retracts.

In the above boarding bridge, even when the tunnel section is in the most retracted state, the drive column
15 and the stairway do not hit each other. This improves the safety.

There is preferably no space between the stairway and the tunnel section when seen in a planar direction.

20 The stairway of the above boarding bridge is of a foldable type. Therefore, even when the tunnel section is in the most retracted state, the drive column and the stairway do not hit each other. It is not necessary to provide a space, between the stairway and the tunnel section, into which the stairway escapes avoiding the drive column.

This can reduce the size of the entire boarding bridge, including the stairway, in the width direction of the tunnel section.

At least a part of the stairway is preferably located below the tunnel section and overlaps the tunnel section when seen in a planar direction.

With the above boarding bridge, a foldable type stairway can be used without the width of the boarding bridge being increased.

A boarding bridge system according to the present invention comprises a first boarding bridge connectable to a first floor entrance/exit of an aircraft having the first floor entrance/exit and a second floor entrance/exit, and a second boarding bridge connectable to the second floor entrance/exit of the aircraft. At least the second boarding bridge is a boarding bridge described above.

In the above boarding bridge system, the stairway of the second boarding bridge is located so as not to easily hit the first boarding bridge. This allows the operators to easily avoid these elements from hitting each other, and thus improves the safety and alleviates the load on the operators.

The stairway of the second boarding bridge is preferably provided on a side surface of the base-side

cylindrical body which does not face the first boarding bridge.

The above boarding bridge system can avoid the stairway of the second boarding bridge from hitting the first boarding bridge with more certainty, and thus further improves the safety.

It is preferable that the first boarding bridge includes a rotunda connectable to a boarding gate of a terminal building; an extendable tunnel section connectable to the rotunda at one end thereof and includes a plurality of cylindrical bodies; a cab connectable to the other end of the tunnel section, the cab being attachable to the first floor entrance/exit of the aircraft; and a stairway attached to the tunnel section for connecting the tunnel section and the ground. The stairway of the first boarding bridge is preferably attached to a tip-side cylindrical body connected to the cab, among the plurality of cylindrical bodies included in the tunnel section of the first boarding bridge, and on a side surface of the tip-side cylindrical body which does not face the second boarding bridge.

The above boarding bridge system can avoid the stairway of the first boarding bridge from hitting the second boarding bridge easily, and thus further improves

the safety.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a boarding bridge system.

5 FIG. 2 is a side view of a boarding bridge connected to a second floor entrance/exit of an aircraft.

FIG. 3 is a plan view of a foldable type stairway.

FIG. 4 is a side view illustrating the positional relationship between the foldable type stairway and a drive
10 column when a tunnel section of the boarding bridge is in a most retracted state.

FIG. 5 is a rear view of the foldable type stairway.

FIG. 6 is a side view of a boarding bridge
15 connected to a first floor entrance/exit of an aircraft.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, the present invention will be described by way of embodiments with reference to the
20 attached drawings.

As shown in FIG. 1, a boarding bridge system 1 according to an embodiment of the present invention includes a plurality of boarding bridges 10, 11 and 12 connectable to boarding gates of a terminal building 2

of an airport. The boarding bridge system 1 is usable for an aircraft 20 having seats both in a first floor space 23 (see FIG. 2) and a second floor space 24 (see FIG. 2). The first floor space 23 of the aircraft 20 has first floor
5 entrances/exits 21, and the second floor space 24 of the aircraft 20 has a second floor entrance/exit 22. The boarding bridges 10 and 11 are structured to be connectable to the first floor entrances/exits 21, and the boarding bridge 12 is structured to be connectable to either the
10 first floor entrance/exit 21 or the second floor entrance/exit 22. In the following description, the boarding bridges 10 and 11 are connected to the first floor entrances/exits 21, and the boarding bridge 12 is connected to the second floor entrance/exit 22.

15 The boarding bridges 10 and 11 have an identical structure. The boarding bridges 10 and 11, and the boarding bridge 12, are different in that the boarding bridges 10 and 11 each include a straight type stairway 31, whereas the boarding bridge 12 includes a foldable
20 type stairway 32. The position at which the stairway 31 is provided with respect to each of the boarding bridges 10 and 11 is different from the position at which the stairway 32 is provided with respect to the boarding bridge 12. Except for these points, the boarding bridges 10 and

11 and the boarding bridge 12 have substantially the same structure.

Hereinafter, the structure of the boarding bridge 12 will be first described, and then the structure of the boarding bridges 10 and 11 will be described mainly regarding the differences from the boarding bridge 12. For the sake of convenience, the side of each boarding bridge closer to the aircraft 20 will be referred to as the "front side", and the side of each boarding bridge closer to the terminal building 2 will be referred to as the "rear side". The right side when seen from the rear side toward the front side will be referred to simply as "the right side", and the left side when seen from the rear side toward the front side will be referred to simply as "the left side".

As shown in FIG. 2, the boarding bridge 12 includes a rotunda (base-side circular chamber) 4 connected to a boarding gate of the terminal building 2, a tunnel section 5 connected to the rotunda 4 so as to be swingable up and down, and a cab (tip-side circular chamber) 6 connected to a tip of the tunnel section 5 so as to be rotatable around a vertical axis thereof. Herein, the expression that "the tunnel section 5 is connected to the rotunda 4 so as to be swingable up and down" means that the tunnel

section 5 is swingable around the rotunda 4 and that the tunnel section 5 moves up and down by a larger distance at an end thereof connected to the cab 6 than an end thereof connected to the rotunda 4. For example, the tunnel
5 section 5 may be connected to the rotunda 4 so as to be rotatable around a horizontal axis.

The rotunda 4 is supported by a support 7 so as to be rotatable around a vertical axis thereof. The tunnel section 5 is an extendable cylindrical member and forms
10 a passageway connecting the terminal building 2 and the entrance/exit 22 of the aircraft 20. The tunnel section 5 includes a first tunnel 5a, a second tunnel 5b, and a third tunnel 5c. The third tunnel 5c is slidable with respect to the second tunnel 5b, and the second tunnel
15 5b is slidable with respect to the first tunnel 5a. The third tunnel 5c slides with respect to the second tunnel 5b and the second tunnel 5b slides with respect to the first tunnel 5a, and thus the entire tunnel section 5 extends or retracts. The tunnel section 5 is not limited to
20 including the three tunnels of the first tunnel 5a, the second tunnel 5b and the third tunnel 5c. For example, the tunnel section 5 may include two tunnels.

The third tunnel 5c is provided with a drive column 8 for supporting the tunnel section 5. The drive column

8 is a support which is extendable upward, and is extended or retracted by a driving motor (not shown). In the boarding bridge 12, the stroke of the drive column 8 is set to be relatively long in order to allow the cab 6 to reach the second floor entrance/exit 22.

At a bottom end of the drive column 8, a driving wheel 9 is attached. The driving wheel 9 is structured to be rotatable around a horizontal axis thereof and also a vertical axis thereof. By the running of the driving wheel 9, the boarding bridge 12 is movable between a wait position which is relatively far from the aircraft 20 and an attachment position (shown in FIG. 1 and FIG. 2) at which the boarding bridge 12 is attached to the aircraft 20. The running of the driving wheel 9 also extends or retracts the tunnel section 5. Therefore, the drive column 8 also has a function of extending or retracting the tunnel section 5.

As shown in FIG. 2, at the bottom end of the drive column 8, an outrigger 50 is attached as an element for preventing the drive column 8 from swaying. The outrigger 50 includes a pair of (right and left) cylinders 51, a rod 52 and a support table 53. An electric motor (not shown) is provided inside the cylinders 51. When the electric motor is driven, the rod 52 and the support table

53 move up and down with respect to the cylinders 51. The
outrigger 50 assists in supporting the tunnel section 5
while the driving wheel 9 is in contact with the ground,
owing to the up-and-down movement of the support table
5 53.

On the right side of the first tunnel 5a, a stairway
32 for connecting the inside of the tunnel section 5 and
the ground (apron) is attached. The stairway 32 is a
foldable type stairway having a landing 32c in the middle.
10 As shown in FIG. 3, the stairway 32 is attached, via a
hinge pin 30a (see FIG. 4), to a floor member 30 extended
from inside the first tunnel 5a. Hereinafter, for the
sake of convenience, a part of the stairway 32 from the
position to the floor member 30 down to the folding position
15 of the landing 32c (the lower part in FIG. 3) will be
referred to an "upper stairway part 32a", and a part thereof
from the folding position down to the ground (the upper
part in FIG. 3) will be referred to a "lower stairway part
32b".

20 As shown in FIG. 5, the lower stairway part 32b
includes a pair of (right and left) girders 35b and a
plurality of footboards 36 welded to the girder 35b at
both ends thereof. As shown in FIG. 4, the lower stairway
part 32b is supported by support members 34a, 34b and 34c.

In more detail, a bottom end of each girder 35b is supported by the support member 34a extending in the horizontal direction, a rear end of the floor plate of the landing 32c (in the vicinity of a top end of each girder 35b) is supported by the support member 34b extending in the vertical direction, and a front end of the floor plate of the landing 32c is supported by the support member 34c extending obliquely forward and upward. The support members 34a, 34b and 34c are connected together at a bottom end of the support member 34b. A castor 60 extending downward is attached to the connection position. A castor 60 is also attached to the bottom end of each girder 35b.

As shown in FIG. 3, the upper stairway part 32a extends to the side of the tunnel section 5, while a part of the lower stairway part 32b is located below the tunnel section 5. Namely, when seen in a planar direction, the part of the lower stairway part 32b overlaps the tunnel section 5.

As shown in FIG. 5, the upper stairway part 32a includes a pair of (right and left) girders 35a and a plurality of footboards 36 welded to the girders 35a at both ends thereof, like the lower stairway part 32b. As shown in FIG. 4, a top end of the upper stairway part 32a is attached, via the hinge pin 30a, to the floor member

30 so as to be rotatable up and down (i.e., rotatable around the horizontal axis) as described above. A bottom end of the upper stairway part 32a is supported by the support member 34b. In more detail, the bottom end of the upper
5 stairway part 32a is supported by the girders 35a being tightened to the support member 34b by a bolt. The upper stairway part 32a and the lower stairway part 32b are provided with a handrail 37 substantially over the entire length.

10 In FIG. 4, reference numeral 40 represents a hinge pin for connecting the first tunnel 5a and the rotunda 4. By the hinge pin 40, the tunnel 5a is connected to the rotunda 4 so as to be rotatable up and down. Therefore, as the cab 6 moves up and down, the tunnel section 5 rotates
15 around the hinge pin 40. As a result, the gradient of the tunnel section 5 changes. The hinge pin 40 and the hinge pin 30a are designed to be relatively close to each other. Here, the term "relatively close" refers to that the distance between the hinge pin 40 and the hinge pin
20 30a is equal to or shorter than half of the length of the first tunnel 5a in the longitudinal direction. Owing to this, even when the gradient of the tunnel section 5 changes as a result of the up-and-down movement of the cab 6, the level of the hinge pin 30a in the height direction changes

only slightly. Moreover, the change of the level of the hinge pin 30a in the height direction is absorbed by the upper stairway part 32a being slightly flexed, and so does not influence the gradient of the lower stairway part 32b.

5 FIG. 3 and FIG. 4 are respectively a plan view and a right side view of the tunnel section 5 when the tunnel section 5 is retracted most (hereinafter, referred to as the "most retracted state"). As shown in FIG. 3 and FIG. 4, the stairway 32 is designed such that a front
10 end 32d thereof is positioned rearward with respect to the drive column 8 when the tunnel section 5 is in the most retracted state. The upper stairway part 32a and the lower stairway part 32b are designed to have a gradient equal to or smaller than 40 degrees. The angle "40 degrees"
15 is an example in this embodiment, and such a defined angle is not specifically limited.

Next, the boarding bridges 10 and 11 will be described.

As shown in FIG. 1, the boarding bridges 10 and
20 11 each have a rotunda 4, a tunnel section 15 connected to the rotunda 4, and a cab 6 connected to a tip of the tunnel section 15 so as to be rotatable around a vertical axis thereof, like the boarding bridge 12. The tunnel section 15 of the boarding bridge 10, 11 includes a first

tunnel 15a and a second tunnel 15b. The second tunnel 15b is slidable with respect to the first tunnel 15a. The second tunnel 15b slides with respect to the first tunnel 15a, and thus the entire tunnel section 15 extends or retracts.

Amiddle part of the second tunnel 15b is provided with a drive column 8 for supporting the tunnel section 15. The stairway 31 is attached to a side surface of the second tunnel 15b. As shown in FIG. 6, the stairway 31 is a straight type stairway which descends rearward from a top end located forward with respect to the drive column 8. The stairway 31 includes a pair of (right and left) girders 31a and a plurality of footboards which are pin-jointed to the girders 31a at both ends thereof. The stairway 31 is pin-jointed to a floor plate 31c extending to the side from an opening of the second tunnel 15b. The gradient of the stairway 31 changes in accordance with the up-and-down movement of the cab 6.

The boarding bridge 12 according to this embodiment provides the following effects. The stairway 32 is attached to the first tunnel 5a. Therefore, even when the cab 6 is moved upward to be attached to the second floor entrance/exit 22 of the aircraft 20, the gradient of the stairway 32 is not substantially influenced. For

this reason, it is not necessary to design the stairway 32 to be longer in order to attach the stairway 32 to the second floor entrance/exit 22 while keeping the gradient thereof equal to or smaller than 40 degrees. Since the
5 gradient of the stairway 32 is not influenced by the up-and-down movement of the cab 6, the stairway 32 can be produced with predetermined standards. In addition, the footboards 36 conventionally having a link structure can be fixed to the girders 35a or 35b by welding. Thus,
10 the stairway 32 can have a simpler structure and can be produced more easily. The means for fixing the footboards 36 to the girders 35a or 35b is not limited to welding, and may be adhesion or the like. The footboards 36 may be integrally formed with the girders 35a or 35b.

15 In general, the second floor entrance/exit 22 of the aircraft 20 is often provided in the vicinity of the mainplane thereof, which raises a concern that the stairway 32 may hit the main plane, engine or the like. However, in the boarding bridge 12 according to this embodiment,
20 the stairway 32 is attached to the first tunnel 5a and therefore would not hit the main plane, engine or the like.

After the boarding bridge 12 is attached to the aircraft 20, various operations on the aircraft 20 are performed below the boarding bridge in the vicinity of

the tip thereof. It is desired that a space for such operations is provided. With the boarding bridge 12 according to this embodiment, the stairway 32 is attached to the first tunnel 5a. Therefore, a large space for such operations can be provided.

The hinge pin 40 for connecting the first tunnel 5a and the rotunda 4, and the hinge pin 30a for connecting the stairway 32 and the floor member 30 extended from the first tunnel 5a, are designed to be relatively close to each other. Owing to such a design, the hinge pin 30a moves up and down only slightly even though the cab 6 moves up and down. The gradient of the stairway 32 is not influenced by the up-and-down movement of the cab 6. Therefore, the stairway 32 does not need to be extended and thus can have a simpler structure.

The stairway 32 is of a foldable type. This can shorten the stairway 32 in the longitudinal direction of the boarding bridge 12. The boarding bridge 12 according to this embodiment is designed such that the front end 32d of the stairway 32 is positioned rearward with respect to the drive column 8 when the tunnel section 5 is in the most retracted state. Therefore, even when the tunnel section 5 is retracted, the stairway 32 does not hit the drive column 8. This eliminates the need to provide a

space for accommodating the drive column 8 between the stairway 32 and the tunnel section 5 (in other words, there is no need to provide a space between the stairway 32 and the tunnel section 5 when seen in the planar direction).
5 As a result, it is made easy to shorten the width of the boarding bridge 12.

The stairway 32 is attached such that a part of the lower stairway part 32b is below the tunnel section 5. Therefore, even though the stairway 32 is of a foldable
10 type, the width of the boarding bridge 12 is prevented from being increased.

The stairway 32 is attached to the first tunnel 5a. Therefore, even when the tunnel section 5 extends or retracts, the stairway 32 does not move in the
15 extending/retracting direction. The moving distance of the stairway 32 is shorter than that in the conventional art when the boarding bridge 12 is attached or detached, which alleviates the load on the stairway 32. This also extends the life of the castors 60. Since the stairway
20 32 moves by such a short distance, the mechanics or the like working on the ground are not disturbed by the stairway 32.

The boarding bridge system 1 according to this embodiment provides the following effects. The stairway

31 of the boarding bridge 11 is attached to the tip side of the tunnel section 15, whereas the stairway 32 of the boarding bridge 12 is attached to the base side of the tunnel section 5. Although the boarding bridges 11 and 12 are located close to each other, the stairways 31 and 32 are prevented from hitting each other when the boarding bridges 11 and 12 are attached to the aircraft 20. This alleviates the load on the operators of the cabs 6.

The stairway 32 is attached to the side surface of the boarding bridge 12 which does not face the boarding bridge 11, and therefore is prevented from hitting the boarding bridge 11. This improves the safety. In this embodiment, the stairway 32 is attached to the right side of the first tunnel 5a. Alternatively, the stairway 32 may be attached to the left side of the first tunnel 5a as long as the safety is guaranteed.

When seen in the planar direction, the first floor entrance/exit 21 to which the boarding bridge 11 is connected is relatively close to the second floor entrance/exit 22 to which the boarding bridge 12 is connected. However, the stairway 31 is attached to the side surface of the boarding bridge 11 which does not face the boarding bridge 12, and therefore is prevented from hitting the boarding bridge 12. This improves the safety.

In this embodiment, the stairway 32 is folded such that the lower stairway part 32b extends in the opposite direction to (at 180 degrees away from) the upper stairway part 32a. The present invention is not limited to this, although it is preferable that the angle between the upper stairway part 32a and the lower stairway part 32b is 90 degrees or smaller. For example, the lower stairway part 32b may be perpendicular to the upper stairway part 32a.

The stairway 32 does not need to be of a foldable type and may be of a straight type, as long as the safety is guaranteed.

In the boarding system 1 according to this embodiment, the boarding bridges 10 and 11 have the same structure and are connected to different first floor entrances/exits 21, whereas the boarding bridge 12 is connectable to either the first floor entrance/exit 21 or the second floor entrance/exit 22. The boarding system may have various other combinations of boarding bridges. For example, the boarding bridge 10 may have the same structure as that of the boarding bridge 12, in which case the boarding bridge 11 may be omitted.

WHAT IS CLAIMED IS:

1. A boarding bridge (12), comprising:

a rotunda (4) connectable to a boarding gate of a terminal building (2);

an extendable tunnel section (5) connectable to the rotunda (4) at one end thereof so as to be swingable up and down, the tunnel section (5) including a plurality of cylindrical bodies (5a, 5b, 5c), wherein

a base-side cylindrical body (5a) is connected to the rotunda (4) and an adjacent cylindrical body (5b) is slidable with the respect to the base-side cylindrical body (5a);

a cab (6) connectable to the other end of the tunnel section (5), the cab (6) being attachable to an entrance/exit (22) of an aircraft (20);

an elevation device for moving the cab (6) up and down, directly or by moving the tunnel section (5) up and down; and

a stairway (32) attached to an outside of the base-side cylindrical body (5a) for connecting the tunnel section (5) and the ground;

wherein the stairway (32) is attached to the base-side cylindrical body (5a) at a position to avoid hitting the adjacent cylindrical body (5b) when the tunnel section (5) is in the most retracted state.

2. A boarding bridge (12) according to claim 1, wherein the stairway (32) is attached to a position closer to the rotunda (4) than a central part of the base-side cylindrical body (5a) in a longitudinal direction thereof.

3. A boarding bridge (12) according to claim 1, wherein:
the stairway (32) includes at least a plurality of footboard members (36) and a pair of girders (35a,35b) for supporting the footboard members (36); and
the plurality of footboard members (36) are integrally formed with, or unpivotably fixed to, the pair of girders (35a,35b).

4. A boarding bridge (12) according to claim 1, wherein the stairway (32) includes a first stairway part (32a) inclining downward in a first direction, and a second stairway part (32b) inclining downward in a second direction which is different from the first direction.

5. A boarding bridge (12) according to claim 4, wherein:
the stairway (32) includes the first stairway part (32a) and the second stairway part (32b);

a top end of the first stairway part (32a) is attached to a side surface of the base-side cylindrical body (5a);

a top end of the second stairway part (32b) is connected to a bottom end of the first stairway part (32a);

the first direction is parallel to a direction in which the tunnel section (5) extends when seen in a planar direction; and

the second direction is parallel to a direction in which the tunnel section (5) retracts, or crosses the direction in which the tunnel section (5) retracts at an angle equal to or smaller than 90 degrees, when seen in the planar direction.

6. A boarding bridge (12) according to claim 1, further comprising a drive column (8) for directly or indirectly supporting the tunnel section (5), the drive column (8) being provided with a wheel (9) at a bottom end thereof

wherein when the tunnel section (5) is in a most retracted state, an end of the stairway (32) closer to the cab (6) is closer to the rotunda (4) than the drive column (8) is, in the direction parallel to the direction in which the tunnel section (5) extends or retracts.

7. A boarding bridge (12) according to claim 6, wherein there is no space between the stairway (32) and the tunnel section (5) when seen in a planar direction.

8. A boarding bridge (12) according to claim 1, wherein at least a part of the stairway (32) is located below the tunnel section (5) and overlaps the tunnel section (5) when seen in a planar direction.

9. A boarding bridge system (1) comprising a first boarding bridge (11) connectable to a first floor entrance/exit (21) of an aircraft (20) having the first floor entrance/exit (21) and a second floor entrance/exit (22), and a second boarding bridge (12) connectable to the second floor entrance/exit (22) of the aircraft (20), wherein at least the second boarding bridge (12) is a boarding bridge according to any one of claims 1 through 8.

10. A boarding bridge system (1) according to claim 9, wherein the stairway (32) of the second boarding bridge (12) is provided on a side surface of the base-side cylindrical body (5a) which does not face the first boarding bridge (11).

11. A boarding bridge system (1) according to claim 9, wherein:

the first boarding bridge (11) includes:

- a rotunda (4) connectable to a boarding gate of a terminal building (2);
- an extendable tunnel section (15) connectable to the rotunda (4) at one end thereof and includes a plurality of cylindrical bodies (15a,15b);
- a cab (6) connectable to the other end of the tunnel section (15), the cab (6) being attachable to the first floor entrance/exit (21) of the aircraft (20); and
- a stairway (31) attached to the tunnel section (15) for connecting the tunnel section (15) and the ground;

wherein the stairway (31) of the first boarding bridge (11) is attached to a tip-side cylindrical body (15b) connected to the cab (6), among the plurality of cylindrical bodies (15a,15b) included in the tunnel section (15) of the first boarding bridge (11), and on a side surface of the tip-side cylindrical body (15b) which does not face the second boarding bridge (12).