

DESCRIPTION

TITLE OF THE INVENTION: FREE HANDRAIL

TECHNICAL FIELD

[0001]

The present invention relates to a free handrail that is attached to temporary stairs or scaffolds installed at a building site or the like, and particularly relates to a free handrail that is less limited in installation location, has a simple configuration, and can be produced with less cost.

BACKGROUND ART

[0002]

A temporary scaffold is installed at a building site, a construction site, or the like, in order to facilitate worker's movement. Temporary stairs are sometimes installed to connect temporary scaffolds that are disposed vertically. Such temporary scaffolds or temporary stairs often require a handrail for prevention of accidental fall of a worker.

A handrail installed at a temporary scaffold or the like is to be dismantled after the completion of the construction work. Furthermore, there is usually no sufficient space around a temporary scaffold. There has been conventionally required a handrail that has a simple configuration and enables easy conveyance as well as safe and easy work such as attachment and detachment.

In order to fulfill these requirements, temporary handrails of light configurations have been variously researched and developed in recent years, and there have been already disclosed several inventions and devices relating to such temporary handrails.

[0003]

For example, Patent Document 1 discloses the invention relating to "temporary stairs" that are light in weight and safe, and also can be used as a ladder.

According to the invention disclosed in Patent Document 1, a metal tread has a cross section bent into a substantially gate shape and metal single pipe beams instead of bamboo whisk boards are attached to the right and left ends of the metal tread so as to be angularly adjustable. A handrail receiving pillar stands from the metal tread and a handrail made of a metal single pipe is detachably attached to the handrail receiving pillar so as to be angularly changeable.

Such a configuration includes a small number of components and is light in weight, and can be thus conveyed easily. The temporary stairs can be also leaned at a different location to be used like a ladder.

[0004]

Patent Document 2 discloses the invention titled as “a work scaffold for a structure” relating to a work scaffold that is temporarily installed around a structure to be assembled or repaired.

The invention disclosed in Patent Document 2 relates to a work scaffold including a scaffold mount that has a proximal end coupled to a plurality of eye plates provided at predetermined peripheral intervals on the outer peripheral surface of a structure, a support member that has a distal end coupled to the scaffold mount and a proximal end coupled to the eye plates, a handrail pillar that has a lower end inserted to a handrail support cylinder fixed to the distal end of a scaffold attachment member, and a transverse handrail pipe inserted to a fixed cylinder fixed to an upper portion of the handrail pillar.

The work scaffold thus configured can be easily bridged near the outer periphery of a structure using common members and the handrail pillar can be easily provided to the work scaffold.

[0005]

Patent Document 3 discloses the invention relating to “a framework scaffold” that allows a worker to ascend and descend or walk at a building construction site or the like and is assembled and dismantled easily.

The framework scaffold according to the invention disclosed in Patent Document 3 includes a standard frame made of a pair of front and rear standard members and transverse members bridged between the standard members, a scaffold board detachably bridged between the transverse members of the standard frame, and a frame body detachably coupled between the standard members laterally adjacent to each other. This frame body includes a pair of right and left vertical pillars as well as a baseboard and a handrail detachably bridged between the lower portions and the upper portions of the insides of the vertical pillars. The standard members are provided with flanges detachably coupled to the distal ends of the transverse members.

In this configuration, the vertical pillars, the handrail pillar, and the baseboard can be simultaneously assembled to or dismantled from the both sides of the scaffold board. The frame body disposed at each side of the scaffold board secures worker's safety. The baseboard also prevents a tool, a fastener, a broken piece, or the like from dropping from the scaffold board.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0006]

Patent Document 1: JP 2011-241560 A

Patent Document 2: JP 2000-129908 A

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007]

In the invention disclosed in Patent Document 1 as the conventional art, the handrail receiving pillar can be attached only to the dedicated metal tread. This invention has a problem of being inapplicable to existing temporary stairs or scaffolds.

[0008]

In the invention disclosed in Patent Document 2, the handrail pillar is inserted to the handrail support cylinder that is fixed to the distal end of the scaffold attachment member. This invention has a problem of poor applicability due to limited installation targets.

[0009]

In the invention disclosed in Patent Document 3, the handrail configures part of the frame body that is entirely installed to the scaffold board. This invention has limited installation targets and installation locations. This invention further has a problem of uneasy conveyance and storage due to a large size.

[0010]

The present invention has been made in view of these conventional circumstances, and an object thereof is to provide a free handrail that has a simple configuration, enables easy conveyance and production with less cost, and can be attached easily and safely to existing temporary stairs and scaffolds.

SOLUTIONS TO THE PROBLEMS

[0011]

In order to achieve the object mentioned above, claim 1 of the present invention provides a free handrail attached to a plate forming a tread of a temporary stair or a floor plate of a temporary scaffold, the free handrail including: a handrail member including a bar body and coupling pieces provided at ends of the bar body to project in a longitudinal direction; a bar-shaped pillar having a circular sectional outline; a fixing means attached to a lower end of the pillar and having a clamp configured to catch the plate; and a retaining means provided to the pillar and coupled with an end of the handrail member.

The free handrail thus configured has a simple configuration roughly including the two types of members, namely, the handrail member and the pillar. The free handrail can be thus produced easily. The free handrail not in use can be dismantled into the handrail member and the pillar so as to be easily conveyed.

[0012]

Claim 2 of the present invention provides the free handrail according to claim 1, wherein the handrail member includes a joint coupled with the coupling piece to be swingable within a virtual plane parallel to the longitudinal direction of the bar body and provided with a locking piece, the retaining means includes a first retaining tool and a second retaining tool disposed opposite to each other, and a male screw portion provided to part of an outer peripheral surface of the pillar, and one of the first retaining tool and the second retaining tool is screwed to the male screw portion and the other is fixed to the outer peripheral surface of the pillar, and at least one of opposed surfaces is provided with a recessed groove configured to be locked with the locking piece.

[0013]

The free handrail thus configured has the function of easily changing the angle between the locking piece and the bar body within the virtual plane, in addition to the function of the invention according to claim 1. In the state where the locking piece is disposed between the first retaining tool and the second retaining tool, one screwed to the male screw portion out of the first retaining tool and the second retaining tool is rotated to decrease the gap therebetween until the locking piece is locked to the recessed groove, so that the handrail member is undetachably retained by the retaining means. When the retaining tool screwed to the male screw portion is rotated from this state to increase the gap between the first retaining tool and the second retaining tool, the handrail member can be easily detached from the retaining member.

[0014]

Claim 3 of the present invention provides the free handrail according to claim 2, wherein the joint is replaced with a coupling tool including a bar-shaped insert portion and a plate-shaped coupling portion provided at an end of the insert portion, and having a substantially L shape in a side view, and a coupling ring including a locking piece having a partial circular arc outer shape in a planar view and a retaining portion configured to rotatably retain the insert portion about a center axis and connected to the locking piece, in the handrail member, the coupling portion of the coupling tool, instead of the joint, is swingably coupled to the coupling piece, and the coupling ring is provided to be locked to the recessed groove in a state where the locking piece is interposed between the first retaining tool and the second retaining tool.

[0015]

In the invention according to claim 2, the handrail member has a swing center axis limited to the center axis of the coupling piece. It is thus necessary to change the gap between the first retaining tool and the second retaining tool in order to change a swing plane of the handrail member from the state in parallel with the longitudinal direction of the pillar to the state perpendicular thereto, for example. In contrast, the handrail member is swingable

simultaneously about the center axis of the coupling piece and the center axis of the insert portion of the coupling tool perpendicular thereto in the invention according to claim 3. There is no need to perform the work of, for example, changing the gap between the first retaining tool and the second retaining tool to cause the swing plane of the handrail member to be changed from the state in parallel with the longitudinal direction of the pillar to the state perpendicular thereto. Furthermore, the coupling tool can be easily coupled to or detached from the coupling ring.

[0016]

Claim 4 of the present invention provides the free handrail according to any one of claims 1 to 3, wherein the bar body includes a cylindrical outer member and an inner member slidably inserted to the outer member.

The free handrail thus configured has the function of easily adjusting the entire length of the handrail member by sliding the inner member relative to the outer member, in addition to the function of the invention according to any one of claims 1 to 3.

[0017]

Claim 5 of the present invention provides the free handrail according to any one of claims 1 to 4, wherein the pillar is provided at the lower end with a support piece projecting downward, the fixing means is provided as an angle adjusting plate that is rotatably coupled to the support piece via a first shaft body perpendicular to the longitudinal direction of the pillar, the support piece is provided with a first insertion hole allowing the first shaft body to be inserted therethrough, and a first angle fixing hole that is disposed with a predetermined gap in the longitudinal direction of the pillar from the first insertion hole and allows a second shaft body to be inserted therethrough, the angle adjusting plate is provided with a second insertion hole allowing the first shaft body to be inserted therethrough in a state of communicating with the first insertion hole, and a plurality of second angle fixing holes substantially at equal intervals along a rotation locus having a predetermined radius around the second insertion hole, the plurality of second angle fixing holes allows the second shaft body to be inserted therethrough in a state of communicating with the first angle fixing hole, and the fixing means is attached to the angle adjusting plate with an open-close direction of the clamp being perpendicular to the first shaft body.

[0018]

The free handrail thus configured has, in addition to the function of the invention according to any one of claims 1 to 4, the function that, in a state where the angle adjusting plate is rotatably coupled to the support piece via the first shaft body inserted to the first insertion hole and the second insertion hole and the second shaft body is inserted to the first angle fixing hole and the second angle fixing hole to restrict rotation of the angle adjusting plate, the angle adjusting plate becomes rotatable about the first shaft body relative to the

support piece by extracting the second shaft body from the second angle fixing hole to enable change in angle between an open-close direction of the clamp and the longitudinal direction of the pillar within a virtual plane perpendicular to the first shaft body. When the second shaft body is inserted to the second angle fixing hole to restrict rotation of the angle adjusting plate relative to the support piece, fixed is the angle between the open-close direction of the clamp and the longitudinal direction of the pillar.

[0019]

Claim 6 of the present invention provides the free handrail according to any one of claims 1 to 4, wherein the pillar is provided at the lower end with a support piece projecting downward, the fixing means is provided as an angle adjusting plate that is rotatably coupled to the support piece via a first shaft body perpendicular to the longitudinal direction of the pillar, the support piece is provided with a first insertion hole allowing the first shaft body to be inserted therethrough, and a first angle fixing hole that is disposed with a predetermined gap in the longitudinal direction of the pillar from the first insertion hole and allows a second shaft body to be inserted therethrough, the angle adjusting plate is provided with a second insertion hole allowing the first shaft body to be inserted therethrough in a state of communicating with the first insertion hole, a second angle fixing hole having a long hole shape along a rotation locus having a predetermined radius around the second insertion hole, and a male screw portion at a circular arc side surface, the support piece is provided with a gear rotatably meshed with the male screw portion of the angle adjusting plate, and a rotation inhibitor configured to cause frictional force with a side surface of the gear, and the fixing means is attached to the angle adjusting plate with an open-close direction of the clamp being perpendicular to the first shaft body.

[0020]

In the invention according to claim 5, the second shaft body inserted through one of the second angle fixing holes needs to be inserted to a different one of the second angle fixing holes in order to change the rotation angle of the angle adjusting plate to the pillar. In contrast, the rotation angle of the angle adjusting plate to the pillar is continuously changed in the invention according to claim 6. Rotation of the gear rotatably meshed with the male screw portion of the angle adjusting plate is inhibited by the rotation inhibitor so as to adjust rotation speed of the fixing means relative to the pillar.

[0021]

Claim 7 of the present invention provides the free handrail according to claim 5 or 6, wherein the fixing means includes a coupling plate parallel to the first shaft body and provided with the angle adjusting plate standing therefrom, and a coupling plate angle fixing means configured to fix a rear surface of the clamp to the coupling plate at a predetermined rotation angle.

The free handrail thus configured has, in addition to the function of the invention according to claim 5 or 6, the function that the rear surface of the clamp becomes rotatable relative to the coupling plate by canceling restriction by the coupling plate angle fixing means and the angle can be changed between the open-close direction of the clamp and the first shaft body projected on a virtual plane parallel to the coupling plate. Furthermore, when the coupling plate angle fixing means restricts rotation of the rear surface of the clamp relative to the coupling plate, fixed is the angle between the open-close direction of the clamp and the first shaft body.

[0022]

Claim 8 of the present invention provides the free handrail according to any one of claims 1 to 7, and the free handrail further includes a baseboard having a rectangular shape in a planar view and an end formed to be inserted to a retaining frame provided to a side surface of the pillar, wherein the baseboard includes a first flat plate in a square tube shape and a second flat plate slidably inserted to the first flat plate.

The free handrail thus configured has the function of adjusting the entire length of the baseboard by sliding the second flat plate relative to the first flat plate, in addition to the function of the invention according to any one of claims 1 to 7.

EFFECTS OF THE INVENTION

[0023]

As described above, the free handrail according to claim 1 of the present invention achieves reduction in conveyance cost and production cost.

[0024]

The free handrail according to claim 2 of the present invention achieves common application of the retaining means to a plurality of handrail members having the locking pieces in different sizes, in addition to the effect made by the invention according to claim 1. The handrail member can be coupled to and detached from the pillar by simple operation of rotating the first retaining tool or the second retaining tool. The free handrail can be thus installed easily and safely to temporary stairs or the like. The handrail member, the pillar, the fixing means, and the retaining means are configured simply and lightly, so that the free handrail can be easily conveyed and produced with less cost.

Change in gap between the opposed surfaces to retain the joint with the first retaining tool and the second retaining tool enables adjustment in angle between the longitudinal direction of the pillar and the swing plane of the joint. There is thus no limitation in coupling direction of the handrail member to the pillar and the pillar is less limited in installation location. The free handrail can be thus installed to existing temporary stairs and scaffolds.

[0025]

The free handrail according to claim 3 of the present invention facilitates operation for swinging the handrail member with excellent workability as compared with the invention according to claim 2.

[0026]

The free handrail according to claim 4 of the present invention achieves, in addition to the effect made by the invention according to any one of claims 1 to 3, the effect of high utility with less limitation in location of the pillars, because the handrail member can be changed in length in accordance with the gap between the installed pillars.

[0027]

The free handrail according to claim 5 of the present invention achieves, in addition to the effect made by the invention according to any one of claims 1 to 4, the effect that any member thin enough to be caught by the clamp can be easily attached regardless of its attachment angle because it is possible to adjust the angle between the open-close direction of the clamp and the longitudinal direction of the pillar within a plane perpendicular to the first shaft body.

[0028]

The free handrail according to claim 6 of the present invention achieves, in addition to the effect made by the invention according to any one of claims 1 to 4, the effect of improvement in work efficiency with no need to insert the second shaft body to a different one of the holes in order to change the rotation angle of the angle adjusting plate to the pillar. With adjustment of the rotation speed of the fixing means relative to the pillar, this configuration safely prevents accidents such as sudden fall of the pillar during the work of installing the fixing means to temporary stairs or the like. Furthermore, any member thin enough to be caught by the clamp can be easily attached regardless of its attachment angle because it is possible to adjust the angle between the open-close direction of the clamp and the longitudinal direction of the pillar within a plane perpendicular to the first shaft body.

[0029]

The free handrail according to claim 7 of the present invention achieves adjustment in angle between the open-close direction of the clamp and the first shaft body projected on a plane parallel to the coupling plate, and thus more strongly exerts the effect made by the invention according to claim 5 or 6 that the free handrail can be installed to any member thin enough to be caught by the clamp.

[0030]

The free handrail according to claim 8 of the present invention exerts, in addition to the effect made by the invention according to any one of claims 1 to 7, the effect of less limitation in gap between the installed pillars as compared with a case where the baseboard

has a fixed entire length.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031]

FIG. 1 is an external view of a free handrail according to Embodiment 1 of the present invention.

FIGS. 2(a) to 2(c) are a front view, a side view, and a rear view, respectively, of a pillar configuring the free handrail according to Embodiment 1.

FIGS. 3(a) and 3(b) are front views of a state where the pillar shown in FIG. 2(a) is dismantled, and FIG. 3(c) is an enlarged view of the lower end of the pillar shown in FIG. 3(b).

FIGS. 4(a) to 4(d) are a front view, a side view, a plan view, and a rear view, respectively, of a fixing portion configuring a fixing means shown in FIGS. 2(a) to 2(c).

FIGS. 5(a) and 5(b) are a front view and a side view, respectively, of an attachment portion configuring the fixing means shown in FIGS. 2(a) to 2(c).

FIGS. 6(a) and 6(b) are partially enlarged views of the fixing means and its vicinity shown in FIGS. 2(b) and 2(c), respectively.

FIG. 7(a) is a front view of a handrail member configuring the free handrail according to Embodiment 1, and FIG. 7(b) is a partially enlarged longitudinal sectional view of a joint and its vicinity shown in FIG. 7(a).

FIGS. 8(a) is a partially enlarged view of a retaining means and its vicinity shown in FIG. 1, and FIGS. 8(b) is a longitudinal sectional view of FIG. 8(a).

FIG. 9(a) is a sectional view taken along arrow C-C indicated in FIG. 8(a), and FIG. 9(b) is a view of a coupled state of handrail member according to a modification example of FIG. 8(a).

FIG. 10 is an external view of a free handrail according to Embodiment 2 of the present invention.

FIGS. 11(a) to 11(d) are sectional views taken along arrows E-E, F-F, G-G, and H-H indicated in FIG. 10, respectively.

FIG. 12 is an external view of a free handrail according to Embodiment 3 of the present invention.

FIG. 13(a) is a front view of a handrail member configuring the free handrail according to Embodiment 3, FIG. 13(b) is an enlarged view along arrow I, of an end of the handrail member shown in FIG. 13(a), and FIG. 13(c) is a sectional view taken along arrow J-J indicated in FIG. 13(a).

FIG. 14(a) and 14(b) are a side view and a front view of a coupling tool, respectively, and FIG. 14(c) is a sectional view taken along arrow K-K indicated in FIG. 14(b).

FIGS. 15(a) and 15(b) are a side view and a plan view of a coupling ring, respectively, and FIG. 15(c) is a partially enlarged view of the retaining means and its vicinity shown in FIG. 12.

FIG. 16 is an enlarged view of a fixing means shown in FIG. 12.

FIG. 17 is a view along arrow L indicated in FIG. 16.

FIG. 18(a) is a sectional view taken along arrow M-M indicated in FIG. 16, and FIG. 18(b) is a perspective view of outer appearance of components assembled to a shaft.

EMBODIMENTS OF THE INVENTION

[0032]

A free handrail according to the present invention will now be described specifically with reference to FIG. 1 to 18(b), in terms of its configurations, functions and effects.

The free handrail is assumed to be installed to temporary stairs in the present embodiment. The following description will apply also to a case where the free handrail is installed to a temporary scaffold.

EMBODIMENT 1

[0033]

The free handrail according to Embodiment 1 will now be described with reference to FIGS. 1 to 9(b) (particularly corresponding to claims 1, 2, 4, 5, and 7).

FIG. 1 shows outer appearance of a free handrail 1a according to the present embodiment, with temporary stairs S shown schematically. FIGS. 3(a) and 3(b) are external views of an upper pillar portion 6 and a lower pillar portion 7, respectively. FIG. 3(c) is a partially enlarged view of the lower end of the lower pillar portion 7 shown in FIG. 3(b). FIG. 3(c) does not include illustration of bolts or nuts.

As shown in FIG. 1, the free handrail 1a includes handrail members 2 installed along the slanted temporary stairs S, cylindrical pillars 3 configured to retain ends of the handrail members 2, and fixing means 4 provided respectively at the lower ends of the pillars 3. The free handrail 1a is detachably coupled to treads P of the temporary stairs S via the fixing means 4.

[0034]

As shown in FIGS. 2(a) to 3(c), each of the pillars 3 is a metal bar member having a circular sectional outline, and includes the upper pillar portion 6 having an upper end 6a provided with an annular grip portion 5a, and the lower pillar portion 7 having a cylindrical shape and allowing the upper pillar portion 6 to be slidably inserted thereto from upward. The upper pillar portion 6 is inserted to the lower pillar portion 7 in the present embodiment. Alternatively, the lower pillar portion 7 can be inserted to the upper pillar portion 6. The

upper pillar portion 6 and the lower pillar portion 7 each have the cylindrical shape (see FIG. 8(b)). Alternatively, only the pillar portion to receive the other pillar portion can have the cylindrical shape and the pillar portion to be inserted can have a solid configuration.

[0035]

The upper pillar portion 6 is provided, near the grip portion 5a, with a retaining means 8. A pair of upper and lower pin insertion holes 6c and 6c is provided at two locations in the side surface between the retaining means 8 and a lower end 6b.

The lower pillar portion 7 is provided, near an upper end 7a and substantially in the center, with retaining means 9 and 10, respectively. Upper and lower pin insertion holes 7c and 7c are provided at two locations in the side surface between the retaining means 9 and 10 so as to communicate with the pin insertion holes 6c and 6c. There is further provided a grip portion 5b on the side surface between the retaining means 10 and a lower end 7b.

In other words, the pillar 3 is configured to keep its length by sliding the upper pillar portion 6 relative to the lower pillar portion 7 to adjust the entire length and then inserting a pin 23a transversely through the pin insertion hole 6c and the pin insertion hole 7c.

The pillar 3 is provided with the retaining means at three locations in the present embodiment. The present invention is not limited thereto regarding the locations and the number of the retaining means but can be modified appropriately. The number and the locations of the pin insertion holes 6c and 7c can be modified similarly.

[0036]

The lower pillar portion 7 is provided with a substrate 11 configured to close the lower end 7b. Stands from the substrate 11 is a pair of support pieces 12 and 12 each having a bolt insertion hole 12a and an angle fixing hole 12b. The support pieces 12 and 12 are disposed to cause the bolt insertion holes 12a and 12a and the angle fixing holes 12b and 12b to communicate with each other as well as to oppose each other with a predetermined gap therebetween in the longitudinal direction of the pillar 3. The angle fixing hole 12b allowing a bolt 23b to be inserted therethrough is provided at a distance R_1 from the center of the bolt insertion hole 12a (see FIGS. 6(a) and 6(b)). A bolt 13a inserted through the bolt insertion holes 12a and 12a has an end to which a nut 13b is fastened and a retaining pin 14 is attached.

[0037]

A fixing portion 15 and an attachment portion 20 configuring the fixing means 4 will now be described with reference to FIGS. 4(a) to 5(b).

As shown in FIGS. 4(a) to 4(d), the fixing portion 15 includes a clamp 17 that has a substantially cornered U shape in a side view and is provided, near the distal end of an upper portion 17a, with two bolts 16 and 16 screwed thereto, and a coupling plate 19 that is joined to the rear surface of the clamp 17 and is provided with two male screws 18a and 18a standing and projecting to one side. The male screws 18a and 18a are disposed symmetrically with

respect to the center of the coupling plate 19 and at a distance R_2 from the center. Nuts 18b and 18b are attached to the male screws 18a and 18a, respectively.

The fixing portion 15 is not limited to such a configuration. Alternatively, the male screws 18a and 18a can be replaced with bolts and the coupling plate 19 can be provided with bolt insertion holes therefor.

[0038]

As shown in FIGS. 5(a) and 5(b), the attachment portion 20 includes a coupling plate 21 and an angle adjusting plate 22 that stands from one surface of the coupling plate 21 so as to include the center of the coupling plate 21. The coupling plate 21 is provided with a pair of long holes 21a and 21a along a rotation locus of a radius R_2 so as to be symmetrical with respect to the angle adjusting plate 22 and allow the male screws 18a and 18a at the fixing portion 15 to be inserted therethrough.

The angle adjusting plate 22 is provided, substantially in the center in the width direction (parallel to the coupling plate 21), with a bolt insertion hole 22a equal in diameter to the bolt insertion hole 12a, and is also provided with angle fixing holes 22b that are equal in diameter to the angle fixing hole 12b and are disposed at 13 locations at the intervals of 15 degrees along a rotation locus of a radius R_1 around the bolt insertion hole 22a.

The angle fixing holes 22b and 22b at the respective ends are provided such that a straight line connecting the centers is parallel to the coupling plate 21. The attachment portion 20 is fixed to the fixing portion 15 by fastening the nuts 18b to the male screws 18a inserted through the long holes 21a in a state where the rear surfaces of the coupling plate 19 and the coupling plate 21 are in contact with each other with the centers thereof being matched, (see FIG. 2(b)).

[0039]

As shown in FIG. 6(a), the fixing means 4 is coupled to the lower end of the pillar 3 by disposing the angle adjusting plate 22 of the attachment portion 20 between the support pieces 12 and 12 so as to cause the bolt insertion hole 22a (see FIG. 5(b)) to communicate with the bolt insertion holes 12a and 12a (see FIG. 3(c)), transversely inserting the bolt 13a to these holes, and fastening the nut 13b. In this state, the bolt 13a is perpendicular to the longitudinal direction of the pillar 3 and serves as a shaft body that rotatably couples the angle adjusting plate 22 to the support pieces 12 and 12. The fixing means 4 thus becomes swingable relative to the pillar 3 as indicated by arrow A. The clamp 17 opens or closes perpendicularly to the bolt 13a.

When the bolt 23b is transversely inserted to the three holes, namely, the angle fixing holes 12b and 12b (see FIG. 3(c)) in the support pieces 12 and 12 and one of the angle fixing holes 22b disposed to communicate with one another, the angle adjusting plate 22 becomes unrotatable relative to the support pieces 12 and 12 and the fixing means 4 is thus restricted

from swinging along arrow A relative to the pillar 3.

In this case, the angle fixing holes 12b and 12b, the angle fixing hole 22b, and the bolt 23b serve as adjusting plate angle fixing means configured to fix the angle adjusting plate 22 to the pillar 3 at a predetermined rotation angle.

[0040]

Specifically, the angle adjusting plate 22 becomes rotatable relative to the support pieces 12 and 12 when the bolt 23b is extracted from the angle fixing holes 12b and 12b and the angle fixing hole 22b. In this state, it is possible to change the angle between an open-close direction of the clamp 17 and the pillar 3 within a virtual plane perpendicular to the bolt 13a. When the bolt 23b is inserted to the angle fixing holes 12b and 12b and the angle fixing hole 22b to restrict rotation of the angle adjusting plate 22 relative to the support pieces 12 and 12, fixed is the angle between the open-close direction of the clamp 17 and the pillar 3.

In the present embodiment, the rotation angle of the angle adjusting plate 22 to the pillar 3 is adjustable at the intervals of 15 degrees within the range from 0 degrees to 180 degrees by changing combination of the angle fixing hole 12b and 12b and the angle fixing hole 22b that receive the bolt 23b. The locations and the number of the angle fixing holes 12b are not limited to this case but can be modified appropriately.

[0041]

When the nuts 18b fastened to the male screws 18a are loosened, the coupling plate 19 becomes rotatable relative to the coupling plate 21 within the range where the male screws 18a are movable inside the long holes 21a as indicated by arrow B in FIG. 6(b). In this case, the fixing portion 15 becomes swingable relative to the pillar 3 as indicated by arrow B. When the nuts 18b are fastened, the coupling plate 19 becomes unrotatable relative to the coupling plate 21 and the fixing portion 15 is restricted from swinging relative to the pillar 3 along arrow B.

In this case, the male screws 18a, the nuts 18b, and the long holes 21a serve as coupling plate angle fixing means configured to fix the rear surface of the clamp 17 to the coupling plate 21 at a predetermined rotation angle.

[0042]

Specifically, when the nuts 18b fastened to the male screws 18a are loosened, the coupling plate 19 becomes rotatable relative to the coupling plate 21. In this state, it is possible to change the angle between the open-close direction of the clamp 17 and the pillar 3 projected on a virtual plane parallel to the coupling plate 21. When the nuts 18b are fastened to the male screws 18a to restrict rotation of the coupling plate 19 relative to the coupling plate 21, fixed is the angle between the open-close direction of the clamp 17 and the pillar 3.

The rotation angle of the attachment portion 20 to the fixing portion 15 is adjustable

within the range from 0 degrees to 90 degrees in the present embodiment. The ranges of the long holes 21a is not limited to this case but can be changed appropriately.

[0043]

The handrail member 2 will now be described in terms of its configuration with reference to FIGS. 7(a) and 7(b). FIG. 7(b) is a view of a state where the end shown in FIG. 7(a) is enlarged and cut along a plane including the center axis.

As shown in FIGS. 7(a) and 7(b), the handrail member 2 includes a metal bar body 2a and joints 24 coupled to the respective ends. The bar body 2a includes a cylindrical outer member 33 and a cylindrical inner member 34 that is slidably inserted to the outer member 33. The outer member 33 is provided, in the side surface, with a screw hole (not shown), into which a thumbscrew 35 is screwed.

In other words, the entire length of the handrail member 2 in the free handrail 1a is easily adjustable by sliding the inner member 34 relative to the outer member 33 with the thumbscrew 35 being loosened, whereas the inner member 34 is unslidably fixed to the outer member 33 by turning the thumbscrew 35 so as to cause the lower end to press the side surface of the inner member 34.

In this manner, the handrail member 2 can be changed in length in accordance with the intervals of the installed pillars 3. The free handrail 1a thus achieves high utility with less limitation in location of the pillars 3.

[0044]

Each of the outer member 33 and the inner member 34 has the cylindrical shape in the present embodiment. Alternatively, only the outer member 33 can have the cylindrical shape and the inner member 34 can have a solid configuration. The gap between the pillars 3 remains unchanged after the pillars 3 are once installed. The handrail member 2 will not be changed in length due to spontaneous slide of the inner member 34 even though the inner member 34 is not fixed to the outer member 33. Accordingly, the thumbscrew 35 can be removed from the configuration. If the thumbscrew 35 is provided as in the present embodiment, the inner member 34 can be safely fixed so as not to be slid spontaneously when the handrail member 2 is conveyed.

[0045]

The bar body 2a is provided at the respective ends with coupling pieces 2b so as to project in the longitudinal direction. The joints 24 each include a pair of coupling pieces 24a and 24a disposed to oppose each other so as to allow the coupling piece 2b to be inserted therebetween, and a disc-shaped locking piece 24b from which the coupling pieces 24a and 24a stand. The coupling pieces 2b are each provided with an axial hole and the coupling pieces 24a are each provided with an axial hole so as to communicate with the axial hole in the coupling piece 2b. A shaft body 25 is inserted to be fitted to these axial holes so that the

coupling piece 2b and the coupling pieces 24a and 24a are coupled rotatably about the shaft body 25. The joints 24 and 24 are thus swingable relative to the bar body 2a.

In other words, the handrail member 2 can easily change the angle between the locking piece 24b and the longitudinal direction of the bar body 2a within a virtual plane parallel to the longitudinal direction of the bar body 2a.

The locking piece 24b is formed to have the peripheral edge projecting laterally from the coupling pieces 24a and 24a in a planar view.

[0046]

The retaining means 9 used to couple the handrail member 2 to the pillar 3 will be described next with reference to FIGS. 8(a) to 9(b). FIG. 8(b) shows a state where a retaining tool 27 shown in FIG. 8(a) is descended to interpose the handrail member 2 between the retaining tool 27 and a retaining tool 28. FIG. 8(b) is obtained by taking the view shown in FIG. 8(a) along a plane including the center axis of the lower pillar portion 7.

The retaining means 10 is configured similarly to the retaining means 9, and the retaining means 8 can be described by replacing the lower pillar portion 7 with the upper pillar portion 6 in the description of the retaining means 9. Accordingly, the retaining means 9 will now be described exemplarily and the retaining means 8 and 10 will not be described herein.

[0047]

The retaining means 9 includes a male screw portion 26 provided partially on an outer peripheral surface 7d of the lower pillar portion 7, the ring-shaped retaining tool 27 having an antislipping uneven outer peripheral surface and screwed to the male screw portion 26, and the ring-shaped retaining tool 28 disposed below the male screw portion 26 so as to oppose to the retaining tool 27 and fixed to the outer peripheral surface 7d of the lower pillar portion 7. The retaining tool 27 has an opposed surface 27a and the retaining tool 28 has an opposed surface 28a. The opposed surface 27a and the opposed surface 28a are provided with ring-shaped recessed grooves 27b and 28b along the outer peripheral surface 7d of the lower pillar portion 7 so as to be locked with the locking pieces 24b, respectively.

The retaining tool 27 is screwed to the male screw portion 26 and the retaining tool 28 is fixed to the outer peripheral surface 7d of the lower pillar portion 7 in the present embodiment. The present invention is not limited to this case. Alternatively, at least one of the retaining tools 27 and 28 can be screwed to the male screw portion 26. Still alternatively, the recessed groove can be provided to at least one of the opposed surfaces 27a and 28a.

[0048]

When the joints 24 of the handrail member 2 are set to the opposed surface 28a of the retaining tool 28 such that the shaft body 25 is parallel to the axis direction of the lower pillar

portion 7 and the lower portions of the locking pieces 24b are locked to the recessed groove 28b as shown in FIG. 8(a) and the retaining tool 27 is then rotated to descend until the upper portions of the locking pieces 24b are locked to the recessed groove 27b as shown in FIG. 8(b), the joints 24 are undetachably retained by the retaining tools 27 and 28. The coupling pieces 24a and 24a of the joints 24 are in contact with the opposed surfaces 27a and 28a of the retaining tools 27 and 28 in this case. The locking pieces 24b are thus inhibited from rotating about the center axis.

In contrast, the coupling piece 2b is rotatable about the shaft body 25 relative to the coupling pieces 24a and 24a. As indicated by arrow D₁ in FIG. 9(a), the bar body 2a is thus swingable within a plane perpendicular to the axis direction of the lower pillar portion 7.

When the retaining tool 27 is rotated to ascend from this state and the locking pieces 24b unlock the recessed grooves 27b and 28b, the handrail member 2 becomes easily detachable from the retaining means 9.

When the joints 24 of the handrail member 2 are set to the opposed surface 28a of the retaining tool 28 such that the shaft body 25 is perpendicular to the axis direction of the lower pillar portion 7 and the lower portions of the locking pieces 24b are locked to the recessed groove 28b and the retaining tool 27 is then rotated to descend until the upper portions of the locking pieces 24b are locked to the recessed groove 27b as shown in FIG. 9(b), the joints 24 are undetachably retained by the retaining tools 27 and 28. However, the bar body 2a is swingable within a plane including the center axis of the lower pillar portion 7 as indicated by arrow D₂ in this case.

[0049]

The free handrail 1a can adjust the angle between the open-close direction of the clamp 17 and the longitudinal direction of the pillar 3 within a plane perpendicular to the bolt 13a and the angle between the open-close direction of the clamp 17 and the bolt 13a projected on a plane parallel to the coupling plate 21. The free handrail 1a can be thus installed to members of the temporary stairs S other than the treads P if the members are thin enough to be caught by the clamp 17.

Change in gap between the opposed surfaces 27a and 28a upon retaining the joint 24 by the retaining tools 27 and 28 enables adjustment in angle between the longitudinal direction of the pillar 3 and the swing plane of the joint 24. The handrail member 2 can be thus coupled to the pillar 3 in a desired direction. The retaining means 8 to 10 can be commonly applied to the plurality of handrail members 2 different in size (diameter) of the locking pieces 24b.

[0050]

As described above, the free handrail 1a according to the present invention enables the pillar 3 to be installed vertically regardless of the posture of a target caught by the clamp

17. There is no limitation in coupling direction of the handrail member 2 to the pillar 3. In other words, the free handrail 1a has less limitation in location of the pillars 3 and can thus be installed also to existing temporary stairs and scaffolds. The clamp 17 can be adjusted in attachment posture in accordance with coupling or detachment of the handrail member 2 to or from the pillar 3 as well as an installation target of the pillar 3 by simple operation such as rotation of the retaining tool 27 and the nuts 18b and insertion or extraction of the bolt 23b. The free handrail 1a can be thus installed easily and safely. Furthermore, the free handrail 1a has the simple configuration roughly including the two types of members, namely, the handrail members 2 and the pillars 3. The free handrail 1a can be thus produced easily. The free handrail 1a not in use can be dismantled into the handrail members 2 and the pillars 3 so as to be easily conveyed. The fixing means 4 and the retaining means 8 to 10 also have simple and light configurations. The free handrail 1a achieves reduction in conveyance cost and production cost.

EMBODIMENT 2

[0051]

A free handrail according to Embodiment 2 will now be described with reference to FIGS. 10 to 11(d) (particularly corresponding to claim 8).

FIG. 10 corresponds to FIG. 1 but does not include the handrail members 2. FIGS. 11(a) to 11(d) are partially enlarged sectional views taken along arrows E-E, F-F, G-G, and H-H indicated in FIG. 10, respectively. The constituent elements shown in FIGS. 1 to 9(b) are denoted by the same reference signs and will not be described repeatedly.

[0052]

As shown in FIGS. 10 to 11(d), a free handrail 1b according to the present embodiment is obtained by adding, to the free handrail 1a according to Embodiment 1, a baseboard 29 and providing, to the lower pillar portion 7, a retaining frame 30 configured to attach the baseboard 29 to the pillar 3.

The baseboard 29 has a rectangular shape in a planar view and includes flat plates 29a and 29a and square tube flat plates 29b and 29c that each extend from an end of corresponding one of the flat plates 29a and 29a. The flat plates 29a are each welded to corresponding one of the flat plates 29b and 29c with an end inserted to be fitted thereto. The flat plate 29c has an end slidably inserted to the flat plate 29b.

The retaining frame 30 has a flat square tube shape so as to allow an end of the flat plate 29a to be inserted thereto and is fixed to the outer peripheral surface 7d by screws 32 so as to be parallel to the axis direction of the lower pillar portion 7.

As shown in FIGS. 11(a) and 11(c), the flat plate 29a is inserted to the retaining frame 30 with a receiving frame 31 serving as a spacer attached to its end in the present

embodiment.

[0053]

The free handrail 1b thus configured achieves adjustment in entire length of the baseboard 29 by sliding the flat plate 29c relative to the flat plate 29b. There is thus less limitation in gap between the installed pillars 3 rather than the case where the baseboard 29 is fixed in entire length.

EMBODIMENT 3

[0054]

A free handrail according to Embodiment 3 will now be described with reference to FIGS. 12 to 17 (particularly corresponding to claims 3 and 6).

FIG. 12 is an external view of a free handrail 1c according to the present embodiment. FIG. 13(a) is a front view of a handrail member 36 configuring the free handrail 1c, FIG. 13(b) is an enlarged view along arrow I, of an end of the handrail member 36 shown in FIG. 13(a), and FIG. 13(c) is a sectional view taken along arrow J-J indicated in FIG. 13(a). FIG. 14(a) and 14(b) are a side view and a front view of a coupling tool 38, respectively, and FIG. 14(c) is a sectional view taken along arrow K-K indicated in FIG. 14(b). The thumbscrew 35 and a spring 40c have cross sections not hatched in FIGS. 13(c) and 14(c).

FIGS. 15(a) and 15(b) are a side view and a plan view of a coupling ring 41, respectively, and FIG. 15(c) is a partially enlarged view of any one of the retaining means 8 to 10 and its vicinity shown in FIG. 12. FIG. 16 is an enlarged view of a fixing means 37 shown in FIG. 12, and FIG. 17 is a view along arrow L indicated in FIG. 16. FIG. 18(a) is a sectional view taken along arrow M-M indicated in FIG. 16, and FIG. 18(b) is a perspective view of outer appearance of respective components assembled to a shaft 49.

FIG. 15(c) shows part of the retaining tools 27 and 28, the coupling tool 38, and the coupling ring 41, which are cut along a plane including both the axis of the pillar 3 and the axis of the handrail member 36. FIG. 18(a) does not include an attachment portion 43 and a fixing portion 42. The constituent elements shown in FIGS. 1 to 11(d) are denoted by the same reference signs and will not be described repeatedly.

[0055]

As shown in FIG. 12, the free handrail 1c according to the present embodiment is obtained by replacing the handrail member 2 and the fixing means 4 in the free handrail 1b according to Embodiment 2 with a handrail member 36 and the fixing means 37.

As shown in FIGS. 13(a) and 13(b), the handrail member 36 includes a metal bar body 36a and a pair of coupling pieces 36b and 36b provided at the respective ends of the bar body 36a so as to project in the longitudinal direction. The coupling pieces 36b and 36b are disposed to oppose each other so as to allow a coupling portion 38b of the coupling tool 38,

which is to be described later (see FIGS. 14(a) to 14(c)) to be inserted therebetween. The coupling pieces 36b and 36b are provided with axial holes 39b and 39b so as to communicate with an axial hole 39a provided in the coupling portion 38b of the coupling tool 38.

The bar body 36a includes the cylindrical outer member 33 and the cylindrical inner member 34 that is slidably inserted to the outer member 33. As shown in FIG. 13(c), the outer member 33 is provided in the side surface with a screw hole 33a into which the thumbscrew 35 is screwed, and the inner member 34 is provided in a surface with a lock groove 34a in the longitudinal direction of the inner member 34 so as to be locked with the distal end of the thumbscrew 35. In other words, the outer member 33 and the inner member 34 are inhibited from relatively rotating about cylindrical shafts by locking, to the lock groove 34a, the distal end of the thumbscrew 35 screwed into the screw hole 33a.

The outer member 33 and the inner member 34 according to the present embodiment are inhibited from rotating about the cylindrical shafts by locking the distal end of the thumbscrew 35 to the lock groove 34a in the inner member 34 so as to allow movement only in the longitudinal direction. However, the free handrail according to the present invention is not limited to such a configuration.

For example, a bolt or the like can replace the thumbscrew 35 or can be additionally provided to the thumbscrew 35. In a configuration in which the distal end of the bolt or the like screwed into the screw hole 33a is locked to the lock groove 34a in the inner member 34, the rotation of the outer member 33 and the inner member 34 can be inhibited more effectively.

[0056]

As shown in FIGS. 14(a) to 14(c), the coupling tool 38 includes a bar-shaped insert portion 38a and the plate-shaped coupling portion 38b provided at an end of the insert portion 38a, and entirely has a substantially L shape in a side view. The coupling portion 38b is provided with the axial hole 39a as described above, and the insert portion 38a is provided, near the distal end, with a long and narrow recessed groove 40a in the longitudinal direction. The recessed groove 40a incorporates therein a locking piece 40b and the spring 40c biasing the locking piece 40b so as to be pressed outward. In other words, the locking piece 40b is biased by the spring 40c and is set inside the recessed groove 40a so as to be partially incorporated therein and extracted therefrom.

[0057]

As shown in FIGS. 15(a) and 15(b), the coupling ring 41 includes a locking piece 41a having a partial circular arc outer shape in a planar view, a retaining portion 41b having a ring shape in a planar view and configured to rotatably retain the insert portion 38a of the coupling tool 38, and a connecting portion 41c configured to connect the locking piece 41a and the retaining portion 41b.

As shown in FIG. 15(c), after the insert portion 38a of the coupling tool 38 having the coupling portion 38b coupled with the coupling pieces 36b and 36b of the bar body 36a is inserted through the retaining portion 41b of the coupling ring 41 and the locking piece 41a of the coupling ring 41 is set to the opposed surface 28a of the retaining tool 28 so as to allow the lower portion of the locking piece 41a to be locked to the recessed groove 28b, the retaining tool 27 screwed to the male screw portion 26 is rotated to descend until the upper portion of the locking piece 41a is locked to the recessed groove 27b. The coupling ring 41 is thus undetachably retained by the retaining tools 27 and 28, and the handrail member 36 is coupled rotatably about the center axes of the axial hole 39a in the coupling tool 38 and the retaining portion 41b of the coupling ring 41.

In this case, the locking piece 40b is locked to the coupling ring 41 so as to prevent extraction of the insert portion 38a of the coupling tool 38 from the retaining portion 41b of a coupling ring 41. When the locking piece 40b is pushed into the recessed groove 40a against the spring 40c in this state, the locking piece 40b is not locked to the retaining portion 41b. The insert portion 38a can be thus easily extracted from the retaining portion 41b.

The retaining tools 28 and 29 configuring the retaining means 8 to 10 can each couple at least two handrail members 36.

[0058]

In the free handrail 1c thus configured, the coupling tool 38 can be easily coupled to or detached from the coupling ring 41. In the free handrail 1a according to Embodiment 1, the handrail member 2 is swingable only about the center axis of the coupling piece 2b. It is thus necessary to change the gap between the retaining tool 27 and the retaining tool 28 in order to change the swing plane of the handrail member 2 from the state in parallel with the longitudinal direction of the pillar 3 to the state perpendicular thereto, for example. In contrast, in the free handrail 1c according to the present embodiment, the handrail member 36 is swingable independently about the two axes perpendicular to each other, namely, the center axis of the coupling piece 2b and the center axis of the insert portion 38a of the coupling tool 38. There is thus no need to perform the work of, for example, changing the gap between the retaining tools 27 and 28 to cause the swing plane of the handrail member 36 to be changed from the state in parallel with the longitudinal direction of the pillar 3 to the state perpendicular thereto.

[0059]

The fixing portion 42 and the attachment portion 43 configuring the fixing means 37 will be described next with reference to FIGS. 16 to 18(b).

As shown in FIG. 16, the fixing portion 42 has a clamp in a substantially cornered U shape in a side view and has a rear surface to which the attachment portion 43 is rotatably fixed by a bolt. Similarly to the fixing portion 15 for the attachment portion 20 according to

Embodiment 1, the fixing portion 42 is provided, in the rear surface, with a plurality of bolt insertion holes so as to adjust the rotation angle of the attachment portion 43.

[0060]

The attachment portion 43 includes a coupling plate 44 and an angle adjusting plate 45 that stands from one surface of the coupling plate 44 so as to include the center of the coupling plate 44 and is provided, at the side surface in a circular arc shape, with a male screw portion 45b. The coupling plate 44 is provided with a pair of long holes along a rotation locus of a predetermined radius so as to be symmetrical with respect to the angle adjusting plate 45 and allow bolts 47 for attachment to the fixing portion 42 to be inserted therethrough. The coupling plate 44 is provided, in the center, with a shaft body 46 configured to be inserted through a through hole provided substantially in the center of the rear surface of the fixing portion 42, so as to have the distal end projecting oppositely from the angle adjusting plate 45.

The angle adjusting plate 45 is provided, substantially in the center in the width direction (parallel to the coupling plate 44), with a through hole for the bolt 13a to be inserted therethrough and an angle fixing hole 45a for the bolt 23b to be inserted therethrough. The angle fixing hole 45a is formed substantially in a long hole shape along a rotation locus of a radius having a predetermined length around the insertion hole for the bolt 13a.

[0061]

The angle fixing hole 45a is provided such that a straight line connecting the start point and the end point is parallel to the coupling plate 44. The attachment portion 43 is fixed by fastening the bolts 47 inserted through the bolt insertion holes provided in the rear surface in the state where the distal end of the shaft body 46 projecting from the coupling plate 44 is rotatably inserted through the through hole provided in the rear surface of the fixing portion 42.

When the bolts 47 are loosened, the fixing portion 42 becomes rotatable about the shaft body 46 relative to the coupling plate 44 within the movable range of the bolts 47 inside the long holes provided in the coupling plate 44, and the fixing portion 42 becomes swingable relative to the pillar 3. When the bolts 47 are fastened, the fixing portion 42 becomes unrotatable relative to the coupling plate 44 and the fixing portion 42 is restricted from swinging relative to the pillar 3.

In this case, the bolts 47 and the long holes in the coupling plate 44 serve as coupling plate angle fixing means configured to fix the rear surface of the fixing portion 42 to the coupling plate 44 at a predetermined rotation angle.

[0062]

As shown in FIGS. 17 to 18(b), the substrate 11 has a pair of support pieces 48 and 48 standing therefrom and provided with a bolt insertion hole 48a and an angle fixing hole

48b allowing the bolts 13a and 23b to be inserted therethrough, and a retaining hole 48c configured to rotatably retain the shaft 49.

The shaft 49 has a square pillar portion 49a having a hexagonal sectional shape and male screw portions 49b and 49c provided at the respective ends of the square pillar portion 49a. The square pillar portion 49a allows a gear retaining tool 50 and a spring retaining tool 51 to be inserted therethrough, the male screw portions 49b and 49c are screwed with a grip 52 and a nut 53, respectively, and washers 54 are provided between the gear retaining tool 50 and the nut 53 as well as between the spring retaining tool 51 and the grip 52.

The gear retaining tool 50 includes a fitting portion 50a having a circular outer surface and a hexagonal inner surface, and a locking portion 50b standing from the fitting portion 50a and having a rectangular plate shape. The fitting portion 50a inserted through the square pillar portion 49a becomes unrotatable relative to a shaft 9 and unrotatable relative to the support piece 48 due to the locking portion 50b locked with part of the inner wall of the support piece 48.

[0063]

The spring retaining tool 51 includes a fitting portion 51a having a circular outer surface and a hexagonal inner surface, and a stepped portion 51b provided at one end of the fitting portion 51a and having a finely uneven end surface. The fitting portion 51a inserted through the square pillar portion 49a becomes unrotatable relative to the shaft 9.

A gear 55 is externally provided to the fitting portion 50a of the gear retaining tool 50 such that a finely uneven side surface 55a can be in contact with the end surface of the stepped portion 51b of the spring retaining tool 51 and is rotatably meshed with the male screw portion 45b of the angle adjusting plate 45.

A coil-shaped push spring 56 is provided between the inner wall surface of the support piece 48 and the stepped portion 51b such that the push spring 56 is externally provided to the fitting portion 51a of the spring retaining tool 51 and can bias to press the spring retaining tool 51 against the gear 55.

[0064]

In the free handrail 1c thus configured, the locking portion 50b is locked with part of the inner wall of the support piece 48 to inhibit the shaft 49 from rotating relative to the support piece 48 in cooperation with a fitting portion 49a. In this case, the spring retaining tool 51 and the push spring 56 generate frictional force with the side surface 55a of the gear 55 to inhibit rotation thereof. When the grip 52 is rotated to press the spring retaining tool 51 against the gear 55, the spring retaining tool 51 is directly pressed against the gear 55 by the grip 52 with force larger than the press force by the push spring 56. In this case, rotation of the gear 55 is inhibited more effectively. The force inhibiting rotation of the gear 55 is stronger as the grip 52 is operated to move forward the spring retaining tool 51 so as to press

the gear 55. The gear 55 finally comes into a completely unrotatable state.

In other words, the shaft 49, the spring retaining tool 51, the grip 52, and the push spring 56 serve as adjusting plate angle fixing means configured to fix the angle adjusting plate 45 to the pillar 3 at a predetermined rotation angle.

[0065]

In the free handrails 1a and 1b according to Embodiments 1 and 2, the bolt 23b needs to be inserted to a different one of the angle fixing holes 22b in order to change the rotation angle of the angle adjusting plate 22 to the pillar 3. In contrast, in the free handrail 1c according to the present embodiment, the rotation angle of the angle adjusting plate 45 to the pillar 3 is continuously changed without the work of inserting the bolt 23b to a different one of the angle fixing holes. This configuration achieves excellent work efficiency.

Rotation of the gear 55 rotatably meshed with the male screw portion 45b of the angle adjusting plate 45 is inhibited by the spring retaining tool 51 and the push spring 56 to adjust rotation speed of the fixing means 37 relative to the pillar 3. This configuration safely prevents accidents such as sudden fall of the pillar 3 during the work of installing the fixing means 37 to temporary stairs or the like.

INDUSTRIAL APPLICABILITY

[0066]

The invention according to any one of claims 1 to 8 is applicable to temporary stairs and scaffolds installed at a building site, a construction site, or the like.

DESCRIPTION OF REFERENCE SIGNS

[0067]

- 1a: Free handrail
- 1b: Free handrail
- 1c: Free handrail
- 2: Handrail member
- 2a: Bar body
- 2b: Coupling piece
- 3: Pillar
- 4: Fixing means
- 5a: Grip portion
- 5b: Grip portion
- 6: Upper pillar portion
- 6a: Upper end
- 6b: Lower end

6c: Pin insertion hole
7: Lower pillar portion
7a: Upper end
7b: Lower end
7c: Pin insertion hole
7d: Outer peripheral surface
8: Retaining means
9: Retaining means
10: Retaining means
11: Substrate
12: Support piece
12a: Bolt insertion hole
12b: Angle fixing hole
13a: Bolt
13b: Nut
14: Retaining pin
15: Fixing portion
16: Bolt
17: Clamp
17a: Upper portion
18a: Male screw
18b: Nut
19: Coupling plate
20: Attachment portion
21: Coupling plate
21a: Long hole
22: Angle adjusting plate
22a: Bolt insertion hole
22b: Angle fixing hole
23a: Pin
23b: Bolt
24: Joint
24a: Coupling piece
24b: Locking piece
25: Shaft body
26: Male screw portion
27: Retaining tool

27a: Opposed surface
27b: Recessed groove
28: Retaining tool
28a: Opposed surface
28b: Recessed groove
29: Baseboard
29a: Flat plate
29b: Flat plate
29c: Flat plate
30: Retaining frame
31: Receiving frame
32: Screw
33: Outer member
33a: Screw hole
34: Inner member
34a: Lock groove
35: Thumbscrew
36: Handrail member
36a: Bar body
36b: Coupling piece
37: Fixing means
38: Coupling tool
38a: Insert portion
38b: Coupling portion
39a: Axial hole
39b: Axial hole
40a: Recessed groove
40b: Locking piece
40c: Spring
41: Coupling ring
41a: Locking piece
41b: Retaining portion
41c: Connecting portion
42: Fixing portion
43: Attachment portion
44: Coupling plate
45: Angle adjusting plate

45a: Angle fixing hole
45b: Male screw portion
46: Shaft body
47: Bolt
48: Support piece
48a: Bolt insertion hole
48b: Angle fixing hole
48c: Retaining hole
49: Shaft
49a: Square pillar portion
49b: Male screw portion
49c: Male screw portion
50: Gear retaining tool
50a: Fitting portion
50b: Locking portion
51: Spring retaining tool
51a: Fitting portion
51b: Stepped portion
52: Grip
53: Nut
54: Washer
55: Gear
55a: Side surface
56: Push spring
S: Temporary stair
P: Tread

CLAIMS

1. A free handrail (1a) attached to a plate forming a tread (P) of a temporary stair (S) or a floor plate of a temporary scaffold, the free handrail comprising:
 - a handrail member (2) including a bar body (2a) and coupling pieces (2b) provided at ends of the bar body to project in a longitudinal direction;
 - a bar-shaped pillar (3) having a circular sectional outline;
 - a fixing means (4) attached to a lower end of the pillar (3) and having a clamp (17) configured to catch the plate; and
 - a retaining means (8) provided to the pillar (3) and coupled with an end of the handrail member (2).
2. The free handrail (1a) according to claim 1, wherein the handrail member (2) includes
 - a joint (24) coupled with the coupling piece (2b) to be swingable within a virtual plane parallel to the longitudinal direction of the bar body (2a) and provided with a locking piece (24b),
 - the retaining means (8) includes
 - a first retaining tool (27) and a second retaining tool (28) disposed opposite to each other, and
 - a male screw portion (26) provided to part of an outer peripheral surface of the pillar (3), and
 - one of the first retaining tool (27) and the second retaining tool (28) is screwed to the male screw portion (26) and the other is fixed to the outer peripheral surface of the pillar (3), and at least one of opposed surfaces (27a, 28a) is provided with a recessed groove (27b, 28b) configured to be locked with the locking piece (24b).
3. The free handrail (1c) according to claim 2, wherein the joint (24) is replaced with
 - a coupling tool (38) including a bar-shaped insert portion (38a) and a plate-shaped coupling portion (38b) provided at an end of the insert portion, and having a substantially L shape in a side view, and
 - a coupling ring (41) including a locking piece (41a) having a partial circular arc outer shape in a planar view and a retaining portion (41b) configured to rotatably retain the insert portion (38a) about a center axis and connected to the locking piece (41a),
 - in the handrail member (36), the coupling portion (38b) of the coupling tool (38), instead of the joint (24), is swingably coupled to the coupling piece (36b), and
 - the coupling ring (41) is provided to be locked to the recessed groove (27b, 28b) in a

state where the locking piece (41a) is interposed between the first retaining tool (27) and the second retaining tool (28).

4. The free handrail (1a) according to any one of claims 1 to 3, wherein the bar body (2a) includes a cylindrical outer member (33) and an inner member (34) slidably inserted to the outer member (33).

5. The free handrail (1a) according to any one of claims 1 to 4, wherein
the pillar (3) is provided at the lower end with a support piece (12) projecting downward,
the fixing means (4) is provided as an angle adjusting plate (22) that is rotatably coupled to the support piece (12) via a first shaft body (13a) perpendicular to the longitudinal direction of the pillar (3),
the support piece (12) is provided with
a first insertion hole (12a) allowing the first shaft body (13a) to be inserted therethrough, and
a first angle fixing hole (12b) that is disposed with a predetermined gap in the longitudinal direction of the pillar (3) from the first insertion hole (12a) and allows a second shaft body (23b) to be inserted therethrough,
the angle adjusting plate (22) is provided with
a second insertion hole (22a) allowing the first shaft body (13a) to be inserted therethrough in a state of communicating with the first insertion hole (12a), and
a plurality of second angle fixing holes (22b) substantially at equal intervals along a rotation locus having a predetermined radius around the second insertion hole (22a),
the plurality of second angle fixing holes (22b) allows the second shaft body (23b) to be inserted therethrough in a state of communicating with the first angle fixing hole (12b), and
the fixing means (4) is attached to the angle adjusting plate (22) with an open-close direction of the clamp (17) being perpendicular to the first shaft body (13a).

6. The free handrail (1c) according to any one of claims 1 to 4, wherein
the pillar (3) is provided at the lower end with a support piece (48) projecting downward,
the fixing means (37) is provided as an angle adjusting plate (45) that is rotatably coupled to the support piece (48) via a first shaft body (13a) perpendicular to the longitudinal direction of the pillar (3),
the support piece (48) is provided with

a first insertion hole (48a) allowing the first shaft body (13a) to be inserted therethrough, and

a first angle fixing hole (48b) that is disposed with a predetermined gap in the longitudinal direction of the pillar (3) from the first insertion hole (48a) and allows a second shaft body (23b) to be inserted therethrough,

the angle adjusting plate (45) is provided with

a second insertion hole allowing the first shaft body (13a) to be inserted therethrough in a state of communicating with the first insertion hole (48a),

a second angle fixing hole (45a) having a long hole shape along a rotation locus having a predetermined radius around the second insertion hole, and

a male screw portion (45b) at a circular arc side surface,

the support piece (48) is provided with

a gear (55) rotatably meshed with the male screw portion (45b) of the angle adjusting plate (45), and

a rotation inhibitor configured to cause frictional force with a side surface of the gear (55), and

the fixing means (37) is attached to the angle adjusting plate (45) with an open-close direction of the clamp being perpendicular to the first shaft body (13a).

7. The free handrail (1a) according to claim 5 or 6, wherein the fixing means (4) includes

a coupling plate (21) parallel to the first shaft body (13a) and provided with the angle adjusting plate (22) standing therefrom, and

a coupling plate angle fixing means configured to fix a rear surface of the clamp (17) to the coupling plate (21) at a predetermined rotation angle.

8. The free handrail (1b) according to any one of claims 1 to 7, further comprising a baseboard (29) having a rectangular shape in a planar view and an end formed to be inserted to a retaining frame (30) provided to a side surface of the pillar (3), wherein

the baseboard (29) includes a first flat plate (29b) in a square tube shape and a second flat plate (29c) slidably inserted to the first flat plate (29b).