

DESCRIPTION

Title of Invention

HOLLOW MEMBER INSTALLATION STRUCTURE

Technical Field

[0001] The present invention relates to a hollow member installation structure, and specifically, to a hollow member installation structure on a lower end side of a hollow member.

Background Art

[0002] Fixation of a hollow member to an underlying member located on a lower end side of the hollow member has been performed on an outer side of the hollow member.

[0003] For example, Patent Literature 1 discloses a column base structure including: a steel column base including a steel column (a hollow member) and a column base hardware member integrally bonded to a lower end part of the hollow member; and foundation concrete (an underlying member), wherein on an outer side of the hollow member, the steel column base is fixed to the underlying member via an anchor bolt embedded in the underlying member and a nut screwed on an upper end part of the anchor bolt.

[0004] In such a column base structure as disclosed in Patent Literature 1, however, the column base hardware member is located on the outer side of the hollow member, and the upper end part of the anchor bolt on which the nut is screwed protrudes upward from an upper surface of the column base hardware member. Thus, work around the column base structure has to be performed while the column base hardware member is avoided, and therefore, workspace on the outer side of the hollow member is likely to be restricted.

Citation List

Patent Literature

[0005] Patent Literature 1: JP H 10-25807 A

Summary of Invention

[0006] An object of the present disclosure is to provide a hollow member installation structure

which makes workspace on an outer side of a hollow member less likely to be limited.

[0007] An aspect according to the present invention is a hollow member installation structure including: a hollow member having a length direction along a vertical direction; a coupler member connecting the hollow member to an underlying member located on a lower end side of the hollow member; and a fixing member fixing the coupler member to the underlying member. The hollow member has a hollow. The hollow is open at least at a lower end of the hollow member. The coupler member includes a fixing part fixing the hollow member and a base part continuous with the fixing part and fixed to the underlying member. The fixing member and at least part of the base part are in an area overlapping the hollow in plan view as seen in the vertical direction.

[0008] According to the aspect of the present invention, the fixing member and the at least part of the base part are in the area overlapping the hollow in plan view as seen in the vertical direction, and therefore, workspace on the outer side of the hollow member is less likely to be restricted.

Brief Description of Drawings

[0009] FIGS. 1A to 1C are views illustrating a first example of a hollow member installation structure according to an embodiment;

FIGS. 2A and 2B are views illustrating a first example of a coupler member according to the embodiment;

FIG. 3A is an exploded view of a second example of the coupler member according to the embodiment;

FIG. 3B is an exploded view of a third example of the coupler member according to the embodiment;

FIG. 3C is an exploded view of a fourth example of the coupler member according to the embodiment;

FIGS. 4A to 4C are views illustrating a second example of the hollow member installation structure according to the embodiment;

FIG. 5A is a perspective view illustrating an example of the hollow member according to the embodiment;

FIG. 5B is a perspective view of a fifth example of the coupler member according to the embodiment;

FIG. 6 is a view illustrating a third example of the hollow member installation structure

according to the embodiment;

FIG. 7 is a view illustrating a sixth example of the coupler member according to the embodiment;

FIG. 7 is a view illustrating a first example of a support member according to the embodiment;

FIG. 8 is a view illustrating a fourth example of the hollow member installation structure according to the embodiment;

FIG. 9 is a view illustrating a seventh example of the coupler member according to the embodiment; and

FIG. 9 is a view illustrating a second example of the support member according to the embodiment.

Description of Embodiments

[0010] Embodiments of the present invention will be described below.

[0011] (First Embodiment)

<Hollow Member Installation Structure>

First, a hollow member installation structure (hereinafter referred to as an installation structure in some cases) 1 according to a first embodiment will be described with reference to FIGS. 1A to 3C.

[0012] The installation structure 1 according to the present embodiment is a structure which is applicable to, for example, a skeletal frame of a building and which allows a hollow member 2 to be installed on, in particular, an underlying member 6 which is described later. Thus, the vertical direction Y of the installation structure 1 is defined by the vertical direction of the building.

[0013] As illustrated in FIGS. 1A to 1C, the installation structure 1 includes the hollow member 2, a coupler member 3, and a fixing member 4. The hollow member 2 has a length direction along the vertical direction Y. The hollow member 2 has a hollow 21 which is continuous along the vertical direction Y. The coupler member 3 is configured to connect the hollow member 2 and the underlying member 6 located on a lower end side of the hollow member 2 to each other and has a base part 31 and a fixing part 32. The fixing member 4 is configured to fix the coupler member 3 to the underlying member 6. The fixing part 32 is a part which fixes the hollow member 2. The base part 31 is a part which is continuous with the fixing part 32 and which is to be fixed to the underlying member 6. the fixing member 4 and at

least part of the base part 31 are in an area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y.

[0014] According to such an installation structure 1, the fixing member 4 and the at least part of the base part 31 are in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y, and therefore, the fixing member 4 is no longer disposed on the outer side of the hollow member 2, and the base part 31 is less likely to be disposed on the outer side of the hollow member 2. Thus, workspace on the outer side of the hollow member 2 is less likely to be restricted.

[0015] As illustrated in FIG. 1A, the coupler member 3 is a member configured to connect the hollow member 2 to the underlying member 6 in a state where the base part 31 is fixed to the underlying member 6 with the fixing member 4. The coupler member 3 has a support part 33 continuous with the base part 31 in addition to the base part 31 and the fixing part 32. The coupler member 3 is, for example, a member made of metal such as iron.

[0016] The fixing part 32 is a part which rises upward in the vertical direction Y from an outer side end of the base part 31. The fixing part 32 preferably has a flat plate shape. In this case, the fixing part 32 has a counter surface facing the hollow member 2. The counter surface is preferably parallel to an outer side surface of the hollow member 2. In this case, the hollow member 2 is more easily fixed to the fixing part 32. Thus, the fixing part 32 more easily supports the hollow member 2 in a state where the hollow member 2 is fixed to the fixing part 32. To fix the hollow member 2 to the fixing part 32, a fixing member 5 is used.

[0017] Moreover, the fixing part 32 has a thickness. The thickness direction of the fixing part 32 is orthogonal to the vertical direction Y. The thickness of the fixing part 32 is preferably greater than the thickness of the hollow member 2. In this case, the strength of the installation structure 1 can be easily improved. The thickness of the fixing part 32 is, for example, 9 mm.

[0018] As illustrated in FIG. 2A, the fixing part 32 has a through hole 35. The through hole 35 is a hole penetrating the fixing part 32 along a direction orthogonal to the vertical direction Y. The through hole 35 is larger than the diameter of a shaft of the fixing member 5 and is smaller than a head of the fixing member 5 in a front view. Thus, in a state where the shaft of the fixing member 5 is inserted in the through hole 35, the shaft of the fixing member 5 is driven in the hollow member 2 to bring the head of the fixing member 5 into contact with the fixing part 32, thereby fixing the hollow member 2 to the fixing part 32 on the outer side of the hollow 21 (on the outer side of the hollow member 2). Specifically, the fixing part 32 is fixed to the outer side surface of the hollow member 2. In the present embodiment, the fixing part 32 has a

plurality of (in the example shown in FIG. 2A, four) through holes 35, and shafts of fixing members 5 are driven in the hollow member 2 via the respective through holes 35 (e.g., see FIG. 1C). Alternatively, the hollow member 2 may be fixed to the fixing part 32 by one fixing member 5.

[0019] The support part 33 is at a location different from the fixing part 32 and is a part which rises upward in the vertical direction Y from an outer side end of the base part 31. Such a support part 33 laterally supports the hollow member 2. Moreover, the support part 33 preferably has a flat plate shape. In this case, the support part 33 has a counter surface facing the hollow member 2. The counter surface is preferably parallel to the outer side surface of the hollow member 2. In this case, the support part 33 more easily supports the hollow member 2, and the installation structure 1 is more easily stabilized. In the present embodiment, the height of the support part 33 along the vertical direction Y is equal to, but may be different from, the height of the fixing part 32.

[0020] Moreover, the support part 33 has a thickness. The thickness direction of the support part 33 is orthogonal to the vertical direction Y. The thickness of the support part 33 is preferably greater than the thickness of the hollow member 2. In this case, the strength of the installation structure 1 can be improved. The thickness of the support part 33 is, for example, 9 mm.

[0021] As illustrated in FIG. 1A, the hollow member 2 is also fixed to the support part 33 in the present embodiment. However, the hollow member 2 does not have to be fixed to the support part 33. The support part 33 can support the hollow member 2 without fixing the hollow member 2 to the support part 33.

[0022] In the case of fixing the hollow member 2 to the support part 33, the support part 33 has a through hole 36 as illustrated in FIG. 2A. The through hole 36 is a hole penetrating the support part 33 along a direction orthogonal to the vertical direction Y. The through hole 36 is larger than the diameter of the shaft of the fixing member 5 and is smaller than the head of the fixing member 5 in a front view. Thus, in a state where the shaft of the fixing member 5 is inserted in the through hole 36, the shaft of the fixing member 5 is driven in the hollow member 2 to bring the head of the fixing member 5 into contact with the support part 33, thereby fixing the hollow member 2 to the support part 33 on the outer side of the hollow 21 (on the outer side of the hollow member 2). In the case of fixing the support part 33 in the manner described above, the support part 33 is fixed to the outer side surface of the hollow member 2. In the present embodiment, the support part 33 has a plurality of (in the example shown in FIG. 2A,

four) through holes 36, and shafts of fixing members 5 are driven in the hollow member 2 via the respective through holes 36 (e.g., see FIG. 1C). Alternatively, the support part 33 may have one through hole 36, and the hollow member 2 may be fixed to the support part 33 with one fixing member 5.

[0023] The base part 31 is a flat plate-like part to be fixed to the underlying member 6 in a state where the base part 31 is installed on an installation surface of the underlying member 6. Moreover, as illustrated in FIG. 1A, the base part 31 does not protrude toward the outer side of the hollow 21 from the fixing part 32 and the support part 33. Specifically, the base part 31 does not protrude toward the outer side of the hollow 21 from the fixing part 32 and the support part 33 in plan view as seen from above in the vertical direction Y.

[0024] In the present embodiment, part of the base part 31 is in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y. In other words, the base part 31 is connected to the fixing part 32 and the support part 33 under the hollow member 2, and part of the base part 31 is under the hollow 21.

[0025] Moreover, the base part 31 has a thickness. The thickness direction of the base part 31 is parallel to the vertical direction Y. The thickness of the base part 31 is preferably greater than the thickness of the hollow member 2 and is equal to the thickness of each of the fixing part 32 and the support part 33. In this case, the strength of the coupler member 3 is easily improved, and the strength of the installation structure 1 can be easily improved. The thickness of the base part 31 is, for example, 9 mm.

[0026] As illustrated in FIG. 2A, the base part 31 has a through hole 34. The through hole 34 is a hole penetrating the base part 31 along the vertical direction Y. The through hole 34 is greater than the diameter of a shaft 43 of the fixing member 4 and is smaller than an upper end part of the fixing member 4 in plan view as seen from above in the vertical direction Y. Thus, bringing the upper end part of the fixing member 4 into contact with the base part 31 in a state where the shaft 43 is inserted in the through hole 34, thereby fixing the base part 31 to the underlying member 6. As illustrated in FIG. 1B, the fixing member 4 is in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y. In other words, the upper end part of the fixing member 4 is in the hollow 21.

[0027] In the present embodiment, the base part 31 is fixed to the underlying member 6 with one fixing member 4. Alternatively, the base part 31 may be fixed to the underlying member 6 with a plurality of fixing members 4. In the case of fixing the base part 31 with the plurality of fixing members 4, the base part 31 has a plurality of through holes 34.

[0028] In the coupler member 3 as shown in FIG. 2A, the fixing part 32 faces the support part 33 in a direction orthogonal to the vertical direction Y. Such a coupler member 3 is manufactured by, for example, a process of bending, at locations of folding lines 37 and 37, a plate having the through holes 34, 35, and 36 as illustrated in FIG. 2B. Note that the coupler member 3 is not necessarily manufactured from the plate as illustrated in FIG. 2B but may be manufactured from a plate as illustrated in each of FIGS. 3A to 3C. In the case of a coupler member 3 formed from the plate as illustrated in FIG. 3A, a support part 33 and a fixing part 32 are adjacent to each other in a state where the support part 33 and the fixing part 32 rise upward from the base part 31. In the case of a coupler member 3 formed from the plate as illustrated in FIG. 3B, a fixing part 32 is adjacent to one support part 33 of a pair of support parts 33 and 33 facing each other with a base part 31 provided between the support parts 33, and the other support part 33 is adjacent to the fixing part 32 in a state where the support parts 33 and the fixing part 32 rise upward from the base part 31. In the case of a coupler member 3 formed from the plate as illustrated in FIG. 3C, a support part 33 and a fixing part 32 face each other with the base part 31 provided therebetween, the fixing part 32 is adjacent to one support part 33 of a pair of support parts 33 and 33 facing each other with the base part 31 provided between the support parts 33, and the other support part 33 is adjacent to the fixing part 32 in a state where the support parts 33 and the fixing part 32 rise upward from the base part 31. Moreover, the coupler member 3 may be manufactured by molding.

[0029] When the installation structure 1 includes any one of the coupler members 3 described above and the hollow member 2 is fixed to not only the fixing part 32 but also the support part(s) 33, the hollow member 2 is fixed to the fixing part 32 and the support part(s) 33.

[0030] In the installation structure 1 according to the present embodiment, before the coupler member 3 is disposed on the underlying member 6 (e.g., in a factory), the through holes 34, 35, and 36 may be formed in the coupler member 3 which is lighter in weight than the hollow member 2, and therefore, the coupler member 3 is easily manufactured. As a result, complication of work to finish the installation structure 1 can be easily reduced, and the installation structure 1 is easily manufactured.

[0031] The hollow member 2 has an outer width W. The outer width W is the width of an outer periphery of the hollow member 2. The direction of the outer width W is orthogonal to the vertical direction Y. The outer width W may be arbitrarily set and is, for example, 50 mm to 150 mm. In this case, the weight of the hollow member 2 can be reduced. The outer width W is, for example, 100 mm.

[0032] The hollow member 2 has a length. The length direction of the hollow member is along the vertical direction Y. That is, the length direction of the hollow member is parallel to the vertical direction Y. The length of the hollow member is greater than the outer width W. The length of the hollow member is not particularly limited as long as it is greater than the outer width W. The length of the hollow member is arbitrarily set in accordance with the height or the like of a place where the installation structure 1 is installed.

[0033] Moreover, the hollow member 2 has a thickness. The thickness direction of the hollow member 2 is orthogonal to the vertical direction Y and is parallel to the direction of the outer width W. The thickness of the hollow member 2 may be arbitrarily set and is, for example, 1.6 mm to 3.2 mm. In this case, the weight of the hollow member 2 can be reduced. The thickness of the hollow member 2 is, for example, 2.3 mm.

[0034] The hollow member 2 according to the present embodiment may have, but does not have to have, through holes at locations corresponding to the through holes 35 and 36 before installation. When the hollow member 2 has the through holes, each of these through holes is smaller than the diameter of the shaft of the fixing member 5.

[0035] The hollow member 2 has the hollow 21. The hollow 21 has a length. The length direction of the hollow 21 is parallel to the vertical direction Y and is equal to the length of the hollow member 2. Thus, one hollow 21 is open at an upper end and a lower end of the hollow member 2.

[0036] The hollow member 2 is, for example, a member made of metal such as iron. Examples of such a hollow member 2 include a steel tube and a C-channel. Moreover, examples of the steel tube include a steel tube having a circular or elliptic cross section in a direction orthogonal to the vertical direction Y and a carbon steel square or rectangular tube. In particular, the hollow member 2 is preferably a carbon steel square or rectangular tube. The carbon steel square or rectangular tube is a steel tube having a quadrangular cross section in a direction orthogonal to the vertical direction Y.

[0037] According to the installation structure 1 of the present embodiment, part of the base part 31 and the fixing member 4 are in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y, and therefore, the fixing member 4 is no longer disposed on the outer side of the hollow member 2, and the base part 31 is less likely to be disposed on the outer side of the hollow member 2. Thus, workspace on the outer side of the hollow member 2 is less likely to be restricted.

[0038] In the present embodiment, “orthogonal” refers not only to an aspect of being

orthogonal to the vertical direction Y in strict sense but conceptually includes an aspect of being substantially orthogonal. Moreover, “parallel” refers not only to an aspect of being parallel to the vertical direction Y in strict sense but conceptually includes an aspect of being substantially parallel.

[0039] In the installation structure 1 according to the present embodiment, the lower end of the hollow member 2 is in contact with the base part 31 as illustrated in FIG. 1A. Thus, on an outer side of the base part 31 along the installation surface of the underlying member 6, a gap is formed between the hollow member 2 and the underlying member 6.

[0040] The fixing member 4 is a fixing member for fixing the base part. The fixing member 4 includes, for example, an anchor bolt which is the shaft 43, a washer 42, and a nut 41 (see FIG. 1A). In this case, the washer 42 is located between the base part 31 and the nut 41 in a state where the upper end part of the anchor bolt is screwed in the nut 41 to fix the base part 31 to the underlying member 6. In such an aspect, the upper end part of the fixing member 4 includes the washer 42 and the nut 41 screwed on the anchor bolt. Examples of the fixing member 4 further include a screw, a nail, and a rivet. In this case, the upper end part of the fixing member 4 is constituted by the head of a screw or the like. The diameter of the shaft 43 is preferably 8 mm to 16 mm.

[0041] The fixing member 5 is a fixing member to be driven in the outer side surface of the hollow member 2 (a fixing member for the outer side surface of the hollow member). Examples of the fixing member 5 include a screw, a nail, and a rivet. The fixing member 5 is different from the fixing member 4, and the diameter of the shaft of the fixing member 5 is smaller than the diameter of the shaft 43. The length of the shaft of the fixing member 5 may be arbitrarily set and is, for example, greater than the sum of the thickness of the fixing part 32 and the thickness of the hollow member 2 and is less than the distance between the fixing member 4 and an outer surface of the fixing part 32 in a direction orthogonal to the vertical direction Y. Moreover, when the hollow member 2 is fixed to the support part 33 with the fixing member 4, the length of the shaft of the fixing member 4 may be set in a similar manner to a fixing aspect of the fixing part 32.

[0042] Examples of the underlying member 6 include a girth, a floor beam, a base, and foundation concrete. When the underlying member 6 is foundation concrete, for example, the anchor bolt is embedded in the foundation concrete, and the upper end part of the anchor bolt is exposed from the foundation concrete.

[0043] The installation structure 1 according to the present embodiment is preferably a column

base structure. In this case, the hollow member 2 is a pillar of a building. Moreover, the installation structure 1 is applicable to, for example, a leg structure of a vertical furring strip.

[0044] <Hollow Member Installation Method>

Next, a hollow member installation method (hereinafter referred to as an installation method in some cases) according to the present embodiment will be described. The installation method is a method for manufacturing the installation structure 1 by installing the hollow member 2 on the underlying member 6. Thus, the installation method may be referred to the description of the installation structure 1.

[0045] The installation method of the present embodiment includes a preparation step, a disposition step, and an installation step.

[0046] The preparation step is a step of preparing the underlying member 6, the hollow member 2, the coupler member 3, and the fixing member 5. The preparation step includes forming the through holes 34 and 35 respectively in the base part 31 and the fixing part 32 and optionally forming the through hole 36 in the support part 33. The through holes 34, 35, and 36 are formed by arbitrary hole boring. Examples of the hole boring include punching hole boring and drill hole boring.

[0047] Moreover, in the preparation step, through holes may be formed in the hollow member 2 at locations corresponding to the through holes 35 and 36. Moreover, in the present embodiment, the anchor bolt serving as the shaft 43 is embedded in the underlying member 6, but the anchor bolt does not have to be embedded in the underlying member 6. After the preparation step, the disposition step, and the installation step are performed.

[0048] The disposition step is a step of disposing the coupler member 3 on the underlying member 6. When the anchor bolt is embedded in the underlying member 6, the upper end part of the anchor bolt is inserted into the through hole 34 and the washer 42 and is then screwed in the nut 41 in the disposition step. Then, the washer 42 is brought into contact with the base part 31, and the nut 41 is brought into contact with the washer 42, thereby fixing the base part 31 to the underlying member 6. Alternatively, when the anchor bolt is not embedded in the underlying member 6, the shaft 43 of the fixing member 4 may be inserted in the through hole 34 from above the base part 31 in a state where the coupler member 3 is disposed on the underlying member 6, and thereafter, the shaft 43 may be driven in the underlying member 6, thereby fixing the base part 31 to the underlying member 6. In this case, a washer may be provided between the base part 31 and the head of the fixing member 4. After the disposition step, the installation step is performed.

[0049] The installation step is a step of installing the hollow member 2. In the installation step, the lower end of the hollow member 2 is brought into contact with the base part 31, and in this state, the shaft of the fixing member 5 is inserted into the through hole 35 and is then driven in the hollow member 2, thereby fixing the hollow member 2 to the fixing part 32 with the fixing member 5. Moreover, in the present embodiment, the shaft of the fixing member 5 inserted in the through hole 36 is driven in the hollow member 2 to fix the hollow member 2 also to the support part 33. However, the hollow member 2 does not have to be fixed to the support part 33. The support part 33 can support the hollow member 2 without fixing the hollow member 2 to the support part 33. Moreover, when the hollow member 2 and the coupler member 3 are members made of metal such as iron, the coupler member 3 and the hollow member 2 may be connected to each other by welding.

[0050] In the installation method according to the present embodiment, the hollow member 2 is installed on the underlying member 6 by connecting the hollow member 2 to the coupler member 3 fixed to the underlying member 6, thereby manufacturing the installation structure 1.

[0051] (Second Embodiment)

Next, an installation structure 1 according to a second embodiment will be described with reference to FIGS. 4A to 5B. In the present embodiment, components common to the first embodiment are denoted by the same reference signs as those in the first embodiment, and the detailed description thereof will be omitted.

[0052] As illustrated in FIGS. 4A to 4C, the installation structure 1 of the present embodiment includes a hollow member 2, a coupler member 3, a fixing member 4, and a fixing member 5.

[0053] As illustrated in FIG. 4A, in the installation structure 1, the hollow member 2 is installed on an underlying member 6 in a state where a lower end of the hollow member 2 is in contact with the underlying member 6. As illustrated in FIG. 5A, such a hollow member 2 has a through hole 22. The through hole 22 is a hole penetrating the hollow member 2 along a direction orthogonal to the vertical direction Y and is located at a lower end part of the hollow member 2. The lower end part of the hollow member 2 is a part between the lower end of the hollow member 2 and a location at the same height as a higher one of upper ends of a fixing part 32 and a support part 33 in the state of the installation structure 1. To fix the hollow member 2 to the fixing part 32, a shaft of the fixing member 5 is driven in the fixing part 32 in a hollow 21 through the through hole 22. This fixes the fixing part 32 to an inner side surface of the hollow member 2.

[0054] The hollow member 2 according to the present embodiment has a plurality of through

holes 22, but the number of the through holes 22 may be arbitrarily set. For example, the hollow member 2 may have one through hole 22.

[0055] As illustrated in FIG. 4A, the coupler member 3 is in the hollow 21 in a state where a base part 31 is fixed to the underlying member 6 with the fixing member 4. Thus, the entirety of the base part 31 is in the hollow 21, and an upper end part of the fixing member 4 is also in the hollow 21. In this case, an increased workspace is more likely to be provided on an outer side of the lower end part of the hollow member 2.

[0056] The fixing part 32 has a counter surface facing the hollow member 2. The counter surface is preferably parallel to an inner side surface of the hollow member 2. In this case, the hollow member 2 is more easily fixed to the fixing part 32. Thus, the fixing part 32 more easily supports the hollow member 2 in a state where the hollow member 2 is fixed to the fixing part 32.

[0057] The fixing part 32 has no through holes at locations corresponding to the through holes 22 (see FIG. 5B), but the fixing part 32 may have through holes. When the fixing part 32 has the through holes, each through hole is smaller than the diameter of the shaft of the fixing member 5.

[0058] The support part 33 has a counter surface facing the hollow member 2. The counter surface is preferably parallel to the inner side surface of the hollow member 2. In this case, the support part 33 more easily supports the hollow member 2, and the installation structure 1 is more easily stabilized. In the present embodiment, the height of the support part 33 along the vertical direction Y is equal to, but may be different from, the height of the fixing part 32.

[0059] The support part 33 has no through holes at locations corresponding to the through holes 22 (see FIG. 5B) but may have through holes. When the support part 33 has the through holes, each through hole is smaller than the diameter of the shaft of the fixing member 5. Moreover, in the present embodiment, the hollow member 2 is also fixed to the support part 33 (see FIG. 4A), but the hollow member 2 does not have to be fixed to the support part 33. To fix the hollow member 2 to the support part 33, the shaft of the fixing member 5 is driven in the support part 33 through the through holes 22. Thus, the support part 33 is fixed to the inner side surface of the hollow member 2.

[0060] To install the hollow member 2 according to the present embodiment on the underlying member 6, the through holes 22 are formed in the lower end part of the hollow member 2 in the preparation step. The through holes 22 are formed in a part which is to face the fixing part 32 in the installation step, and optionally, through holes 22 are also formed in a part which is to face

the support part 33. The through holes 22 are formed by arbitrary hole boring. Examples of the hole boring include punching hole boring and drill hole boring.

[0061] In the installation step, the lower end of the hollow member 2 is brought into contact with the underlying member 6 in a state where the coupler member 3 is in the hollow 21. Then, shafts of fixing members 5 are inserted into the through holes 22 and are then driven in the fixing part 32, thereby fixing the hollow member 2 to the fixing part 32 with the fixing members 5. Moreover, shafts of fixing members 5 are inserted into the through holes 22 and are then driven in the support part 33, thereby fixing the hollow member 2 also the support part 33 with the fixing members 5.

[0062] (Third Embodiment)

<Hollow Member Installation Structure>

Next, an installation structure 1 according to a third embodiment will be described with reference to FIGS. 6 and 7. In the third embodiment, components common to the first and second embodiments are denoted by the same reference signs as those in the first and second embodiments, and the detailed description thereof will be omitted.

[0063] As illustrated in FIG. 6, the installation structure 1 of the present embodiment includes a hollow member 2, a coupler member 3, a support member 7, a fixing member 4, and a fixing member 8. The fixing member 4 is a first fixing member, and the fixing member 8 is a second fixing member. In such an installation structure 1, the hollow member 2 is installed on an underlying member 6 (see FIG. 6) in a state where a lower end of the hollow member 2 is in contact with base parts 31 and 71 which will be described later.

[0064] As illustrated in FIG. 6, the coupler member 3 includes the base part 31 and a fixing part 32. The base part 31 has a through hole 34, and the fixing part 32 has through holes 35 (see FIG. 7). Moreover, the coupler member 3 has no support part (e.g., support part 33 in FIG. 2A). Examples of such a coupler member 3 include an L-shaped angle.

[0065] In the present embodiment, part of the base part 31 is in an area overlapping a hollow 21 in plan view as seen from above in the vertical direction Y. In other words, the base part 31 is under the hollow member 2, and the part of the base part 31 is under the hollow 21.

[0066] As illustrated in FIG. 6, the support member 7 is a member configured to support the hollow member 2 with the support member 7 being fixed to the underlying member 6 with the second fixing member 8. The support member 7 has the base part 71 and a support part 72 continuous with the base part 71. The support member 7 is, for example, a member made of metal such as iron.

[0067] The support part 72 is a part which rises upward in the vertical direction Y from an outer side end of the base part 71. Such a support part 72 laterally supports the hollow member 2. Moreover, the support part 72 preferably has a flat plate shape. In this case, the support part 72 has a counter surface facing the hollow member 2. The counter surface is preferably parallel to an outer side surface of the hollow member 2. In this case, the support part 72 more easily supports the hollow member 2, and the installation structure 1 is more easily stabilized. In the present embodiment, the height of the support part 72 along the vertical direction Y is equal to, but may be different from, the height of the fixing part 32. For example, the support part 72 may be higher than the fixing part 32.

[0068] Moreover, the support part 72 has a thickness. The thickness direction of the support part 72 is orthogonal to the vertical direction Y. The thickness of the support part 72 is preferably greater than the thickness of the hollow member 2. In this case, the strength of the installation structure 1 can be easily improved. The thickness of the support part 72 is, for example, 9 mm.

[0069] As illustrated in FIG. 6, the hollow member 2 is also fixed to the support part 72 in the present embodiment. However, the hollow member 2 does not have to be fixed to the support part 72. The support part 72 can support the hollow member 2 without fixing the hollow member 2 to the support part 72.

[0070] In the case of fixing the hollow member 2 to the support part 72, the support part 72 has a through hole 75 as illustrated in FIG. 7. The through hole 75 is a hole penetrating the support part 72 along a direction orthogonal to the vertical direction Y. The through hole 75 is larger than the diameter of a shaft of a fixing member 5 and is smaller than a head of the fixing member 5 in the front view. Thus, in a state where the shaft of the fixing member 5 is inserted in the through hole 75, the shaft of the fixing member 5 is driven in the hollow member 2 to bring the head of the fixing member 5 into contact with the support part 72, thereby fixing the hollow member 2 to the support part 72 on an outer side of the hollow 21 (on an outer side of the hollow member 2). That is, the support part 72 is fixed to an inner side surface of the hollow member 2. In the present embodiment, the support part 72 has a plurality of (in the example shown in FIG. 7, four) through holes 75, and shafts of fixing members 5 are driven in the hollow member 2 via the respective through holes 75 (e.g., see FIG. 6). Alternatively, the support part 72 may have one through hole 36, and the hollow member 2 may be fixed to the support part 72 with one fixing member 5.

[0071] The base part 71 is a flat plate-like part disposed on an installation surface of the

underlying member 6 along a direction orthogonal to the vertical direction Y. Moreover, as illustrated in FIG. 6, the base part 71 does not protrude toward the outer side of the hollow 21 from the support part 72. Specifically, the base part 71 does not protrude from the support part 72 toward the outer side of the hollow 21 in plan view as seen from above in the vertical direction Y.

[0072] In the present embodiment, part of the base part 71 is in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y. In other words, the base part 71 is under the hollow member 2, and the part of the base part 71 is under the hollow 21.

[0073] Moreover, the base part 71 has a thickness. The thickness direction of the base part 71 is parallel to the vertical direction Y. The thickness of the base part 71 is preferably greater than the thickness of the hollow member 2 and is equal to the thickness of the support part 72. In this case, the strength of the support member 7 is easily improved, and the strength of the installation structure 1 is easily improved. The thickness of the base part 71 is, for example, 9 mm.

[0074] As illustrated in FIG. 7, the base part 71 has a through hole 74. The through hole 74 is a hole penetrating the base part 71 along the vertical direction Y. The through hole 74 is greater than the diameter of a shaft 83 of the second fixing member 8 and is smaller than an upper end part of the second fixing member 8 in plan view as seen from above in the vertical direction Y. Thus, bringing the upper end part of the second fixing member 8 into contact with the base part 71 in a state where the shaft 83 is inserted in the through hole 74, thereby fixing the base part 71 to the underlying member 6. As illustrated in FIG. 6, the second fixing member 8 is in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y. In other words, the upper end part of the second fixing member 8 is in the hollow 21.

[0075] In the present embodiment, the base part 71 is fixed to the underlying member 6 with one second fixing member 8, but the base part 71 may be fixed to the underlying member 6 with a plurality of second fixing members 8. When the base part 71 is fixed with the plurality of second fixing members 8, the base part 71 has a plurality of through holes 74.

[0076] Examples of the support member 7 having the base part 71 and the support part 72 as described above include an L-shaped angle.

[0077] According to the installation structure 1 of the present embodiment, part of the base part 31, part of the base part 71, the first fixing member 4, and the second fixing member 8 are in the area overlapping the hollow 21 in plan view as seen from above in the vertical direction Y, and therefore, the first and second fixing members 4 and 8 are no longer disposed on the outer side of

the hollow member 2, and the base parts 31 and 71 are less likely to be disposed on the outer side of the hollow member 2. Thus, workspace on the outer side of a lower end part of the hollow member 2 is less likely to be restricted.

[0078] The lower end part of the hollow member 2 is a part between the lower end of the hollow member 2 and a location at the same height as a higher one of upper ends of the fixing part 32 and the support part 72 in the state of the installation structure 1.

[0079] The second fixing member 8 is a fixing member for fixing the base part. The second fixing member 8 includes, for example, an anchor bolt which is the shaft 83, a washer 82, and a nut 81 (see FIG. 6). In this case, the washer 82 is located between the base part 71 and the nut 81 in a state where an upper end part of the anchor bolt is screwed in the nut 81 to fix the base part 71 to the underlying member 6. In such an aspect, the upper end part of the second fixing member 8 includes the washer 82 and the nut 81 screwed on the anchor bolt. Examples of the second fixing member 8 further include a screw, a nail, and a rivet. In this case, the upper end part of the second fixing member 8 is constituted by the head of a screw or the like. The diameter of the shaft 83 is preferably 8 mm to 16 mm. The second fixing member 8 may be the same as the first fixing member 4.

[0080] <Hollow Member Installation Method>

Next, an installation method according to the present embodiment will be described. The installation method is a method for manufacturing the installation structure 1 by installing the hollow member 2 on the underlying member 6. Thus, the installation method may be referred to the description of the installation structure 1.

[0081] The installation method of the present embodiment includes a preparation step, a disposition step, and an installation step.

[0082] The preparation step is a step of preparing the underlying member 6, the hollow member 2, the coupler member 3, the support member 7, and the fixing member 5. The preparation step includes forming the through holes 34, 35, and 74 respectively in the base part 31, the fixing part 32, and the base part 71 and optionally forming the through holes 75 in the support part 72. The through holes 34, 35, 74, and 75 are formed by arbitrary hole boring. Examples of the hole boring include punching hole boring and drill hole boring.

[0083] Moreover, in the preparation step, through holes may be formed at locations in the hollow member 2 which correspond to the through holes 35 and 75. Moreover, in the present embodiment, respective anchor bolts serving as a shaft 43 and the shaft 83 are embedded in the underlying member 6, but the anchor bolts do not have to be embedded in the underlying

member 6. After the preparation step, the disposition step and the installation step are performed.

[0084] The disposition step is a step of disposing the coupler member 3 and the support member 7 on the underlying member 6. When the anchor bolt which is the shaft 43 is embedded in the underlying member 6, the upper end part of the anchor bolt is inserted into the through hole 34 and the washer 42 and is then screwed in the nut 41 in the disposition step. Then, the washer 42 is brought into contact with the base part 31, and the nut 41 is brought into contact with the washer 42, thereby fixing the base part 31 to the underlying member 6. Moreover, when the anchor bolt which is the shaft 83 is embedded in the underlying member 6, the upper end part of the anchor bolt is inserted into the through hole 74 and the washer 82 and is then screwed in the nut 81. Then, the washer 82 is brought into contact with the base part 71, and the nut 81 is brought into contact with the washer 82, thereby fixing the base part 71 to the underlying member 6.

[0085] When the anchor bolts are not embedded in the underlying member 6, the shaft 43 of the first fixing member 4 may be inserted in the through hole 34 from above the base part 31 with the coupler member 3 and the support member 7 being disposed on the underlying member 6, and the shaft 83 of the second fixing member 8 may be inserted into the through hole 74 from above the base part 71. Thereafter, the first and second fixing members 4 and 8 are driven in the underlying member 6, thereby fixing the base parts 31 and 71 to the underlying member 6. In this case, washers may be provided between the base part 31 and the head of the first fixing member 4 and between the base part 71 and the head of the second fixing member 8. After the disposition step, the installation step is performed.

[0086] The installation step is a step of installing the hollow member 2. In the installation step, the lower end of the hollow member 2 is brought into contact with the base parts 31 and 71, and in this state, shafts of fixing members 5 are inserted into the through holes 35 and are then driven in the hollow member 2, thereby fixing the hollow member 2 to the fixing part 32 with the fixing members 5. Moreover, in the present embodiment, shafts of fixing members 5 inserted in the respective through holes 75 are driven in the hollow member 2 to fix the hollow member 2 also to the support part 72. However, the hollow member 2 does not have to be fixed to the support part 72. The support part 72 can support the hollow member 2 without fixing the hollow member 2 to the support part 72. Moreover, when the hollow member 2, the coupler member 3, and the support member 7 are members made of metal such as iron, the hollow member 2 and the coupler member 3 may be connected to each other by welding, and the hollow

member 2 and the support member 7 may be connected to each other by welding.

[0087] In the installation method according to the present embodiment, the coupler member 3 fixed to the underlying member 6 is connected to the hollow member 2, and the support member 7 fixed to the underlying member 6 supports the hollow member 2, thereby installing the hollow member 2 on the underlying member 6, and the installation structure 1 is thus manufactured.

[0088] (Fourth Embodiment)

Next, an installation structure 1 according to a fourth embodiment will be described with reference to FIGS. 8 and 9. In the present embodiment, components common to the second and third embodiments are denoted by the same reference signs as those in the second and third embodiments, and the detailed description thereof will be omitted.

[0089] As illustrated in FIG. 8, the installation structure 1 of the present embodiment includes a hollow member 2, a coupler member 3, a support member 7, a first fixing member 4, a second fixing member 8, and a fixing member 5.

[0090] As illustrated in FIG. 8, in the installation structure 1, the hollow member 2 is installed on an underlying member 6 in a state where a lower end of the hollow member 2 is in contact with the underlying member 6. Such a hollow member 2 has a through hole 22. To fix the hollow member 2 to a fixing part 32, a shaft of the fixing member 5 is driven in the fixing part 32 in a hollow 21 through the through hole 22. This fixes the fixing part 32 to an inner side surface of the hollow member 2. Moreover, the fixing part 32 before the fixing member 5 is driven therein does not have to have the through hole 35 as illustrated in FIG. 7 (see FIG. 9). That is, the fixing part 32 has a counter surface facing the hollow member 2, and the counter surface may be a flat surface in a state where the fixing member 5 is not driven in the fixing part 32.

[0091] The hollow member 2 according to the present embodiment has a plurality of through holes 22, but the number of the through holes 22 may be arbitrarily set. For example, the hollow member 2 may have one through hole 22.

[0092] As illustrated in FIG. 8, the coupler member 3 is in the hollow 21 in a state where a base part 31 is fixed to the underlying member 6 with the first fixing member 4. Thus, the entirety of the base part 31 is in the hollow 21, and an upper end part of the first fixing member 4 is also in the hollow 21. In this case, an increased workspace is more likely to be provided on an outer side of a lower end part of the hollow member 2.

[0093] The support member 7 is in the hollow 21 in a state where a base part 71 is fixed to the underlying member 6 with the second fixing member 8. Thus, the entirety of the base part 71 is

in the hollow 21, and an upper end part of the second fixing member 8 is also in the hollow 21. In this case, an increased workspace is more likely to be provided on the outer side of the lower end part of the hollow member 2.

[0094] A support part 72 has a counter surface facing the hollow member 2. The counter surface is preferably parallel to an inner surface of the hollow member 2. In this case, the support part 72 more easily supports the hollow member 2, and the installation structure 1 is more easily stabilized. In the present embodiment, the height of the support part 72 along the vertical direction Y is equal to, but may be different from, the height of the fixing part 32.

[0095] The support part 72 may have, but does not have to have, through holes at locations corresponding to the through holes 22. When the support part 72 has the through holes, each through hole is smaller than the diameter of the shaft of the fixing member 5. Moreover, in the present embodiment, the hollow member 2 is also fixed to the support part 72 (see FIG. 8), but the hollow member 2 does not have to be fixed to the support part 72. When the hollow member 2 is fixed to the support part 72, shafts of the fixing members 5 are driven in the support part 72 through the through holes 22. Thus, the support part 72 is fixed to the inner side surface of the hollow member 2. Moreover, the support part 72 before the fixing member 5 is driven therein does not have to have the through hole 75 as illustrated in FIG. 7 (see FIG. 9). That is, the support part 72 has a counter surface facing the hollow member 2, and the counter surface may be a flat surface in a state where the fixing member 5 is not driven in the fixing part 32.

[0096] To install the hollow member 2 according to the present embodiment on the underlying member 6, the through holes 22 are formed in the lower end part of the hollow member 2 in the preparation step. The through holes 22 are formed in a part which faces the fixing part 32 in the installation step, and optionally, through holes 22 are also formed in a part which faces the support part 72. The through holes 22 are formed by arbitrary hole boring. Examples of the hole boring include punching hole boring and drill hole boring.

[0097] In the installation step, the lower end of the hollow member 2 is brought into contact with the underlying member 6 in a state where the coupler member 3 and the support member 7 are in the hollow 21. Then, shafts of fixing members 5 are inserted into the through holes 22 and are then driven in the fixing part 32, thereby fixing the hollow member 2 to the fixing part 32 with the fixing members 5. Moreover, when the hollow member 2 is fixed to the support part 72, shafts of fixing members 5 are inserted into the through holes 22 and are then driven in the support part 72, thereby fixing the hollow member 2 to the support part 72 with the fixing members 5.

[0098] The aspects described above illustrate the first to fourth embodiments as preferable embodiments but are not limited to only the first to fourth embodiments, and the first to fourth embodiments may be combined with each other. Moreover, modifications and changes may be made to the first to fourth embodiments as long as such modifications and changes have no influence over the gist of the aspects. Examples of the modifications and changes include the following variations.

[0099] (Variation)

In the embodiments described above, the base part 31 has no portion protruding toward the outer side of the hollow 21 from the fixing part 32 and the support part 33. However, the base part 31 may slightly protrude from the fixing part 32 and the support part 33 toward the outer side of the hollow 21. Such a slightly protruding portion of the base part 31 may be formed by integrating the fixing part 32, the support part 33, and the base part 31 by, for example, welding.

[0100] In the embodiments described above, the base part 71 has no portion protruding from the support part 72 toward the outer side of the hollow 21. However, the base part 71 may slightly protrude from the support part 72 toward the outer side of the hollow 21. Such a slightly protruding portion of the base part 71 may be formed by integrating the support part 72 and the base part 71 by, for example, welding.

[0101] In the embodiments described above, the length of the hollow 21 is equal to the length of the hollow member 2, and one hollow 21 is open at both the upper end and the lower end of the hollow member 2. However, the length of the hollow 21 may be different from the length of the hollow member 2. That is, the length of the hollow 21 may be shorter than the length of the hollow member 2. In this case, one hollow 21 may be open at the lower end of the hollow member 2, and two hollows 21 may be open at the upper end and the lower end of the hollow member 2. According to the description of the embodiments and the variations described above, the hollow 21 is open at least at the lower end of the hollow member 2. Moreover, when the length of the hollow 21 is shorter than the length of the hollow member 2, portions of the hollow member 2 may have a solid portion except for the hollow 21.

Reference Signs List

[0102]	1	HOLLOW MEMBER INSTALLATION STRUCTURE
	2	HOLLOW MEMBER
	21	HOLLOW

3	COUPLER MEMBER
31	BASE PART
32	FIXING PART
4	FIXING MEMBER
6	UNDERLYING MEMBER
Y	VERTICAL DIRECTION

CLAIMS

1. A hollow member installation structure, comprising:
 - a hollow member having a length direction along a vertical direction;
 - a coupler member connecting the hollow member to an underlying member located on a lower end side of the hollow member; and
 - a fixing member fixing the coupler member to the underlying member,the hollow member having a hollow,
 - the hollow being open at least at a lower end of the hollow member,
 - the coupler member including
 - a fixing part fixing the hollow member and
 - a base part continuous with the fixing part and fixed to the underlying member,
 - the fixing member and at least part of the base part being in an area overlapping the hollow in plan view as seen in the vertical direction.
2. The hollow member installation structure of claim 1, wherein
 - the base part has no portion protruding toward an outer side of the hollow from the fixing part.
3. The hollow member installation structure of claim 1 or 2, wherein
 - the fixing part is fixed to an outer side surface of the hollow member.
4. The hollow member installation structure of any one of claims 1 to 3, wherein
 - the fixing part is fixed to an inner side surface of the hollow member.
5. The hollow member installation structure of any one of claims 1 to 4, wherein
 - the hollow member is a steel tube.
6. The hollow member installation structure of any one of claims 1 to 5, wherein
 - the coupler member further has a support part continuous with the base part.
7. The hollow member installation structure of claim 6, wherein

the base part has no portion protruding toward the outer side of the hollow from the support part.

8. The hollow member installation structure of claim 6 or 7, wherein the support part is fixed to the hollow member.
9. The hollow member installation structure of any one of claims 1 to 8, wherein the coupler member includes an L-shaped angle having the fixing part and the base part.