

DESCRIPTION

Title of Invention: HANGING TYPE VIBRATION ISOLATOR

Technical Field

[0001]

The present invention relates to a hanging type vibration isolator, and more particularly to a hanging type vibration isolator which is mounted on a hanging bolt for hanging vibrating equipment such as an air conditioner, a pipe for supplying or discharging water, a duct for supplying or discharging air or the like in an interposed manner thus preventing propagation of vibrations of the vibrating equipment. The present invention provides a vibration isolator which can be quickly and smoothly mounted on the hanging bolt, and exhibits high safety by preventing with certainty falling of the vibration isolator.

Background Art

[0002]

An applicant of the present patent application previously proposed a hanging type vibration isolator of the above-mentioned type. This hanging type vibration isolator includes: a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended and, which supports a load of the vibrating equipment; a vibration

isolating member which is disposed between the upper side portion and the lower side portion of the vibration isolator body, and absorbs vibrations of the vibrating equipment; and two members, that is, the upper member which is disposed between the vibration isolating member and the vibration isolator body and the lower member which is disposed between the vibration isolating member and the hanging bolt thus preventing propagation of vibrations of the vibrating equipment, wherein the vibration isolating member has a frustoconical external shape (see Patent Literature 1).

[0003]

With the configuration described above, the hanging type vibration isolator per se can acquire the manner of operation and advantageous effects that the vibration isolator can satisfy the demand for the miniaturization and the reduction of load thereof, and a contact between the vibration isolating member and the vibration isolator body can be prevented even when the position of an insertion and a position where the vibrating equipment is installed are displaced from each other so that the vibration isolator can exhibit a vibration insulating effect with certainty. Accordingly, the vibration isolator has acquired favorable evaluation to some extent. However, the vibration isolator has several drawbacks such as a drawback that, in mounting the vibration isolator body on a hanging bolt, the mounting operation is considerably difficult and time consuming so that the vibration isolator cannot be smoothly mounted.

[0004]

That is, in the vibration isolator, in mounting the vibration isolator body on the hanging bolt, a lower end of a bolt suspended from a ceiling slab (upper hanging bolt) is made to pass through a circular hole formed in the upper side portion of the vibration isolator body, the upper hanging bolt is made to project from a lower end of the vibration isolating member mounted on the vibration isolator body after passing through the inside of the vibration isolating member, a lower nut is threadedly mounted on the upper hanging bolt from the lower end of the bolt to the lower nut is brought into contact with a washer which is mounted in an embedded manner on a lower end of the elastic member which covers the vibration isolating member, and the vibration isolator body is fixedly mounted on the upper hanging bolt by fastening using the lower nut and an upper nut which forms a pair.

[0005]

However, with respect to the mounting of the vibration isolator where the lower end of the hanging bolt is made to pass through the circular hole formed in the vibration isolator body while lifting up the vibrating equipment as described above, it is necessary to perform such mounting at from two to four places which are essential portions of the vibrating equipment in such a mounting. In this case, it is necessary to lift up and support the vibrating equipment which is a heavy object by several installation workers until the lower nut is threadedly mounted on the hanging bolt. Accordingly, there arise

drawbacks that the mounting operation becomes cumbersome and time consuming thus deteriorating operability of the mounting operation. Further, such mounting of the vibration isolator requires predetermined amount of space and hence, mounting of the vibration isolator in a narrow space becomes problem.

Citation List

Patent Literature

[0006]

Patent Literature 1: JP 2012-127438 A

Summary of Invention

Technical Problem

[0007]

The present invention has been made so as to overcome the above-mentioned conventional drawbacks, and it is an object of the present invention to provide a hanging type vibration isolator which can quickly and smoothly mount a vibration isolator body on a hanging bolt, and exhibits high safety by preventing with certainty falling of the vibration isolator.

Solution to Problem

[0008]

In order to achieve the object, the invention described in claim 1 is a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a

load of the vibrating equipment, wherein the vibration isolator body has a first engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the first engaging groove, and the vibration isolator has a locking lug in which a second engaging groove substantially equal to the first engaging groove formed in the vibration isolator body is formed by notching and which is fittable on the shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the locking lug, and in the state where the locking lug is fitted on the shaft portion of the hanging bolt inserted into the first engaging groove, the locking lug and the upper side portion of the vibration isolator body are sandwiched, fastened and fixed to each other by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below.

[0009]

Regarding the invention described in claim 2, in the hanging type vibration isolator described in claim 1, a locking portion which is lockable with an opening-side edge portion of the upper side portion of the vibration isolator body is formed on both distal edge portions of the locking lug on an opening side of the second engaging groove.

[0010]

Regarding the invention described in claim 3, in the hanging type vibration isolator described in claim 2, a recessed

portion in which the locking portion is fittable is formed by notching on the opening-side edge portion of the upper side portion of the vibration isolator body with which the locking portion of the locking lug is lockable.

[0011]

Regarding the invention described in claim 4, in the hanging type vibration isolator described in claim 1, the locking lug has elongated grooves formed by notching along both sides of the second engaging groove, the elongated grooves are configured to slidably engage with projections formed on the upper side portion of the vibration isolator body, and the second engaging groove formed in the locking lug is fittable on the shaft portion of the hanging bolt which is inserted into the first engaging groove in a state where the shaft portion is inserted into the second engaging groove.

[0012]

The invention described in claim 5 is a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, wherein the vibration isolator body has a first engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the first engaging groove, and a hook-shaped locking lug in

which a second engaging groove which is engageable with the shaft portion of the hanging bolt inserted into the first engaging groove from the outside is formed by notching is pivotally supported on the vibration isolator body on one side of the first engaging groove, the vibration isolator includes a mechanism which prevents the disengagement of the locking lug from the vibration insulator body in a state where the locking lug is engaged with the shaft portion of the hanging bolt inserted into the first engaging groove, and the locking lug and the upper side portion of the vibration isolator body are sandwiched, fastened and fixed to each other by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below.

[0013]

Regarding the invention described in claim 6, in the hanging type vibration isolator described in claim 5, a projection which forms a nut receiver is formed on the upper side portion of the vibration isolator body.

[0014]

The invention described in claim 7 is a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has an engaging groove which is formed in the upper side portion by notching and is fittable

on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and a locking portion which is formed by being cut and raised downward and forms a nut receiving portion is formed on an opening-side edge portion of the upper side portion of the vibration isolator body disposed on an opening side of the engaging groove, and in a state where a lower nut of a pair of nuts threadedly mounted on the shaft portion of the hanging bolt is locked to the locking portion, the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by the lower nut and an upper nut from above and below.

[0015]

The invention described in claim 8 is a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has an engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and a circular hole having a slightly larger diameter is formed in a deep side of the engaging groove, and in a state where the shaft portion of the hanging bolt is inserted into and engages with the circular hole, a stepped

locking washer is mounted on the shaft portion of the hanging bolt such that the shaft portion passes through the stepped locking washer, and the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by a pair of nuts which is threadedly mounted on the shaft portion of the hanging bolt from above and below while interposing the washer between the upper side portion and the pair of nuts respectively.

[0016]

Regarding the invention described in claim 9, in the hanging type vibration isolator described in any one of claims 1 to 8, the vibration isolator body is formed of a hollow rectangular frame body having the upper side portion, the lower side portion and a pair of left and right side portions.

[0017]

The invention described in claim 10 is a hanging type vibration isolator including a vibration isolator body which is formed of a hollow rectangular frame body having an upper side portion, a lower side portion and a pair of left and right side portions, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, wherein the vibration isolator body has a first engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the first engaging groove, and

a U-shaped engaging frame body formed of both side portions and a connecting portion which connects the both side portions to each other is mounted on upper portions of both side portions of the vibration isolator body in a state where proximal ends of the engaging frame body are pivotally supported so as to make the engaging frame body swingable to positions above and on lateral sides of the upper side portion and the engaging frame body slidable upward and downward on both side portions of the vibration isolator body, and the vibration isolator includes a mechanism which prevents the disengagement of the engaging frame body from the vibration isolator body in a state where the engaging frame body engages with the vibration isolator body by swinging upward and by sliding downward, a second engaging groove which is substantially equal to the first engaging groove is formed in the connecting portion of the engaging frame body by notching at a position which corresponds to the first engaging groove, and the connecting portion of the engaging frame body and the upper side portion of the vibration isolator body are sandwiched, fastened and fixed to each other by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below.

[0018]

The invention call for in claim 11 is a hanging type vibration isolator including a vibration isolator body which is formed of a U-shaped frame body having an upper side portion, a lower side portion and either one of a left side portion or a right side portion, is mounted in an interposed manner on a

middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, wherein

the vibration isolator body has an engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and

a locking portion bent downward is formed on an edge portion of the upper side portion of the vibration isolator body disposed on an opening side of the engaging groove, and in a state where the shaft portion of the hanging bolt is inserted into the engaging groove, the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below.

[0019]

Regarding the invention described in claim 12, in the hanging type vibration isolator described in claim 11, wherein one or a plurality of ribs are formed along a longitudinal direction of the side portions of the vibration isolator body.

[0020]

Regarding the invention described in claim 13, in the hanging type vibration isolator described in any one of claims 1 to 12, a projecting portion which prevents the rotation of the nut is formed on a back surface of the upper side portion of the vibration isolator body.

Advantageous Effects of Invention

[0021]

The present inventions have the above-mentioned configurations. According to the inventions described in claims 1 to 4, in a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has a first engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the first engaging groove, and the vibration isolator has a locking lug in which a second engaging groove substantially equal to the first engaging groove formed in the vibration isolator body is formed by notching and which is fittable on the shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the locking lug, and in the state where the locking lug is fitted on the shaft portion of the hanging bolt inserted into the first engaging groove, the locking lug and the upper side portion of the vibration isolator body are sandwiched, fastened and fixed to each other by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below. With such a configuration, in

mounting the vibration isolator body on the hanging bolt, the vibration isolator body can be mounted on the hanging bolt by merely inserting the shaft portion of the hanging bolt into the first engaging groove formed in the upper side portion of the vibration isolator body from a horizontal direction and by inserting the shaft portion of the hanging bolt into the second engaging groove formed in the locking lug from the same horizontal direction so as to make the shaft portion engage with the second engaging groove and, thereafter, by fastening the upper side portion of the vibration isolator body and the locking lug together by the pair of nuts mounted on the shaft portion from above and below.

[0022]

Accordingly, a mounting operation of the vibration isolator body can be performed extremely quickly and smoothly compared to a conventional mounting operation and hence, an installation time can be shortened and installation can be simplified and made easier. Further, mounting of the vibration isolator body can prevent falling of the equipment or the like by merely hanging the first engaging groove of the vibration isolator body to the lower nut threadedly mounted on the shaft portion of the hanging bolt and hence, falling of the equipment can be prevented with certainty and safety is also taken into consideration. Further, the place where the vibration isolator body is mounted is mainly a space in a ceiling and hence, it is necessary to carry and install equipment through a narrow space such as an inspection opening. However, such a drawback

can be overcome by the hanging type vibration isolator of the present invention. Further, although at least two installation workers are necessary for mounting one set of equipment conventionally, the vibration isolator body can be inserted from the horizontal direction, that is, the vibration isolator body can be mounted in a slidable manner and hence, the vibration isolator body can be mounted also by one installation worker. In this manner, the present invention can acquire excellent advantageous effects such as the reduction of cost and the reduction of number of installation workers not to mention securing safety of installation workers.

[0023]

In the hanging type vibration isolator having the above-mentioned configuration, a locking portion which is lockable with an opening-side edge portion of the upper side portion of the vibration isolator body may be formed on both distal edge portions of the locking lug on an opening side of the second engaging groove. With such a configuration, the present invention can acquire an advantageous effect that an engagement state at the time of engagement of the locking lug becomes stable. Further, in the hanging type vibration isolator having the above-mentioned configuration, a recessed portion in which the locking portion is fittable may be formed by notching on the opening-side edge portion of the upper side portion of the vibration isolator body with which the locking portion of the locking lug is lockable. With such a configuration, the locking portion of the locking lug can be

accommodated while preventing the locking portion of the locking lug from projecting toward an opening side of the upper side portion of the vibration isolator body. Further, in the hanging type vibration isolator having the above-mentioned configuration, the locking lug may have elongated grooves formed by notching along both sides of the second engaging groove, the elongated grooves may be configured to slidably engage with projections formed on the upper side portion of the vibration isolator body, and the second engaging groove formed in the locking lug may be fittable on the shaft portion of the hanging bolt which is inserted into the first engaging groove in a state where the shaft portion is inserted into the second engaging groove. With such a configuration, it is possible to hold the locking lug such that the locking lug is always attached to the upper side portion of the vibration isolator body.

[0024]

According to the invention described in claim 5, in a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has a first engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the first engaging groove, and a hook-shaped

locking lug in which a second engaging groove which is engageable with the shaft portion of the hanging bolt inserted into the first engaging groove from the outside is formed by notching is pivotally supported on the vibration isolator body on one side of the first engaging groove, the vibration isolator includes a mechanism which prevents the disengagement of the locking lug from the vibration isolator body in a state where the locking lug is engaged with the shaft portion of the hanging bolt inserted into the first engaging groove, and the locking lug and the upper side portion of the vibration isolator body are sandwiched, fastened and fixed to each other by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below. With such a configuration, also due to the provision of the hook-shaped locking lug, the present invention can expect an advantageous effect substantially equal to the advantageous effect acquired by the locking lug according to the invention described in claim 4. In the hanging type vibration isolator having the above-mentioned configuration, a projection which forms a nut receiver is formed on the upper side portion of the vibration isolator body. With such a configuration, the nut can be mounted in a stable state with no stepped portion.

[0025]

According to the invention described in claim 7, in a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a

hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has an engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and a locking portion which is formed by being cut and raised downward and forms a nut receiving portion is formed on an opening-side edge portion of the upper side portion of the vibration isolator body disposed on an opening side of the engaging groove, and in a state where a lower nut of a pair of nuts threadedly mounted on the shaft portion of the hanging bolt is locked to the locking portion, the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by the lower nut and an upper nut from above and below. With such a configuration, the vibration isolator body can be mounted without particularly requiring a member such as the locking lug.

[0026]

According to the invention described in claim 8, in a hanging type vibration isolator including a vibration isolator body which has an upper side portion and a lower side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has an engaging groove which is formed in the upper side portion by

notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and a circular hole having a slightly larger diameter is formed in a deep side of the engaging groove, and in a state where the shaft portion of the hanging bolt is inserted into and engages with the circular hole, a stepped locking washer is mounted on the shaft portion of the hanging bolt such that the shaft portion passes through the stepped locking washer, and the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by a pair of nuts which is threadedly mounted on the shaft portion of the hanging bolt from above and below while interposing the washer between the upper side portion and the pair of nuts respectively. With such a configuration, the vibration isolator body can be mounted while preventing the removal of the shaft portion by the locking washer. In the above-mentioned configuration, the vibration isolator body may be formed of a hollow rectangular frame body having the upper side portion, the lower side portion and a pair of left and right side portions. [0027]

According to the invention described in claim 10, in a hanging type vibration isolator including a vibration isolator body which is formed of a hollow rectangular frame body having an upper side portion, a lower side portion and a pair of left and right side portions, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which

supports a load of the vibrating equipment, the vibration isolator body has a first engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the first engaging groove, and a U-shaped engaging frame body formed of both side portions and a connecting portion which connects the both side portions to each other is mounted on upper portions of both side portions of the vibration isolator body in a state where proximal ends of the engaging frame body are pivotally supported so as to make the engaging frame body swingable to positions above and on lateral sides of the upper side portion and the engaging frame body slidable upward and downward on both side portions of the vibration isolator body, and the vibration isolator includes a mechanism which prevents the disengagement of the engaging frame body from the vibration isolator body in a state where the engaging frame body engages with the vibration isolator body by swinging upward and by sliding downward, a second engaging groove which is substantially equal to the first engaging groove is formed in the connecting portion of the engaging frame body by notching at a position which corresponds to the first engaging groove, and the connecting portion of the engaging frame body and the upper side portion of the vibration isolator body are sandwiched, fastened and fixed to each other by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below. With such a configuration, the vibration isolator body can be simply

mounted by a series of operations consisting of swinging and sliding of the engaging frame body.

[0028]

According to the invention described in claim 11, in a hanging type vibration isolator including a vibration isolator body which is formed of a U-shaped frame body having an upper side portion, a lower side portion and either one of a left side portion or a right side portion, is mounted in an interposed manner on a middle portion of a hanging bolt from which vibrating equipment which generates vibrations is suspended, and which supports a load of the vibrating equipment, the vibration isolator body has an engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and a locking portion bent downward is formed on an edge portion of the upper side portion of the vibration isolator body disposed on an opening side of the engaging groove, and in a state where the shaft portion of the hanging bolt is inserted into the engaging groove, the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below. With such a configuration, even in the vibration isolator of a type where the frame body has the side portion only on one side, such a vibration isolator can be practically used depending on a position where the engaging groove is formed and hence, a scope where the present

invention is applicable is expanded. In the above-mentioned configuration, one or a plurality of ribs may be formed along a longitudinal direction of the side portions of the vibration isolator body. With such a configuration, a strength of the side portion of the vibration isolator body formed of the U-shaped frame body can be maintained by the rib and hence, the side portion of the vibration isolator body can be reinforced. In the above-mentioned configuration, a projecting portion which prevents the rotation of the nut may be formed on a back surface of the upper side portion of the vibration isolator body. With such a configuration, it is unnecessary to prevent the rotation of the nut by a tool and hence, a mounting operation can be performed efficiently.

Brief Description of Drawings

[0029]

FIG. 1 is a perspective view of a hanging type vibration isolator according to a first example of a first embodiment of the present invention showing a mounting state of the hanging type vibration isolator.

FIG. 2 is a perspective view showing a relationship between a hanger box, an upper hanging bolt and a locking lug of the hanging type vibration isolator before the vibration isolator is mounted.

FIGS. 3(A) to 3(C) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 3(A) is a plan view of the hanger box, FIG. 3(B) is a front view of the hanger

box, and FIG. 3(C) is a bottom view of the hanger box.

FIGS. 4(A) and 4(B) are views showing the locking lug of the hanging type vibration isolator, wherein FIG. 4(A) is a plan view of the locking lug, and FIG. 4(B) is a side view of the locking lug.

FIGS. 5(A) and 5(B) are views showing another locking lug of the hanging type vibration isolator, wherein FIG. 5(A) is a plan view of another locking lug, and FIG. 5(B) is a side view of another locking lug.

FIG. 6 is a perspective view showing a mounting state of a hanging type vibration isolator according to a second example.

FIG. 7 is a perspective view showing a relationship between a hanger box, an upper hanging bolt, and a locking lug of the hanging type vibration isolator before the vibration isolator is mounted.

FIGS. 8(A) to 8(C) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 8(A) is a plan view of the hanger box, FIG. 8(B) is a front view of the hanger box, and FIG. 8(C) is a bottom view of the hanger box.

FIGS. 9(A) and 9(B) are views showing the locking lug of the hanging type vibration isolator, wherein FIG. 9(A) is a plan view of the locking lug, and FIG. 9(B) is a side view of the locking lug.

FIG. 10 is a perspective view showing a mounting state of a hanging type vibration isolator according to a third example.

FIG. 11 is a perspective view showing a relationship

between a hanger box, an upper hanging bolt, and a locking lug of the hanging type vibration isolator before the vibration isolator is mounted.

FIGS. 12(A) to 12(C) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 12(A) is a plan view of the hanger box, FIG. 12(B) is a front view of the hanger box, and FIG. 12(C) is a bottom view of the hanger box.

FIGS. 13(A) and 13(B) are views showing the locking lug of the hanging type vibration isolator, wherein FIG. 13(A) is a plan view of the locking lug, and FIG. 13(B) is a side view of the locking lug.

FIG. 14 is a perspective view showing a mounting state of a hanging type vibration isolator according to a fourth example.

FIG. 15 is a perspective view showing a relationship between a hanger box, an upper hanging bolt, and a locking lug of the hanging type vibration isolator before the vibration isolator is mounted.

FIGS. 16(A) to 16(D) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 16(A) is a plan view of the hanger box, FIG. 16(B) is a front view of the hanger box, FIG. 16(C) is a bottom view of the hanger box, and FIG. 16(D) is a side view of a main part of the hanger box.

FIGS. 17(A) and 17(B) are views showing the locking lug of the hanging type vibration isolator, wherein FIG. 17(A) is a plan view of the locking lug, and FIG. 17(B) is a side view of the locking lug.

FIG. 18 is a perspective view showing a mounting state of a hanging type vibration isolator according to a fifth example.

FIG. 19 is a perspective view showing a relationship between a hanger box and an upper hanging bolt of the hanging type vibration isolator before the vibration isolator is mounted.

FIGS. 20(A) to 20(D) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 20(A) is a plan view of the hanger box, FIG. 20(B) is a front view of the hanger box, FIG. 20(C) is a bottom view of the hanger box and FIG. 20(D) is a side view of the hanger box.

FIG. 21 is a perspective view showing a mounting state of a hanging type vibration isolator according to a sixth example.

FIG. 22 is a perspective view showing a relationship between a hanger box and an upper hanging bolt of the hanging type vibration isolator before the vibration isolator is mounted.

FIGS. 23(A) to 23(C) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 23(A) is a plan view of the hanger box, FIG. 23(B) is a front view of the hanger box, and FIG. 23(C) is a bottom view of the hanger box.

FIGS. 24(A) to 24(C) are views showing a hanger box according to a seventh example, wherein FIG. 24(A) is a plan view of the hanger box, FIG. 24(B) is a bottom view of the hanger box, and FIG. 24(C) is a cross-sectional view of the hanger box

taken along a line A-A' in FIG. 24(B).

FIG. 25 is a perspective view showing a hanging type vibration isolator according to an eighth example, and is also a view for describing a process from before to after the mounting of the hanging type vibration isolator.

FIGS. 26(A) to 26(D) are views showing the hanger box of the hanging type vibration isolator, wherein FIG. 26(A) is a plan view of the hanger box, FIG. 26(B) is a front view of the hanger box, FIG. 26(C) is a bottom view of the hanger box and FIG. 26(D) is a side view of the hanger box.

FIGS. 27(A) to 27(C) are views showing a U-shaped engaging frame body of the hanging type vibration isolator, wherein FIG. 27(A) is a plan view of the U-shaped engaging frame body, FIG. 27(B) is a front view of the U-shaped engaging frame body, and FIG. 27(C) is a side view of the U-shaped engaging frame body.

FIG. 28 is a perspective view of a hanging type vibration isolator according to a first example of a second embodiment of the present invention showing a mounting state of the hanging type vibration isolator.

FIGS. 29(A) to 29(C) are views showing a hanger frame of the hanging type vibration isolator, wherein FIG. 29(A) is a plan view of the hanger frame, FIG. 29(B) is a front view of the hanger frame, and FIG. 29(C) is a bottom view of the hanger frame.

FIG. 30 is a perspective view showing a mounting state of a hanging type vibration isolator according to a second example.

FIGS. 31(A) to 31(E) are views showing a hanger frame of the hanging type vibration isolator, wherein FIG. 31(A) is a plan view of the hanger frame, FIG. 31(B) is a front view of the hanger frame, FIG. 31(C) is a bottom view of the hanger frame, FIG. 31(D) is a side view of the hanger frame, and FIG. 31(E) is a cross-sectional view of the hanger frame taken along a line A-A' in FIG. 31(D).

Description of Embodiments

[0030]

Hereinafter, embodiments of a hanging type vibration isolator according to the present invention are described with reference to drawings.

[0031]

<First embodiment>

(First example)

In FIG. 1, numeral 1 indicates a vibration isolating hanger exemplified as one embodiment of a hanging type vibration isolator. The vibration isolating hanger 1 is mounted in an interposed manner on a middle portion of a hanging bolt, that is, between an upper hanging bolt B1 and a lower hanging bolt B2. The vibration isolating hanger 1 elastically supports an air conditioner, pipes of the air conditioner or the like not shown in the drawing by way of a vibration isolating member described later. With such a configuration, the vibration isolating hanger 1 has a function of absorbing mainly a vertical vibration component out of vibrations generated from the air

conditioner or the like thus preventing propagation of the vertical vibration component to a concrete slab (not shown in the drawing). In general, as the hanging bolt, a fully-threaded bolt having a nominal diameter of 10 is used and hence, in the drawing, fully-threaded bolts each having a nominal diameter of 10 are illustrated as the upper hanging bolt B1 and the lower hanging bolt B2 respectively. It is needless to say, however, that bolts having other specifications such as a 3/8 inch bolt or a 1/2 inch bolt are also available.

[0032]

The vibration isolating hanger 1 is mainly formed of a hanger box 2 which is a vibration isolator body which elastically supports an air conditioner or the like, and an elastic rubber member 3 which is a vibration isolating member mounted on the hanger box 2 for absorbing vibrations of the air conditioner or the like.

[0033]

As also shown in FIG. 2 and FIGS. 3(A) to 3(C), the hanger box 2 is formed of a frame body which has an upper side portion 21, a lower side portion 22, and a pair of left and right side portions 23, 24. The hanger box 2 is formed by bending a rolled steel material for general structural use (SS400) into a hollow rectangular shape (a box shape with a front surface and a back surface thereof opened). The hanger box 2 is configured as described above so that, while supporting a load of an air conditioner or the like, the hanger box 2 can elastically support the air conditioner or the like by dividing

(terminating) the hanging bolt into the upper hanging bolt B1 and the lower hanging bolt B2 in a spaced-apart manner and by interposing an elastic rubber member 3 which forms the above-mentioned vibration isolating member between the upper hanging bolt B1 and the lower hanging bolt B2. Further, the frame body is formed into an elongated and miniaturized shape as a whole and hence, the vibration isolating hanger 1 can be installed even in a narrow space.

[0034]

In the upper side portion 21 of the hanger box 2, an engaging groove 25 having an approximately U-shape as viewed in a plan view and having a predetermined width (in the drawing, width $W = 25$ mm) which is fittable on a shaft portion of the upper hanging bolt B1 (a fully-threaded bolt having a nominal diameter of 10 or a hexagonal push bolt having a nominal diameter of 10) from a horizontal direction in a state where the shaft portion is inserted into the engaging groove 25 is formed by notching. In the lower side portion 22, a circular hole 26 having a predetermined diameter (in the drawing, diameter $\phi = 19$ mm) in which the lower hanging bolt B2 can be loosely fitted is formed. The engaging groove 25 is formed in a state where a notched opening of the engaging groove 25 is directed toward one box opening side of the hanger box 2.

[0035]

The elastic rubber member 3 is fixed to hanger box 2 in such a manner that an upper end portion of the lower hanging bolt B2 which is made to pass through the circular hole 26 formed

in the lower side portion 22 of the hanger box 2 is made to pass through a center axis hole formed in the elastic rubber member 3, and the elastic rubber member 3 is fastened and fixed to the lower side portion 22 of the hanger box 2 from above by double nuts 27, 28 with a washer interposed between the double nuts 27, 28 and the elastic rubber member 3.

[0036]

FIGS. 4(A), 4(B) and FIGS. 5(A), 5(B) respectively show locking lugs 32, 33 each having a square plate shape in which an approximately U-shaped engaging grooves 30, 31 substantially equal to the engaging groove 25 formed in the upper side portion 21 of the hanger box 2 is formed by notching, and is fittable on the shaft portion of the upper hanging bolt B1 from a horizontal direction in a state where the shaft portion is inserted into the square-plate type engaging grooves 30, 31. The locking lugs 32, 33 are configured such that L-shaped or U-shaped locking portions 34, 35 which are lockable with an edge portion of the upper side portion 21 of the hanger box 2 are formed on both distal edge portions of the locking lugs 32, 33 on a notched opening side of the engaging grooves 30, 31. That is, FIGS. 4(A), 4(B) show an example of the L-shaped locking portion 34. When the engaging groove 30 of the locking lug 32 is fitted on the shaft portion of the upper hanging bolt B1 in a state where the shaft portion is inserted into the engaging groove 30 and, thereafter, the locking lug 32 is moved backward, the locking portion is brought into contact and engaged with an opening-side edge portion of the upper side portion 21 of

the hanger box 2. FIGS. 5(A), 5(B) show an example of the U-shaped locking portion 35. When the engaging groove 31 of the locking lug 33 is fitted on the shaft portion of the upper hanging bolt B1 in a state where the shaft portion is inserted into the engaging groove 31 and, thereafter, the locking lug 33 is moved backward, the locking portion is engaged with the hanger box 2 such that the locking portion sandwiches an opening-side edge portion of the upper side portion 21 of the hanger box 2. Further, either one of the locking lug 32 having the locking portion 34 or the locking lug 33 having the locking portion 35 is fitted on the shaft portion of the upper hanging bolt B1 which is inserted into the engaging groove 30, 31, the locking lug and the upper side portion 21 of the hanger box 2 are sandwiched, fastened and fixed to each other from above and below by the double nuts 37, 38 which are threadedly mounted on the shaft portion of the upper hanging bolt B1 in a state where the locking portions 34, 35 are engaged with the opening-side edge portion of the upper side portion 21 of the hanger box 2.

[0037]

In the above-mentioned description, the case where the locking portion 34 of the locking lug 32 is formed into an L-shape and the case where the locking portion 35 of the locking lug 33 is formed into a U-shape are exemplified. However, it is needless to say that the locking portions 34, 35 may have other shapes. Further, in the above-mentioned description, the case is exemplified where the hanger box 2 is formed using a rolled

steel material for general structural use (SS400). However, a material for forming the hanger box 2 is not limited to such a steel material. A material for forming the hanger box 2 is not particularly limited provided that the material for forming the hanger box 2 has an allowable tensile strength to an extent that a load applied to one hanging bolt (for example, when an air conditioner is supported by four-points suspension structure, one fourth of a weight of the air conditioner) can be supported.

[0038]

<Steps of mounting vibration isolating hanger>

Next, steps of mounting the vibration isolating hanger is described with reference to FIG. 2 and FIG. 1.

Firstly, as shown in FIG. 2, the upper hexagonal nut 37 and the lower hexagonal nut 38 are mounted on a lower end portion of the upper hanging bolt B1 suspended from a concrete slab which forms a structural framework not shown in the drawing with a predetermined distance therebetween. By setting such a distance larger than at least the sum of a thickness of the upper side portion 21 of the hanger box 2 and a thickness of the locking lugs 32, 33, the upper side portion 21 and the locking lugs 32, 33 can be sandwiched between both nuts 37, 38.

[0039]

Next, an instruction worker lifts up vibrating equipment such as an air conditioner, and fits the engaging groove 25 formed in the upper side portion 21 of the hanger box 2 which is mounted in advance on the vibrating equipment by way of the

lower hanging bolt B2 on the shaft portion of the upper hanging bolt B1 between the nuts 37 and 38 from a horizontal direction such that the shaft portion is inserted into the engaging groove 25. When the upper side portion 21 of the hanger box 2 is placed on and engaged with the lower hexagonal nut 38, falling of the equipment is prevented thereafter. Then, the engaging groove 30 of any one of the locking lugs 32 and 33, for example, as shown in FIG. 2, the engaging groove 30 of the locking lug 32 is fitted on the shaft portion of the bolt B1 inserted into the engaging groove 25 between the nut 38 and the upper side portion 21 of the hanger box 2 from a horizontal direction in the same manner. After the fitting of the locking lug 32, the locking lug 32 is slightly retracted so that the locking portion 34 is engaged with an opening-side edge portion of the upper side portion 21 of the hanger box 2. Then, in such an engagement state, the upper hexagonal nut 37 is moved downward along the shaft by threadedly rotating the upper hexagonal nut 37 so that the upper side portion 21 of the hanger box 2 and the locking lug 32 are fastened and fixed to each other by the upper hexagonal nut 37 and the lower hexagonal nut 38 whereby the mounting of the vibration isolating hanger 1 is completed.

[0040]

In mounting the vibration isolating hanger, unlike the conventional working, there is no post working of the lower hexagonal nut 38 and hence, it is possible to minimize the need for an installation worker to support vibrating equipment which is a heavy object. In the description, "minimize" means that

an installation worker is necessary only for a lifting time during which the installation worker lifts up the vibrating equipment, and inserts the shaft portion of the upper hanging bolt B1 into the engaging groove 25 of the hanger box 2, and places the hanger box 2 on the lower hexagonal nut 38.

[0041]

In the above-mentioned configuration, the locking lug 33 may be used in place of the locking lug 32. When the locking lug 33 is used, the locking lug 33 engages with the hanger box 2 such that the locking portions 35 sandwich the opening-side edge portion of the upper side portion 21 of the hanger box 2 and hence, the locking lug 33 is minimally removed from the hanger box 2 whereby the locking lug 33 is engaged with the hanger box 2 with more certainty.

[0042]

<Manner of operation and advantageous effects of vibration isolating hanger>

In the vibration isolating hanger 1 described heretofore which is the hanging type vibration isolator according to the embodiment of the present invention, the engaging groove 25 formed in the upper side portion 21 of the hanger box 2 has an approximately U-shape and the engaging groove 25 is formed in a state where the notched opening of the engaging groove 25 is directed toward a box opening side of the hanger box 2. Accordingly, mounting of the hanger box 2 on the shaft portion of the upper hanging bolt B1 can be performed from a horizontal direction so that the mounting operation can be performed

quickly and smoothly. Further, in an installation operation, a time during which an installation worker supports vibrating equipment which is a heavy object can be also shortened and hence, operability. Accordingly, an installation time can be shortened and installation can be simplified and made easier. Further, mounting of the vibration isolator body can prevent falling of the equipment or the like by merely hanging the engaging groove 25 of the hanger box 2 to the lower nut 38 threadedly mounted on the shaft portion of the upper hanging bolt B1 and hence, falling of the equipment can be prevented with certainty and safety is also taken into consideration. Further, the place where the vibration isolator body is mounted is mainly a space in a ceiling and hence, it is necessary to carry and install equipment through a narrow space such as an inspection opening. However, such a drawback can be overcome by the hanging type vibration isolator of this embodiment. Further, although at least two installation workers are necessary for mounting one set of equipment conventionally, the vibration isolator body can be inserted from the horizontal direction, that is, the vibration isolator body can be mounted in a slidable manner and hence, the vibration isolator body can be mounted by one installation worker. In this manner, this embodiment can acquire excellent advantageous effects such as the reduction of cost and the reduction of number of installation workers not to mention securing safety of installation workers.

[0043]

(Second example)

FIG. 6 to FIGS. 9(A), 9(B) show a second example. A hanging type vibration isolator of the second example includes a locking lug 40 having substantially the same configuration as the locking lug 32 of the first example. That is, the locking lug 40 is configured such that an L-shaped locking portion 42 which is lockable with an edge portion of an upper side portion 21a of a hanger box 2a is formed on both distal edge portions of the locking lug 40 on a notched opening side of an approximately U-shaped engaging groove 41. Further, recessed portions 43 in which the locking portions are fittable are formed by notching on the edge portion of the upper side portion 21a of the hanger box 2a with which the locking portions 42 of the locking lug 40 are engaged. In a state where the locking lug 40 is mounted on the hanger box 2a, the locking portions 42 are fitted in the recessed portions 43. Other configurations of the second example are substantially equal to the corresponding configurations of the first example. Further, the second example is substantially equal to the first example also with respect to the steps of mounting, the manner of operation and the advantageous effects. According to this example, the locking portions 42 of the locking lug 40 are accommodated in the recessed portions 43 without projecting from the opening-side edge portion of the upper side portion 21a of the hanger box 2a and hence, an engagement state at the time of engagement of the locking lug 40 becomes stable.

[0044]

(Third example)

FIG. 10 to FIGS. 13(A), 13(B) show a third example. A hanging type vibration isolator of the third example includes another type of locking lug 45. That is, the locking lug 45 is configured such that elongated grooves 47 are formed by notching along both sides of an engaging groove 46, and the elongated grooves are slidably engaged with rivets (projections) 48 or the like formed on an upper side portion 21b of a hanger box 2b. Further, the engaging groove 46 is fitted on a shaft portion of an upper hanging bolt B1 which is inserted into an engaging groove 25b formed in the upper side portion 21 of the hanger box 2 in a state where the shaft portion of the upper hanging bolt B1 can be inserted into the engaging groove 46 formed in the locking lug 45. Other configurations, steps of mounting, the manner of operation and the advantageous effects of the third example are substantially equal to the corresponding configurations, steps of mounting, the manner of operation, and the advantageous effects of the first example. According to the third example, it is possible to hold the locking lug 45 such that the locking lug 45 is always attached to the upper side portion 21b of the hanger box 2b.

[0045]

(Fourth example)

FIG. 14 to FIGS. 17(A), 17(B) show a fourth example. In the fourth example, a hook-shaped locking lug 49 is pivotally supported on one side of an engaging groove 25c formed in a hanger box 2c in a rotatable (openable and closeable) manner by a rivet

50 or the like. An engaging groove 48 which is engageable with a shaft portion of an upper hanging bolt B1 which is inserted into the engaging groove from the outside is formed in the locking lug 49 by notching. In this example, the engaging groove 48 has a circular arc shape. A projection 51 which forms a nut receiver is formed by cutting and raising on an upper side portion 21c of the hanger box 2c at a position close to a bottom of the engaging groove 25c with a height substantially equal to a height of the rivet 50 or the like. In FIGS. 16(A) to 16(C), symbol 52a indicates an engaging hole formed in the upper side portion 21c of the hanger box 2c on the other side of the engaging groove 25c, and an engaging projecting portion 52b (FIG. 17(B)) formed on the locking lug 49 is engaged with the hole by fitting so that the engagement of the locking lug 49 and the hanger box 2c is not released. The engaging hole 52a and the engaging projecting portion 52b form a mechanism of preventing releasing of the engagement of the locking lug 49. In mounting the vibration isolator body, when the engaging groove 48 of the locking lug 49 is engaged with the shaft portion of the upper hanging bolt B1 which is inserted into the engaging groove 25c from the outside, the engaging projecting portion 52b is fitted in the engaging hole 52a so that the engagement between both members is not released. The mechanism having such a release preventing function shown in the drawing is merely one example, and it is needless to say that other mechanisms which can acquire substantially the same advantageous effect is available. Other configurations, steps of mounting, the manner of

operation and the advantageous effects of the fourth example are substantially equal to the corresponding configurations, steps of mounting, the manner of operation and the advantageous effects of the first example. Accordingly, also in this example, in the same manner as the locking lug 45 of the third example, it is possible to hold the locking lug 49 such that the locking lug 49 is always attached to the upper side portion 21c of the hanger box 2c.

[0046]

(Fifth example)

FIG. 18 to FIGS. 20(A) to 20(C) show a fifth example. In the fifth example, a locking lug substantially equal to the locking lugs used in the examples 1 to 4 is not used. That is, cutout portions 53 are formed on an edge portion on a notched opening side of an engaging groove 25d formed in an upper side portion 21d of a hanger box 2d by notching, and locking portions 54 which are formed by cutting and raising downward from portions where the cutout portions 53 are formed and form nut receiving portions are formed on the edge portion. The locking portions 54 are formed in a downwardly extending manner at an approximately right angle at positions adjacently to the cutout portions 53 of the engaging groove 25d formed in the upper side portion 21d of the hanger box 2d. Further, in this example, in the steps of mounting, the engaging groove 25d formed in the upper side portion 21d of the hanger box 2d is fitted on a shaft portion of the bolt B1 between the nuts 37, 38 in a state where the shaft portion is inserted into the engaging groove 25d, and

the lower nut 38 threadedly mounted on the shaft is brought into contact with the locking portion 54. Then, by threadedly rotating the upper nut 37, the upper side portion 21d of the hanger box 2d and the nuts 37, 38 are fixed to each other by fastening. Other configurations, steps of mounting, the manner of operation and the advantageous effects of the fifth example are substantially equal to the corresponding configurations, steps of mounting, the manner of operation and the advantageous effects of the first example. Accordingly, the nuts 37, 38 can be mounted in a stable state. In such a case, the locking lugs used in the respective examples are unnecessary.

[0047]

(Sixth example)

FIG. 21 to FIGS. 23(A) to 23(C) show a sixth example. In the sixth example, an engaging groove 56 formed in an upper side portion 21e of a hanger box 2e has a circular hole portion 57 having a slightly larger diameter on a deep side thereof. When the engaging groove 56 is fitted on a shaft portion of an upper hanging bolt B1 in a state where the shaft portion is inserted into the engaging groove 56, a stepped locking washer 58 shown in the drawing through which the shaft portion between nuts 37, 38 is made to pass in advance is mounted on the upper side portion 21e of the hanger box 2e such that the stepped locking washer 58 is fitted in the circular hole portion 57. With such a configuration, the upper side portion 21e of the hanger box 2e and the stepped locking washer 58 are fixed to each other by

fastening from above and below by the nuts 37, 38. Other configurations, steps of mounting, the manner of operation and the advantageous effects of the sixth example are substantially equal to the corresponding configurations, steps of mounting, the manner of operation and the advantageous effects of the first example. Accordingly, the vibration isolator body can be mounted on the shaft portion of the upper hanging bolt B1 in a state where the removal of the shaft portion is prevented by the locking washer 58.

[0048]

(Seventh example)

FIGS. 24(A) to 24(C) show a seventh example. In the seventh example, on a back surface of an upper side portion 21f of a hanger box 2f, projections 60 which embrace a lower nut 38 in a state where the projections 60 sandwich an engaging groove 25f and prevents the rotation of the lower nut 38 are formed by cutting and raising. With such a configuration, when the engaging groove 25f of the hanger box 2f is fitted on a shaft portion of an upper hanging bolt B1 in a state where the shaft portion is inserted into the engaging groove 25f, surfaces of the hexagonal lower nut 38 mounted on the shaft portion which opposedly face the projections 60 are brought into contact with the projections 60. Accordingly, the lower nut is brought into a non-rotatable state by the projections 60 and hence, it is unnecessary to hold the lower nut 38 using a tool. Accordingly, a subsequent fastening operation of the upper nut 37 by threading engagement or the like can be also performed without

any difficulty thus enhancing operability. A distance between the projections 60 is arbitrarily adjusted corresponding to a size of the lower nut 38. Also in this case, the vibration isolator body can be mounted without particularly requiring a member such as the locking lugs shown in the respective examples. Other configurations, steps of mounting, the manner of operation and the advantageous effects of the seventh example are substantially equal to the corresponding configurations, steps of mounting, the manner of operation and the advantageous effects of the first example. The projections 60 may be also formed in the examples 1 to 6. Due to the provision of the projections 60, it is unnecessary to hold the lower nut 38 using a tool and hence, operability can be enhanced also in these examples.

[0049]

(Eighth example)

FIG. 25 to FIGS. 27(A) to 27(C) show an eighth example. In the eighth example, a U-shaped engaging frame body 62 is mounted on upper portions of both side portions 23g, 24g of a hanger box 2g in a state where proximal ends of the engaging frame body 62 are pivotally supported so as to make the engaging frame body 62 swingable to positions above and on lateral sides of the upper side portion 21g as indicated by an arrow A and the engaging frame body 62 slidable upward and downward on both side portions 23g, 24g. The engaging frame body 62 is formed of both side portions 63, and a connecting portion 64 which connects the both side portions 63 to each other. Rivets 65

or the like are formed on lower end portions of both side portions 63, and the rivets 65 or the like are respectively engaged with elongated holes 66 formed in both side portions 23g, 24g of the hanger box 2g. At the time of mounting the vibration isolator body, the rivets 65 are engaged with lower ends of the elongated holes 66 respectively so that the engaging frame body 62 is brought into an erected state and, thereafter, the rivets 65 are engaged with upper ends of the elongated holes 66 so that the connecting portion 64 can be brought into contact with an upper surface of the upper side portion 21g. An approximately U-shaped engaging groove 67 substantially equal to an engaging groove 25g is formed by notching in the connecting portion 64 at a position corresponding to the engaging groove 25g. Further, in a state where the engaging groove 67 of the engaging frame body 62 and the engaging groove 25g of the upper side portion 21g of the hanger box 2g are fitted on a shaft portion of an upper hanging bolt B1 so that the shaft portion is inserted into the engaging groove 67 and the engaging groove 25g, the connecting portion 64 of the engaging frame body 62 and the upper side portion 21g of the hanger box 2g are sandwiched, fastened and fixed to each other from above and below by a lower nut 38 and an upper nut 37. In FIGS. 26(A) to 26(D), symbol 68a indicates engaging holes formed in the upper side portion 21g of the hanger box 2g on the other side of the engaging groove 25g. Engaging projecting portions 68b (FIG. 27(B)) formed on the connecting portion 64 of the engaging frame body 62 are engaged with the engaging holes by fitting so that the

engagement of the engaging frame body 62 and the hanger box 2g is not released. The engaging holes 68a and the engaging projecting portions 68b form a mechanism of preventing releasing of the engagement of the engaging frame body 62. In mounting the vibration isolator body, when the engaging groove 67 of the engaging frame body 62 is engaged with the shaft portion of the upper hanging bolt B1 from the outside, the engaging projecting portions 68b are fitted in the engaging holes 68a so that the engagement between both members is not released. The mechanism having the release preventing function shown in the drawing is merely one example in the same manner as the above-mentioned example, and it is needless to say that other mechanisms which can acquire substantially the same advantageous effect are available. Other configurations, steps of mounting, the manner of operation and the advantageous effects of the eighth example are substantially equal to the corresponding configurations, steps of mounting, the manner of operation and the advantageous effects of the first example. Accordingly, in the case of this example, the vibration isolator body can be mounted by performing a simple operation such as swinging and sliding of the engaging frame body 62.

[0050]

<Second embodiment>

(First example)

The second embodiment differs from the first embodiment in the basic configuration with respect the following points. In the second embodiment, a member which corresponds to the

hanger box in the first embodiment is not formed into a box shape or a quadrangular ring shape as viewed in a front view unlike the first embodiment. That is, the member which corresponds to the hanger box in the first embodiment is formed of a frame body (hanger frame) 72 which is formed by bending a plate into a U-shape having an upper side portion 81, a lower side portion 82, and either one of left and right side portions 83. FIG. 28 to FIGS. 29(A) to 29(C) show a first example of the second embodiment. In the first example, an approximately U-shaped engaging groove 85 having a predetermined width (in the drawing, $W = 25 \text{ mm}$) which is fittable on a shaft portion of an upper hanging bolt B1 from a horizontal direction in a state where the shaft portion is inserted into the engaging groove 85 is formed in the upper side portion 81 of a hanger frame 72 by notching. Unlike the engaging groove 25 and the like of the first embodiment, the engaging groove 85 is formed by notching such that a notched opening of the engaging groove 85 is directed not toward a box opening side but toward a side where the hanger box has no side portion (a side opposite to a side edge portion). Locking portions 86 which are bent downward are formed on an edge portion of the upper side portion 81 of the hanger frame 72 disposed on an opening side of the engaging groove 85. A circular hole 83 having a predetermined diameter (in the drawing, diameter $\phi = 15.5 \text{ mm}$) which allows the loose fitting of the lower hanging bolt B2 therein is formed in a lower side portion 82 of the hanger frame 72 substantially in the same manner as the respective examples of the first embodiment.

[0051]

In mounting the hanger frame 72, an installation worker lifts up vibrating equipment such as an air conditioner and fits the engaging groove 85 formed in the upper side portion 81 of the hanger frame 72 which is mounted on the vibrating equipment in advance by way of a lower hanging bolt B2 on the shaft portion of the bolt B1 between the nuts 37, 38 from a horizontal direction in a state where the shaft portion is inserted into the engaging groove 85. Then, when the upper side portion 81 of the hanger frame 72 is placed on and engaged with the lower hexagonal nut 38, the locking portion 86 performs a function of preventing the removal of the nut 38 so that falling of the equipment is prevented thereafter. Then, in such an engagement state, the upper hexagonal nut 37 is moved downward along the shaft by threadedly rotating the upper hexagonal nut 37 so that the upper side portion 81 of the hanger frame 72 is fastened and fixed by the upper hexagonal nut 37 and the lower hexagonal nut 38 whereby the mounting of the vibration isolating hanger is completed.

[0052]

(Second embodiment)

FIG. 30 and FIGS. 31(A) to 31(D) show a second example. In the second example, a plurality of ribs 88 are formed along a longitudinal direction of a side portion 83a of a hanger frame 72a. In the example, as shown in the drawing, the ribs 88 are formed on both sides in a width direction of the side portion 83a. However, it is not always necessary to adopt such a

configuration. Provided that the hanger frame 72a has a plurality of ribs 88, the number of ribs 88 may be arbitrarily set. Further, the hanger frame 72a may have only one rib 88. By forming the ribs 88 on the hanger frame 72a, the side portion 83a of the hanger frame 72a can acquire a high strength. Other configurations including the configuration where locking portions 86a which are bent downward are formed on an edge portion of an upper side portion 81a of the hanger frame 72a disposed on an opening side of the engaging groove 85a and steps of mounting the hanger frame 72a are substantially equal to the corresponding configurations and steps of mounting the hanger frame of the first example. Also the first and second examples of this embodiment may include the configuration described in the seventh example of the first embodiment shown in FIGS. 24(A) to 24(C). That is, projections which prevent the rotation of the lower nut 38 are formed by cutting and raising so as to sandwich the engaging grooves 85, 85a on a back surface of the upper side portions 81, 81a of the hanger frames 72, 72a. With such a configuration, the second embodiment can expect the manner of operation and an advantageous effect substantially equal to the manner of operation and the advantageous effect acquired by the seventh example of the first embodiment.

[0053]

As has been described heretofore, the description has been made by taking an air conditioner as an example of the vibrating equipment in the first and second embodiments of the present invention. However, the vibrating equipment may be a

pipe or the like.

[0054]

Shapes, structures and the like of respective constitutional members shown in the drawings as the constitutional elements of the hanging type vibration isolator according to the first and second embodiments of the present invention merely show one preferred example, and it is needless to say that various design modifications are conceivable without departing from the scope of claims. Particularly, although the concrete slab placed on the deck plate in the building having the steel framed structure (S structure) is exemplified as the structural framework, the structural framework is not limited to such a concrete slab. Provided that the structural framework can support vibrating equipment, the present invention is applicable to any structural framework such as a floor concrete slab in a building having reinforced concrete structure (RC structure), a beam of a steel frame in a construction having S structure, a rafter and a diagonal member of a roof or the like.

Reference Signs List

[0055]

- 1 vibration isolating hanger (hanging type vibration isolator)
- 2 hanger box (vibration isolator body)
- 3 elastic rubber member (vibration isolating member)
- 21 upper side portion

22 lower side portion
23, 24 side portion
25 engaging groove (first engaging groove)
26 circular hole
30, 31 engaging groove (second engaging groove)
32, 33 locking lug
34, 35 locking portion
37 upper hexagonal nut
38 lower hexagonal nut
72 hanger frame (engaging frame body)
81 upper side portion
82 lower side portion
83 side portion
85 engaging groove
86 locking portion
88 rib
B1 upper hanging bolt (hanging bolt)
B2 lower hanging bolt (hanging bolt)

CLAIMS

1. A hanging type vibration isolator including a vibration isolator body which is formed of a U-shaped frame body having an upper side portion, a lower side portion and either one of a left side portion or a right side portion, is mounted in an interposed manner on a middle portion of a hanging bolt suspended from a structural framework such as a ceiling slab in order to suspend a vibrating equipment which generates vibrations, and which supports a load of the vibrating equipment, wherein

the vibration isolator body has an engaging groove which is formed in the upper side portion by notching and is fittable on a shaft portion of the hanging bolt from a horizontal direction in a state where the shaft portion is inserted into the engaging groove, and

in a state where the shaft portion of the hanging bolt is inserted into the engaging groove, the upper side portion of the vibration isolator body is sandwiched, fastened and fixed by a pair of nuts threadedly mounted on the shaft portion of the hanging bolt from above and below.