

DESCRIPTION

Title of Invention: TRAINING SYSTEM AND TRAINING PROGRAM

Technical Field

[0001] The present invention relates to a training art that
5 enables training upon moving of training equipment for sealing work,
etc., to any training site.

Background Art

[0002] For a piping coupling or a connection of a piping to
a facility, such as a pump, etc., sealing work of sandwiching a
10 gasket in a flange joint included in the piping and tightening bolts
disposed at a plurality of locations of the flange joint is performed.
Such a bolt-fastened flange joint is a fastened body fastened by
many bolts and therefore sealing in such a fastened body requires
that certain levels of accuracy and uniformity of tightening loads
15 are secured (Non Patent Literature 1).

Even if control of bolt tightening is implemented by use of
a torque wrench, various conditions, such as variation of friction
coefficient, elastic coefficient of the gasket, environmental
aspects, etc., are added and there are thus differences from
20 tightening in a mechanical structure (Non Patent Literature 1).
The sealing work thus requires high skills and training base materials
for flange tightening are provided.

In regard to training base materials, it is known to fasten
bolts, inserted in bolt insertion holes of a flange, in accordance
25 with a predetermined order by a tightening tool, such as a torque
wrench, etc., detect the tightening force with a load cell installed
at a pressure detection portion, and make a trainee check the detection
result (Patent Literature 1).

Citation List

30 Patent Literature

[0003] Patent Literature 1: Japanese Unexamined Patent
Application Publication No. 2009-191932

Non Patent Literature

[0004] Non Patent Literature 1: Takahito Nishida, "Gendai

Gasuketto Gairon" ("New Gaskets and Gasketing Technology"), NIPPON VALQUA INDUSTRIES, May 10, 2015, pp. 145-176

Summary of Invention

Technical Problem

5 [0005] Now, a piping coupling or a connection of a piping to a facility, such as a pump, etc., is installed inside a factory, such as a plant, etc., and therefore sealing work must be performed at that site. For an engineer involved in sealing work, there is a way to acquire the necessary skills by receiving on-the-job training and work education by an external educational institution. However, 10 such education alone is not necessarily sufficient.

Although in general, sealing work must be learned through both classroom learning and practical training, there is a limit to practical training using equipment in operation onsite and it cannot 15 be denied that the group training at a training center also has restrictions in terms of time and distance.

Sealing work incorporates a wide variety of practical training, such as flange tightening training, torque sensation training, sealing performance training, compression failure training, 20 flange/bolt/washer effect observation training, piping rack training, etc. There is also an issue that there are different facilities according to each site an engineer is in charge of and the engineer involved in the facilities is required to have skills required for the functions of the facilities.

25 [0006] An object of the present invention is thus to lighten restrictions in terms of time and distance and achieve speedup of practical training appropriate for a site of sealing work, etc., in view of the above issues.

Solution to Problem

30 [0007] To achieve the above object, one aspect of a training system according to the present invention is a training system movable to a training site for enabling training, the training system including at least one training equipment unit; and a base unit including an installation portion for installing the training

equipment unit, the training equipment unit being attachable to and detachable from the installation portion, at least one extension base units being couplable to a peripheral edge portion. During training, at least the training equipment unit is attachable to and detachable from the base unit installed at the training site.

[0008] In the training system, the training equipment unit may include at least any of a flange tightening equipment unit, a torque sensation equipment unit, a sealing performance training equipment unit, a compression failure training equipment unit, a flange/bolt/washer effect observation training equipment unit, and a piping rack training equipment unit.

In the training system, the base unit or the extension base unit may, together with a frame and a bridging member bridgingly intersecting the frame, constitute a floor surface.

In the training system, a fitting portion fitting together the base unit and the extension base unit, or a fitting portion fitting together the extension base unit and another coupling base unit may be included, or a fitting portion fitting together the base unit and the extension base unit, or at least one coupling member coupling the extension base unit and another coupling base unit may be included.

In the training system, the training equipment unit may include a plurality of base stand portions and the base unit may include a plurality of the installation portions that support the respective base stand portions.

In the training system, the extension base unit or another coupling base unit may be coupled to the base unit based on a training area assumed on dimensions of the training site, the number of trainees, or the number of the training equipment units installed and used for the training.

[0009] To achieve the above object, one aspect of a training system according to the present invention includes an input unit for inputting at least a training item or site information; an information processing unit that generates equipment unit selection

information selecting at least one training equipment unit from among a plurality of the training equipment units in accordance with the training item, generates base unit selection information on a base unit necessary for installing the training equipment unit or, where necessary, an extension base unit coupled to the base unit, and generates assembly information of which an assembly includes the training equipment unit and the base unit or, where necessary, assembly information of which an assembly includes the extension base unit; and an information presenting unit presenting any of the equipment unit selection information, the base unit selection information, or the assembly information.

[0010] To achieve the above object, one aspect of a training program according to the present invention is a training program executed by a computer to causing the computer to implement functions including an input function for at least a training item or site information; a function of generating, in accordance with the training item, equipment unit selection information on at least one training equipment unit, generating, in accordance with the site information, base unit selection information on a base unit or, where necessary, an extension base unit, and generating assembly information of which an assembly includes the training equipment unit and the base unit or, where necessary, assembly information of which an assembly includes the extension base unit; and a function of presenting any of the equipment unit selection information, the base unit selection information, or the assembly information.

Advantageous Effects of Invention

[0011] By the training system of the present invention according to Claim 1 to Claim 6, the following effects are obtained.

(1) The training equipment units can be delivered from a fixed facility of a specific training center, etc., to the training site of a user and assembled at the site and work training and work practice suited to the user can be performed and therefore convenience of work training is improved.

(2) For the work training, the necessary training can be

performed as long as an installation area for the training equipment unit and the base unit is available and the training area can be extended by coupling the extension base unit to the base unit.

5 (3) At the training site, a concrete or asphalt pavement is not required as long as a flat surface can be secured and an ideal and firm training area can be realized with just the base unit or with the base unit and the extension base unit.

(4) The training equipment unit can be adjusted to be of a size and scale corresponding to a user facility that is an object
10 of sealing work, enabling construction of a highly convenient training system.

[0012] By the training system of the present invention according to Claim 7, a training system that is in accordance with the training item and the training site can be constructed and a training system
15 that enables performing of sealing work required by the user and is efficient can be realized.

[0013] By the training program of the present invention according to Claim 8, together with the training equipment unit, the base unit, and the extension base unit, unit information and
20 assembly information that are in accordance with the training item and the training site can be obtained from information expressing the respective units to enable selection and design of training content to be realized freely and efficiently and enable training content and training information necessary to the user to be provided
25 accurately and promptly.

Brief Description of Drawings

[0014] FIG. 1 is an exploded perspective view showing a training system according to an embodiment.

FIG. 2 is a diagram showing a flange tightening training system
30 according to Example 1.

FIG. 3 is an exploded perspective view showing a training head of a training equipment unit.

FIG. 4A is a sectional view showing the training head covered with a protective cover and FIG. 4B is a plan view showing a connector

plate piece.

FIG. 5A is a perspective view showing a base unit and FIG. 5B is a perspective view showing an extension base unit.

FIG. 6A is a perspective view showing a state before fitting
5 together of fitting portions of the base unit and the extension base units and FIG. 6B is a perspective view showing a fitted state of the fitting portions.

FIG. 7A is a perspective view showing the base unit, the extension base unit, and a first coupler and FIG. 7B is a diagram
10 showing a coupling state of the first coupler.

FIG. 8A is a perspective view showing the base unit, the extension base unit, and a second coupler and FIG. 7B is a diagram showing the second coupler and its coupling state.

FIG. 9 is an exploded perspective view showing a torque
15 sensation training system according to Example 2.

FIG. 10 is an exploded perspective view showing a sealing performance training system according to Example 3.

FIG. 11 is an exploded perspective view showing a compression failure training system according to Example 4.

20 FIG. 12 is an exploded perspective view showing a flange/bolt/washer effect training system according to Example 5.

FIG. 13 is an exploded perspective view showing a piping rack training system according to Example 6.

FIG. 14 is a diagram showing an assembled state of the piping
25 rack training system.

FIG. 15 is a diagram showing a flange tightening training system according to Example 7.

FIG. 16A is a diagram showing a training computer system according to Example 8 and FIG. 16B is a diagram showing hardware
30 of the training system.

FIG. 17 is a diagram showing a database of training information.

FIG. 18A is a diagram showing a display screen of a monitor of the training system before assembly, FIG. 18B is a diagram showing a training information table, and FIG. 18C is a diagram showing

the display screen of the monitor of the training system after assembly.

FIG. 19 is a flowchart showing a processing procedure of the training system.

5 FIG. 20 is a perspective view showing a training system according to Example 9.

Description of Embodiments

[0015] FIG. 1 shows a training system according to an embodiment. The arrangement shown in FIG. 1 is just one example and the present
10 invention is not restricted to this arrangement.

 The training system (hereinafter referred to simply as the "training system") includes a training equipment unit 4, a base unit 6, and extension base units 8. The training equipment unit 4, the base unit 6, and the extension base units 8 can be transported
15 by separate, independent packages, etc.

 The training equipment unit 4 may be any of a flange tightening training equipment unit, a torque sensation training equipment unit, a sealing performance training equipment unit, a compression failure training equipment unit, a flange/bolt/washer effect training
20 equipment unit, a piping rack training equipment unit, or another training equipment unit or two or more units selected from the above may be included. The training equipment unit 4 includes a training head 10 and a base stand portion 12. The training head 10 is furnished with a functional portion for training a trainee in a training item,
25 such as sealing work, etc. The base stand portion 12 is a supporting member that supports the training head 10 and is detachably installed on the base unit 6.

[0016] The base unit 6 includes an installation portion 14 for installing the training equipment unit 4 and the training equipment
30 unit 4 is attachable to and detachable from the installation portion 14. One or two or more of the extension base units 8 are couplable to a peripheral edge portion of the base unit 6. A plurality of base units 6 may be coupled instead.

[0017] Each extension base unit 8 is couplable to the peripheral

edge portion of the base unit 6 and, upon being coupled, practically extends the base unit 6 and can expand a training area. A plurality of the extension base units 8 may be coupled and may be coupled between the plurality of extension base units 8 coupled to the base unit 6 to fortify the coupling of the base unit 6 and the extension base units 8.

[0018] <Effects of the Embodiment>

The following effects are obtained by the embodiment.

(1) The training equipment unit 4, which is a work equipment for sealing work, etc., can be delivered from a fixed facility of a specific training center, etc., to a training site, set up arbitrarily in a user's area for the sealing work, and assembled at the site. Thereby, work training and work practice suited to the user can be performed and convenience of work training can be improved.

(2) For the work training, training necessary for improving work skills can be performed as long as an installation area for the training equipment unit 4 and the base unit 6 can be secured, and by coupling the extension base units 8 to the base unit 6, the training area can be extended to a training area assumed on presence of an explainer and a plurality of observers in addition to the trainee and an instructor. Also, the training area may be set in assumption of the number of training equipment units 4 installed and used for the training.

[0019] (3) At the training site, a concrete or asphalt pavement is not required as long as a flat surface can be secured and an ideal and firm training area can be realized with just the base unit 6 or with the base unit 6 and the extension base units 8.

(4) After the training, disassembly into the training equipment unit 4 and the base unit 6 or separation of the extension base units 8 from the base unit 6 can be performed to enable takeout from the training site with the required units of packages.

(5) The training equipment unit 4 can be made to be of a size and scale corresponding to a user facility that is an object of

sealing work, enabling construction of a highly convenient training system.

Example 1

[0020] FIG. 2 shows a flange tightening training system according to Example 1 of the training system. In FIG. 2, portions that are the same as those of FIG. 1 are provided with the same coincidences.

The flange tightening training system 2-1 (hereinafter referred to simply as the "training system 2-1") includes a flange tightening equipment unit (hereinafter referred to simply as the "equipment unit") 4-1, the base unit 6, and the extension base units 8. The equipment unit 4-1 is an example of the training equipment unit 4 and enables flange tightening defined in JIS B2251 to be performed. That is, flange joint tightening training for sufficient exhibition of a function of a gasket can be performed.

[0021] A flange tightening training head (hereinafter referred to as the "training head") 10-1 is included as an example of the training head 10 and the training head 10-1 includes an attachable/detachable protective cover 16. With the base stand portion 12, the training head 10-1 is included at a top portion and a pedestal 18 is included at a bottom portion. The pedestal 18 is supported on the base stand portion 12 by a plurality of support column portions 20 mounted radially to the base stand portion 12. The pedestal 18 is fixed by a plurality of fixing bolts 21 to the installation portion 14 that is fixed to the base unit 6 side. The equipment unit 4-1 and the base unit 6 are thereby integrated.

For example, four extension base units 8 are couplable to the base unit 6 to extend a base surface of the base unit 6 to the surroundings.

[0022] <Flange Tightening Training Head 10-1>

As shown in FIG. 3, the training head 10-1 includes flange portions 22-1 and 22-2. Whereas the flange portion 22-1 is a disk that is attachable and detachable, the flange portion 22-2 is fixed to the top portion of the circular cylindrical base stand portion

12 and is integrated with the base stand portion 12. Circular annular projections 24 are included at opposing surface portions of the flange portions 22-1 and 22-2, and a circular annular gasket 26 is installed and sandwiched between the circular annular projections 24. A plurality of penetrating holes 28 are formed concentrically to the circular annular projection 24 in each of the flange portions 22-1 and 22-2, bolts 30 are made to penetrate through the respective penetrating holes 28, and tightening nuts 32 are mounted to an upper surface and nuts 34 are mounted to a lower surface side of the flange portions 22-1 and 22-2. The bolts 30, the tightening nuts 32, and the nuts 34 constitute an example of a means of tightening the flange portions 22-1 and 22-2. By tightening the tightening nuts 32 installed on the bolts 30, the gasket 26 is fastened between the flange portions 22-1 and 22-2. The nuts 34, together with the tightening nuts 32, sandwich and fasten the flange portions 22-1 and 22-2 via the bolts 30. The nuts 34 may be those including a co-rotation preventing structure that prevents rotation together with the bolts 30 in the process of tightening the tightening nuts 32 or otherwise may be those including a locking structure, and for example, HARDLOCK (registered trademark) nuts, etc., may be used. Such a tightening structure is the same as that used in sealing work for an actual facility.

[0023] Connector plates 36 are mounted to an intermediate portion of the base stand portion 12. A plurality of relay connectors 38, installed radially on each connector plate 36, are used for relay connection of measurement equipment leads for axial force sensors, etc., installed on the bolts 30. A plurality of through holes 40 are included in a peripheral surface of the intermediate portion of the base stand portion 12 and each through hole 40 can be used as a wire passing hole for passing a lead wire, etc., connected to a relay connector 38, through the base stand portion 12. A through hole 40 that is not used is closed using an elastic bush.

[0024] <Protective Cover 16>

As shown in FIG. 4A, the protective cover 16 includes a plurality

of locking pieces 44 on a cylindrical body 42 formed of a metal or a synthetic resin. The cylindrical body 42 has height such that it at least covers a peripheral surface of the flange 22-2 from the connector plates 36 on the base stand portion 12. Upper end portions of the locking pieces 44 are formed to L shapes toward the flange 22-1 side and are therefore locked to the upper surface of the flange 22-1. The protective cover 16 is thereby installed on the training head 10-1 to cover the training head 10-1 and upper surfaces of the connector plates 36 and a protected space 46 is formed between the training head 10-1 and the connector plates 36. The axial sensors installed on the bolts 30 and other measurement equipment and the leads thereof are disposed in the protected space 46 to enable effects of contact and external disturbance during measurement, etc., to be avoided.

[0025] <Connector Plates 36>

As shown in FIG. 4A, by a plurality of L-shaped supporting pieces 48, each connector plate 36 is fixed to the peripheral surface of the base stand portion 12 by fixing screws 50 and its plate surface is maintained horizontally. These connector plates 36 are members that form an annular plate surface at a periphery of the base stand portion 12 and, as shown in FIG. 4B, are constituted of a pair of semicircular fan shaped connector plates 36.

[0026] <Base Unit 6>

As shown in FIG. 5A, the base unit 6 includes a square frame 52 as a frame member surrounding a periphery. For example, band steel is used in the frame 52. To this frame 52, a plurality of flat bars 54 are mounted in parallel as first bridging members of the same height as constituent members of the frame 52 and a plurality of cross bars 56, intersecting the respective flat bars 54, are mounted in parallel as second bridging members. That is, the base unit 6 is a lattice member, which has the periphery surrounded by the frame 52 and includes the intersecting pluralities of flat bars 54 and cross bars 56, and a flat floor surface is formed by upper edge portions of the frame 52, the flat bars 54, and the cross bars

56 that are intersecting members.

The installation portion 14, of the same shape as the pedestal 18 of the equipment unit 4-1, is mounted to a center of the base unit 6. As with the pedestal 18, the installation portion 14 may
5 be formed, for example, of a steel plate. A plurality of bolt mounting holes 60, for fixing the pedestal 18, are formed in the installation portion 14. The respective bolt mounting holes 60 are matched with bolt mounting positions of the pedestal 18.

At each side surface portion of the frame 52, a plurality of
10 fitting projections 62-1 are projected outward as fitting portions used for coupling to an extension base unit 8.

[0027] <Extension Base Units 8>

As shown in FIG. 5B, with each extension base unit 8, a flat floor surface is formed by the upper edge portions of the frame
15 52, the flat bars 54, and the cross bars 56 with the shape and structure being the same as the base unit 6 to which the installation portion 14 is not mounted.

At each side surface portion of the extension base unit 8, a plurality of fitting hole portions 62-2 are formed as fitting
20 portions used for coupling to the base unit 6.

[0028] <Coupling of the Base Unit 6 and the Extension Base Units 8>

As shown in FIG. 6A, the extension base units 8 that are to be coupled to the base unit 6 are placed temporarily to perform
25 position setting of the fitting projections 62-1 of the base unit 6 and the fitting hole portions 62-2 of the extension base units 8.

The extension base units 8 can be coupled to the base unit 6 by inserting the fitting projections 62-1 of the base unit 6 into
30 the fitting hole portions 62-2 of the extension base units 8 as shown in FIG. 6B. The base unit 6 is thereby extended to a flat floor surface of the same height by the coupling of the extension base units 8.

[0029] The base unit 6 and the extension base units 8 are coupled

at a plurality of locations by a plurality of different coupling members and are coupled by a first coupler 64-1 (FIG. 7) and a second coupler 64-2 (FIG. 8).

As shown in FIG. 7A, the coupler 64-1, corresponding to an interval portion of the cross bars 56, is used. The coupler 64-1 includes a supporting portion 66, to be disposed across two adjacent frames 52, and two pairs of gripping pieces 68 and 70 that are maintained parallel by the supporting portion 66. By mounting the two pairs of gripping pieces 68 and 70, which are maintained parallel by the supporting portion 66, onto the two frames 52, the base unit 6 and an extension base unit 8 can be coupled as shown in FIG. 7B.

[0030] As shown in FIG. 8A, the coupler 64-2, corresponding to an interval portion of the flat bars 54, is used. The coupler 64-2 includes a U-shaped gripping portion 72, to be disposed across two adjacent frames 52. By mounting the gripping portion 72 onto the two frames 52, the base unit 6 and an extension base unit 8 can be coupled as shown in FIG. 8B.

[0031] <Effects of Example 1>

(1) By Example, 1, the training system 2-1 is arranged from each unit of the equipment unit 4-1, the base unit 6, or the extension base unit 8 and can therefore be transferred and assembled, according to the units, to and at the training site based on a request for sealing work training and can be disassembled into and taken away in the units after the training. Therefore, not only can the training facilities be made compact and lightweight but the sealing work training can also be performed using an establishment with good access, etc., such as a customer's conference room, a training center, etc.

(2) The equipment unit 4-1 can be made to correspond to a customer's facility to enable performing of training on a wide range of gaskets as subjects while enabling downsizing, shared use, etc., of an existing facility and the highly convenient training system 2-1 can be constructed.

(3) The training site is not fixed and therefore a customer

receiving the training can do so with little movement and trouble and the training can be performed in correspondence to the customer's facility.

[0032] (4) The extension base units 8 can be coupled to the base unit 6 as necessary or just the base unit 6 can be used in accordance with wideness or narrowness of the training area. In addition, the training area can be adjusted by coupling a single or plurality of the extension base units 8 to the base unit 6, and further, restrictions of installation location are removed such that even narrow installation locations can be accommodated, etc.

(5) The training system 2-1 excels in ease of assembly and ease of disassembly according to units and excels in portability in that it can be packaged compactly in specialized boxes to enable efficient and highly safe transport.

(6) The base unit 6 and the extension base units 8 are coupled using the fitting structures between the frames 52 and the couplers 64-1 and 64-2 and are therefore high in coupling strength, enabling construction of a stable floor space and enabling highly safe and reliable work training.

Example 2

[0033] FIG. 9 shows a torque sensation training system according to Example 2. In FIG. 9, portions that are the same as those of FIG. 1 and FIG. 2 are provided with the same coincidences.

The torque sensation training system 2-2 (hereinafter referred to simply as the "training system 2-2") includes a torque sensation equipment unit (hereinafter referred to simply as the "equipment unit") 4-2, the base unit 6, and the extension base units 8. The equipment unit 4-2 is an example of the training equipment unit 4 and enables training on bodily sensation of precision of tightening using a hand wrench for torque control.

A torque sensation training head (hereinafter referred to as the "training head") 10-2 is included as an example of the training head 10, and a line checker or other equipment that measures a torque value achieved by tightening by a hand wrench or other tightening

tool may be used in the training head 10-2.

Respective members, such as the base unit 6, the extension base units 8, the base stand portion 12, the pedestal 18, etc., are the same as those of Example 1 and description thereof shall thus be omitted.

[0034] <Effects of Example 2>

By Example 2, in addition to providing the same effects as a training system as Example 1, torque sensation training can be realized as the training system.

10 Example 3

[0035] FIG. 10 is a diagram showing a sealing performance training system according to Example 3. In FIG. 10, portions that are the same as those of FIG. 1 and FIG. 2 are provided with the same coincidences.

15 The sealing performance training system 2-3 (hereinafter referred to simply as the "training system 2-3") includes a sealing performance training equipment unit (hereinafter referred to simply as the "equipment unit") 4-3, the base unit 6, and the extension base units 8. The equipment unit 4-3 is an example of the training equipment unit 4 and enables training on control of differences in sealing performance of various types of gaskets, flange surface flaws, etc.

20 Two sealing performance training heads (hereinafter referred to as the "training heads") 10-31 and 10-32 are included as an example of the training head 10. The training heads 10-31 and 10-32 include flange portions 22-31 and 22-32, respectively, and include the bolts 30, the tightening nuts 32, and the nuts 34. Training can be performed individually by the training heads 10-31 and 10-32.

30 Respective members, such as the base unit 6, the extension base units 8, the base stand portion 12, the pedestal 18, etc., are the same as those of Example 1 and description thereof shall thus be omitted.

[0036] <Effects of Example 3>

By Example 3, in addition to providing the same effects as

a training system as Example 1, sealing performance training can be realized with the training system.

Example 4

[0037] FIG. 11 is a diagram showing a compression failure training system according to Example 4. In FIG. 11, portions that are the same as those of FIG. 1 and FIG. 2 are provided with the same coincidences.

The compression failure training system 2-4 (hereinafter referred to simply as the "training system 2-4") includes a compression failure training equipment unit (hereinafter referred to simply as the "equipment unit") 4-4, the base unit 6, and the extension base units 8. The equipment unit 4-4 is an example of the training equipment unit 4 and enables training on compression failure of gaskets, including training on differences in compression failure characteristics of various types of gaskets, difference in compression failure characteristics due to presence/non-presence of paste, etc.

[0038] Two compression failure training heads (hereinafter referred to as the "training heads") 10-41 and 10-42 are included as an example of the training head 10 and these are provided across an interval on the base stand portion 12. The training heads 10-41 and 10-42 include flange portions 22-41 and 22-42, respectively, and include the bolts 30, the tightening nuts 32, and the nuts 34. Training can be performed individually by the training heads 10-41 and 10-42.

Respective members, such as the base unit 6, the extension base units 8, the base stand portion 12, the pedestal 18, etc., are the same as those of Example 1 and description thereof shall thus be omitted.

[0039] <Effects of Example 4>

By Example 4, in addition to providing the same effects as a training system as Example 1, compression failure training can be realized with the training system.

Example 5

[0040] FIG. 12 shows a flange/bolt/washer effect training system according to Example 5. In FIG. 12, portions that are the same as those of FIG. 1 and FIG. 2 are provided with the same coincidences.

The flange/bolt/washer effect training system 2-5 (hereinafter referred to simply as the "training system 2-5") includes a flange/bolt/washer effect training equipment unit (hereinafter referred to simply as the "equipment unit") 4-5, the base unit 6, and the extension base units 8. By the equipment unit 4-5 as an example of the training equipment unit 4, training on effects of bolt servicing states on gasket surface pressure according to differences in material quality, etc., can be performed.

[0041] Two flange/bolt/washer effect training heads (hereinafter referred to as the "training heads") 10-51 and 10-52 are included as an example of the training head 10 and these are provided across an interval on the base stand portion 12. The training heads 10-51 and 10-52 include flange portions 22-51 and 22-52, respectively, and include the bolts 30, the tightening nuts 32, and the nuts 34. Training can be performed individually by the training heads 10-51 and 10-52.

Respective members, such as the base unit 6, the extension base units 8, the base stand portion 12, the pedestal 18, etc., are the same as those of Example 1 and description thereof shall thus be omitted.

[0042] <Effects of Example 5>

By Example 5, in addition to providing the same effects as a training system as Example 1, training on flange/bolt/washer effects can be realized with the training system.

Example 6

[0043] FIG. 13 and FIG. 14 show a piping rack training system according to Example 6, with FIG. 13 showing respective parts before assembly and FIG. 14 showing an assembled mode. In FIG. 13 and FIG. 14, portions that are the same as those of FIG. 1 and FIG. 2 are provided with the same coincidences.

The piping rack training system 2-6 (hereinafter referred to

simply as the "training system 2-6") includes a piping rack training equipment unit (hereinafter referred to simply as the "equipment unit") 4-6, a base unit 6W, and a plurality of the extension base units 8. The equipment unit 4-6 is an example of the training equipment unit 4 and upon being assembled as shown in FIG. 14, difficult circumstances, for example, such as a narrow space, etc., that can be assumed for mounting work in onsite flange work can be assumed as a training item and training on how tightening forces are affected under such circumstances can be performed.

10 [0044] <Equipment Unit 4-6>

The equipment 4-6 includes a first equipment unit portion 4-61, a second equipment unit portion 4-62, and piping units 74-1 and 74-2. The equipment unit portion 4-61 includes a training head 10-61 and a base stand portion 12-1 and the equipment unit portion 4-62 includes a training head 10-62 and a base stand portion 12-2. A piping portion 76-1 is fixed by a plurality of U-bolts 78 to the training head 10-61, and a flange 80-1 is included at an end surface portion at one side of the piping portion 76-1. Similarly, a piping portion 76-2 is fixed by a plurality of U-bolts 78 to the training head 10-62, and a flange 80-2, opposing the flange 80-1, is included at an end surface portion at one side of the piping portion 76-2.

Each of the piping units 74-1 and 74-2 is supported in a U-shape using support pipings 82 and are fixed by the support pipings 82 being inserted in socket portions 84 fixed to the base unit 6W. The respective piping units 74-1 and 74-2 are disposed such as to sandwich the training heads 10-61 and 10-62. A working space for the training heads 10-61 and 10-62 is made narrow by the configuration of the respective pipings 74-1 and 74-2, providing a mode simulating a pipeline in an actual facility.

30 [0045] <Base Unit 6W>

The base unit 6W has a rectangular shape, with which the base units 6 described above are coupled, and has twice the length of the base unit 6. Installation portions 14-1 and 14-2, disposed at portions corresponding to the base unit 6 described above, are mounted

to the base unit 6W. The pedestal 18 of the base stand portion 12-1 of the equipment unit portion 4-61 is detachably fixed by the bolts 21 to the installation portion 14-1, and the pedestal 18 of the base stand portion 12-2 of the equipment unit portion 4-62 is detachably fixed by the bolts 21 to the installation portion 14-2.

Extension base units 8, of the same shape as the base unit 6, are coupled to the base unit 6W, and two serially-coupled extension base units 8 are coupled to a long side portion of the base unit 6W.

Respective members, such as the base stand portion 12, the pedestal 18, etc., are the same as those of Example 1 and description thereof shall thus be omitted.

[0046] <Effects of Example 6>

(1) By Example 6, a floor surface required for training is enlarged by the base unit 6W, having the base unit 6 as a unit and having a length of two of the base units 6, and coupling or removal of the two equipment unit portions 4-61 and 4-62 is enabled.

(2) Due to the length of the base unit 6W being twice the length of the base unit 6 as a unit, a floor area of the base unit 6W can be enlarged by coupling two extension base units 8 in a width direction of the base unit 6W and the floor area can be enlarged by coupling an extension base unit 8 in a width direction of the base unit 6W.

[0047] (3) A unit width of the base unit 6W thus has the width of the base unit 6 as a unit and therefore, as with Examples 1 to 5, a plurality of base units 6 and extension base units 8 can be coupled for enlargement to a desired floor area and to accommodate the scale of the training site.

(4) With Example 6, the piping units 74-1 and 74-2 are disposed in parallel to the piping portions 76-1 and 76-2 to forcibly realize a narrow space and therefore coupling and tightening of the flanges 80-1 and 80-2 of the piping portions 76-1 and 76-2 must be performed, enabling the same work training as that in the actual facility to be performed and enabling improvement of work skills.

Example 7

[0048] FIG. 15 show a flange tightening training system 2-7 according to Example 7 of the training system. In FIG. 15, portions that are the same as those of FIG. 1 and FIG. 2 are provided with the same coincidences. The training system 2-7 includes an equipment unit 4-7 and a base unit 6X. As with Example 1, the flange tightening equipment unit 4-7 enables flange tightening defined in JIS B2251 to be performed. That is, flange joint tightening training for sufficient exhibition of a function of a gasket can be performed.

[0049] <Equipment Unit 4-7>

10 The equipment unit 4-7 includes the training head 10-1 and the base stand portion 12-2. The base stand portion 12-2 is divided into a head side base stand portion 12-21, an intermediate base stand portion 12-22, and a base side base stand portion 12-23 that can be coupled. The head side base stand portion 12-21, the
15 intermediate base stand portion 12-22, and the base side base stand portion 12-23 are cylindrical bodies of the same diameter and at a lower end side of each is included an attachment portion 86. That is, the attachment portion 86 of the head side base stand portion 12-21 can be inserted in and fixed to the intermediate base stand
20 portion 12-22 or the base side base stand portion 12-23, and the attachment portion 86 of the intermediate base stand portion 12-22 can be inserted in and fixed to the base side base stand portion 12-23.

[0050] <Base Unit 6X>

25 In place of the installation portion 14, a socket portion 87 is installed as an example of a fitting portion in the base unit 6X, and the attachment portions 86 of the head side base stand portion 12-21, the intermediate base stand portion 12-22, and the base side base stand portion 12-23 can be fitted and fixed to the socket portion
30 87. Other arrangements of the base unit 6X are the same as those of the base unit 6 described above and description thereof shall thus be omitted.

[0051] <Effects of Example 7>

(1) By Example 7, a height of the equipment unit 4-7 can be

adjusted by the base stand portion 12-2. The training head 10-1 can be selectively adjusted to a minimum height by directly coupling the head side base stand portion 12-21 to the socket portion 82 of the base unit 6X, the training head 10-1 can be selectively adjusted to an intermediate height using the base side base stand portion 12-23 as a relay part, and the training head 10-1 can be selectively adjusted to a maximum height by using the intermediate base stand portion 12-22 and the base side base stand portion 12-23 in combination as relay parts.

(2) Training on sealing work at a desired height can be performed efficiently.

(3) With the equipment unit 4-7, transfer can be performed upon separation into the training head 10-1, the head side base stand portion 12-21, the intermediate base stand portion 12-22, and the base side base stand portion 12-23 and the unit of transfer can be made small.

Example 8

[0052] FIGS. 16A and 16B show a training computer system of Example 8 of the training system. The arrangement shown in FIG. 16 is an example and the present invention is not restricted to this arrangement.

The training computer system 2-8 (hereinafter referred to simply as the "training system 2-8") is an example of the training system according to Claim 6, and the training system 2-8 includes a processing unit 88, a monitor 90, and a keyboard 92, and a display screen 94 of the monitor 90 includes a touch panel 96, which is an operation input unit as is the keyboard 92.

[0053] The processing unit 88 is a computer that handles information processing of the training system and, as shown in FIG. 16B, includes a processor 98, a storage 100, an input/output unit (I/O) 102, and a communication unit 104. The processor 98 executes an OS (operating system), a training program, etc., in the storage 100 to perform calculation processing, generation of image information, etc. The storage 100 includes a ROM (read-only memory),

EEPROM (electrically erasable programmable read-only memory), RAM (random-access memory), etc., and may be arranged with a hard disk device or a semiconductor storage. The storage 100 stores various programs, such as the OS, the training program, etc., and stores
 5 a database (DB) 106 of training information used in executing the training program.

[0054] The I/O 102 is used to receive information input from the keyboard 92 and the touch panel 96 and perform input/output of information, such as information output to the monitor 90. The
 10 communication unit 104 performs transmission and reception of the information through a network with various types of computers and information terminals used in the training system. Besides a public line, near field communication, etc., may be included for the transmission and reception of information.

15 The monitor 90 is an example of an information presenting means and may include a printer or a monitor unit of another information terminal.

The keyboard 92 is an example of an information operation input unit, and the information operation input unit may include the
 20 abovementioned touch panel 96 or a touch panel unit of another information terminal and may also include a barcode input device, etc.

[0055] <DB 106>

FIG. 17 shows an example of a training information table stored
 25 in the DB 106. Training Item 108-1, Equipment Unit 108-2, and Parts 108-3 are set in the information table 108. Category 108-11 and Training Level 108-12 are stored under Training Item 108-1. Item information, such as "Tightening method," "Stress relaxation," "Sealing performance," "Compression failure," "Surface pressure
 30 distribution," "Piping misalignment," "Onsite flange work," etc., are stored under Category 108-11, and a skill level, such as "Basic training" and "Applied training" are stored under Training Level 108-12.

[0056] Unit information on equipment used in training, such

as "Flange tightening equipment unit (equipment unit 4-1)," "Torque sensation equipment unit (equipment unit 4-2)," "Sealing performance equipment unit (equipment unit 4-3)," "Compression failure training equipment unit (equipment unit 4-4)," "Flange/bolt/washer effect observation training equipment unit (equipment unit 4-5)," "Piping rack training equipment unit (equipment unit 4-6)," "Other training equipment unit," etc., are stored under Equipment Unit 108-2.

[0057] Equipment Unit Parts 108-31, Base Unit 108-32, Extension Base Unit 108-33, and Coupling Member 108-34 are set under Parts 108-3. "Flange," "Plate," "Hexagonal nut," "Hexagonal washer," "Head pipe," etc., are stored under Equipment Unit Parts 108-31. "Plate," "Parallel unit," "Hexagonal nut," etc., are stored under Base Unit 108-32. "End plate," "Main bar," "Cross bar," etc., are stored under Extension Base Unit 108-33. "Coupler," etc., are stored under Coupling Member 108-34.

The information are selectable according to training item information, site information on a training site, etc., that are input.

[0058] <Display Content of the Display Screen 94 of the Monitor 90>

FIG. 18A shows a screen display of the training system 2-1 before assembly.

The training system is unfolded in the display screen 94 of the monitor 90 and when, for example, an item expressing flange tightening training as a training item is input by the keyboard 92 or the touch panel 96 and site information for the training is input, an image display 201 of the equipment unit 4-1, the base unit 6, and the plurality of extension base units 8, which are required for the training system 2-1, a training information table 202, and a training area 203 are displayed on the monitor 90 as shown in FIG. 18A.

The selected training item and equipment unit are displayed in the training information table 202 as shown in FIG. 18B.

[0059] When transition from the display of FIG. 18A to an

assembled display is performed, an image display 204 of the equipment unit 4-1, the base unit 6, and the plurality of extension base units 8 in the state of being assembled as the training system 2-1 to be used for training, the training information table 202, and the training area 203 are displayed on the monitor 90 as shown in FIG. 18C.

[0060] <Processing Procedure>

FIG. 19 shows a processing procedure of the information processing of the training system. The processing procedure is an example of a training program of the present invention and indicates functions according to function units realized at the processing unit 88 by the training program executed by the computer. The functions include an information inputting function (S101), a selection information generating function (S102), an assembly information generating function (S103), and a selection information and assembly information presenting function (S104).

[0061] When, after the training system 2-8, which is a computer system, is started up, the training item or the site information is input (S101), equipment unit selection information and base unit selection information are generated (S102), and assembly information of the training system is generated (S103). Based thereon, the equipment unit selection information, the base unit selection information, or the assembly information is presented on the display screen 94 of the monitor 90 (S104). The information presentation is as shown in FIG. 18.

[0062] <Effects of Example 8>

(1) By Example 8, a training system that is in accordance with a training item or a training site can be constructed to enable a user to perform the required sealing work and enable realization of an efficient training system.

(2) Together with the training equipment unit, the base unit, and the extension base unit, unit information and assembly information that are in accordance with the training item and the training site can be obtained from information expressing the

respective units to enable selection and design of training content to be realized freely and efficiently, etc., and enable training content and training information necessary to the user to be provided accurately and promptly.

5 Example 9

[0063] FIG. 20 shows a training system 2-9 of Example 9 of the training system. The training system 2-9 is a multi-training system constructed, for example, through the information processing described above. The training system 2-9 includes the equipment
10 unit 4-1 (flange tightening equipment unit), the equipment unit 4-2 (torque sensation equipment unit), the equipment unit 4-3 (sealing performance training equipment unit), the equipment unit 4-4 (compression failure training equipment unit), the equipment unit 4-5 (flange/bolt/washer effect observation training equipment
15 unit), and the equipment unit 4-6 (piping rack training equipment unit).

With the training system 2-9, a plurality of the base units 6 are coupled with a plurality of the extension base units 8 as intermediaries and training on multiple training items can be
20 performed at a training site.

[0064] Although the training system 2-9 encompasses the equipment units described in Examples 1 to 6 described above, a system may be arranged by selecting any of the units and an alignment training unit, used for alignment training which is not clearly
25 indicated in the Examples, may be included.

In combined use with the training system 2-8 described above, the training system 2-9 may include designations and operations concerning selection of a training item, selection of a training item in accordance with the skills of a trainee, order of training
30 items, etc.

[0065] [Other Embodiments]

(1) In each of Examples 1 to 9, a camera may be used in combination to relay and provide training content to a trainee or perform monitoring of the training content at a center side that provides

training facilities. Also, the monitoring of the training content may include processing of, for example, the configuration of the base unit 6 and the extension base units 8 and of whether or not the equipment unit that is in accordance with the set training item is assembled.

(2) Although sealing work is described with the Examples described above, the present invention can be applied to training besides that on sealing work and is not restricted to the Examples described above.

(3) Although with the Examples described above, the case where the fitting projections 62-1 are formed in the frame 52 of the base unit 6 and the fitting hole portions 62-2 are formed in the side surface portions of the extension base units 8 was indicated, the present invention is not restricted thereto. As the fitting portions used for coupling the base unit 6 and the extension base units 8, for example, fitting hole portions may be included at the base unit 6 side and fitting projections may be included at the extension base unit 8 side. Also, side surfaces of the base unit 6 and the extension base units 8 may include both fitting projections and fitting hole portions in respective correspondence according to positions of opposing configuration.

Further, fitting hole portions may be formed in opposing side surfaces of the frame 52 of the base unit 6 and the frame 52 of the extension base units 8 and coupling may be achieved by inserting fitting projecting members, which are separate parts, in the fitting hole portions. By arranging thus, projection of the fitting projections 62-1 from an external peripheral side surface of an assembled training system can be prevented.

Besides the above, a fitting means other than fitting projections and fitting hole portions may be used as fitting portions used to couple the base unit 6 and the extension base units 8.

[0066] As described above, most preferable embodiments, etc., of the present invention were described. The present invention is not restricted to the above description. Various modifications and

changes are possible by a person skilled in the art based on the gist of the invention described in the claims or disclosed in the description of embodiments. Such modifications and changes are obviously included in the scope of the present invention.

5 Industrial Applicability

[0067] With the present invention, the training equipment unit 4, which is a work equipment for sealing work, etc., can be delivered from a fixed facility of a specific training center, etc., to a training site, set up arbitrarily in a user's area for the sealing
 10 work, and assembled at the site to enable work training and work practice suited to the user to be performed, enable convenience of work training to be improved, and enable a useful and efficient training system to be constructed.

Reference Signs List

- 15 [0068] 2: training system
- 2-1: flange tightening training system
 - 2-2: torque sensation training system
 - 2-3: sealing performance training system
 - 2-4: compression failure training system
 - 20 2-5: flange/bolt/washer effect training system
 - 2-6: piping rack training system
 - 2-7: flange tightening training system
 - 2-8: training computer system
 - 2-9: training system
 - 25 4: training equipment unit
 - 4-61, 4-62: equipment unit portion
 - 6, 6W, 6X: base unit
 - 8: extension base unit
 - 10, 10-1, 10-2, 10-31, 10-32, 10-41, 10-42, 10-51, 10-52, 10-61,
 - 30 10-62: training head
 - 12, 12-1, 12-2: base stand portion
 - 12-21: head side base stand portion
 - 12-22: intermediate base stand portion
 - 12-23: base side base stand portion

	14, 14-1, 14-2: installation portion
	16: protective cover
	18: pedestal
	20: support column portion
5	21: fixing bolt
	22-1, 22-2: flange portion
	24: circular annular projection
	26: gasket
	28: penetrating hole
10	30: bolt
	32: tightening nut
	34: nut
	36: connector plate
	38: relay connector
15	40: through hole
	42: cylindrical body
	44: locking piece
	46: protected space
	48: supporting piece
20	50: fixing screw
	52: frame
	54: flat bar
	56: cross bar
	60: bolt mounting hole
25	62-1: fitting projection
	62-2: fitting hole portion
	64-1: first coupler
	64-2: second coupler
	66: supporting portion
30	68, 70: gripping piece
	72: gripping portion
	74-1, 74-2: piping unit
	76-1, 76-2: piping portion
	78: U-bolt

	80-1, 80-2: flange
	82: support piping
	84, 87: socket portion
	86: attachment portion
5	88: processing unit
	90: monitor
	92: keyboard
	94: display screen
	96: touch panel
10	98: processor
	100: storage
	102: input/output unit (I/O)
	104: communication unit
	106: database (DB)
15	108: information table
	108-1: Training Item
	108-2: Equipment Unit
	108-3: Parts
	108-11: Category
20	108-12: Training Level
	108-31: Equipment Unit Parts
	108-32: Base Unit
	108-33: Extension Base Unit
	108-34: Coupling Member
25	201: image display
	202: training information table
	203: training area
	204: image display

CLAIMS

[Claim 1]

A training system movable to a training site for enabling training, the training system comprising:

- 5 at least one training equipment unit; and
 a base unit including an installation portion for installing the training equipment unit, the training equipment unit being attachable to and detachable from the installation portion, at least one extension base unit being couplable to a peripheral edge portion;
10 and

 wherein, during training, at least the training equipment unit is attachable to and detachable from the base unit installed at the training site.

[Claim 2]

- 15 The training system according to Claim 1, wherein the training equipment unit includes at least any of a flange tightening equipment unit, a torque sensation equipment unit, a sealing performance training equipment unit, a compression failure training equipment unit, a flange/bolt/washer effect observation training equipment
20 unit, and a piping rack training equipment unit.

[Claim 3]

- The training system according to Claim 1 or Claim 2, wherein the base unit or the extension base unit, together with a frame and a bridging member bridgingly intersecting the frame, constitutes
25 a floor surface.

[Claim 4]

- The training system according to Claim 1, further comprising:
 a fitting portion fitting together the base unit and the extension base unit, or a fitting portion fitting together the extension base
30 unit and another coupling base unit; or further comprising: a fitting portion fitting together the base unit and the extension base unit, or at least one coupling member coupling the extension base unit and another coupling base unit.

[Claim 5]

The training system according to Claim 1 or Claim 2, wherein the training equipment unit includes a plurality of base stand portions and the base unit includes a plurality of the installation portions that support the respective base stand portions.

5 [Claim 6]

The training system according to any one of Claim 1 to Claim 5, wherein the extension base unit or another coupling base unit is coupled to the base unit based on a training area assumed on dimensions of the training site, the number of trainees, or the number of the training equipment units installed and used for the training.

[Claim 7]

A training system comprising:

an input unit for inputting at least a training item or site information;

an information processing unit that generates equipment unit selection information selecting at least one training equipment unit from among a plurality of the training equipment units in accordance with the training item, generates base unit selection information on a base unit necessary for installing the training equipment unit or, where necessary, an extension base unit coupled to the base unit, and generates assembly information of which an assembly includes the training equipment unit and the base unit or, where necessary, assembly information of which an assembly includes the extension base unit; and

an information presenting unit presenting any of the equipment unit selection information, the base unit selection information, or the assembly information.

[Claim 8]

30 A training program executed by a computer to cause the computer to implement functions comprising:

an input function for at least a training item or site information;

a function of generating, in accordance with the training item,

equipment unit selection information on at least one training
equipment unit, generating, in accordance with the site information,
base unit selection information on a base unit or, where necessary,
an extension base unit, and generating assembly information of which
5 an assembly includes the training equipment unit and the base unit
or, where necessary, assembly information of which an assembly
includes the extension base unit; and

a function of presenting any of the equipment unit selection
information, the base unit selection information, or the assembly
10 information.