

DESCRIPTION

TITLE OF INVENTION

PIPE SUPPORT

5

TECHNICAL FIELD

[0001]

An embodiment of the present invention relates to a pipe support.

BACKGROUND ART

[0002]

One method for transporting fluids is a piping. When fluid flows in a piping, weight and temperature changes cause the piping to move. A pipe support follows such movement while generating a certain reaction force. For example,
15 the pipe support disclosed in Patent Document 1 has a structure in which springs are arranged as elastic members over and under the piping.

CITATION LIST

PATENT LITERATURE

20 [0003]

Japanese Patent Application Publication No. 2011-12778

SUMMARY OF INVENTION

TECHNICAL PROBLEM

25 [0004]

An object of an embodiment of the present invention is to provide a pipe support with a novel structure. Alternatively, an object of an embodiment of the present invention is to provide a pipe support which is durable, easy to maintain,

and lightweight.

SOLUTION TO PROBLEM

[0005]

5 An embodiment of the present invention is a pipe support. The pipe support has a base ring, a spring, a hanger plate, a pair of guide rods, a spring seat, a pair of securing rods, and a turnbuckle. The spring is located over and overlaps the base ring. The hanger plate is located over the spring. The pair of guide rods is fixed to the hanger plate, downwardly extends from the hanger plate, 10 and sandwiches the spring. The spring seat is located between the spring and the hanger plate, is configured to reversibly move up and down along the guide rods, and has an opening overlapping an inside of the spring. The pair of securing rods is arranged so as to pass through the opening, the inside of the spring, and the base ring and fixes the hanger plate to the base ring. A hook is 15 suspended from the spring seat and is surrounded by the spring and the base ring.

BRIEF DESCRIPTION OF DRAWINGS

[0006]

FIG. 1 is a schematic perspective view of a pipe support according to an 20 embodiment of the present invention.

FIG. 2 is a schematic side view of a pipe support according to an embodiment of the present invention.

FIG. 3 is a schematic side view of a pipe support according to an embodiment of the present invention.

25 FIG. 4 is a schematic top view of a pipe support according to an embodiment of the present invention.

FIG. 5A is a schematic side view of a pipe support according to an embodiment of the present invention.

FIG. 5B is a schematic side view of a pipe support according to an embodiment of the present invention.

FIG. 6 is a schematic side view of a pipe support according to an embodiment of the present invention.

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DESCRIPTION OF EMBODIMENTS

[0007]

Hereinafter, each embodiment of the present invention is explained with reference to the drawings. The invention can be implemented in a variety of
10 different modes within its concept and should not be interpreted only within the disclosure of the embodiments exemplified below.

[0008]

The drawings may be illustrated so that the width, thickness, shape, and the like are illustrated more schematically compared with those of the actual
15 modes in order to provide a clearer explanation. However, they are only an example, and do not limit the interpretation of the invention. In the specification and the drawings, the same reference number is provided to an element that is the same as that which appears in preceding drawings, and a detailed explanation may be omitted as appropriate.

20 [0009]

In the specification and drawings, when a plurality of the same or similar structures is collectively represented, the reference number is used, while a hyphen and a natural number follow the reference number when the structures are independently represented. When a plurality of portions of one component is
25 independently represented, the same reference number is used and a letter of the alphabet is further used.

[0010]

In the specification and drawings, a phrase that a plurality of elements is

integrated means that the plurality of elements has functions different from each other but is formed from one member and has a continuous structure. Hence, the plurality of integrated elements includes the same material and has the same composition as each other.

5 [0011]

Hereinafter, a pipe support 100 according to an embodiment of the present invention is explained. The pipe support 100 supports a piping and has a function of following the movement of the piping due to the changes in heat and weight. In the drawings used in the following description, the vertical direction is defined
10 as a z direction and the horizontal plane perpendicular to the z direction is defined as a xy plane for convenience. As described in detail below, the direction connecting center axes of a pair of guide rods 112 and perpendicular to the z direction is defined as a x direction. The y direction is orthogonal to the z direction and the x direction.

15 [0012]

1. Overall Structure

A perspective view of the pipe support 100 is shown in FIG. 1, a side view observed from the y direction is shown in FIG. 2, and a side view observed from the x direction is shown in FIG. 3. The pipe support 100 includes, as fundamental
20 components, a hanger plate 104, a base ring 110, a spring seat 106, a spring 108, a pair of guide rods 112, a pair of securing rods 102, and a turnbuckle 116. These components are formed using a metal such as iron and stainless steel. Hereinafter, these components are described in detail.

[0013]

25 2. Base Ring

The base ring 110 is a ring-shaped part with an opening in the center and supports the spring 108. Hence, the opening is provided so that its diameter is smaller than the outer diameter of the spring 108. Preferably, the opening is

provided so that its diameter is smaller than the inner diameter of the spring 108. As described below, the securing rods 102 prevent the spring 108 from moving in the xy plane, thereby preventing the spring 108 from falling out of the pipe support 100. Therefore, it is not necessary to provide a structure (depressions, projections, ribs, or the like) on the top surface of the base ring 110 to prevent the movement of the spring 108, and the top surface may be flat over the entire base ring 110.

[0014]

3. Hanger Plate and Guide Rod

10 The hanger plate 104 is located over the base ring 110 and serves as a part supporting the pair of guide rods 112. The guide rod 112 is a bolt having a head 112a at the upper end, and its thread portion is provided with a thread which is not illustrated. Openings are provided in the hanger plate 104 through which the thread portions of the guide rods 112 pass but through which the heads 112a
15 do not pass. The guide rods 112 are inserted into these openings and are fixed with the nuts 120, by which the hanger plate 104 and the guide rods 112 are secured to each other with the guide rods 112 extending downward (z direction) from the hanger plate 104. As described above, the direction connecting the center axes of the pair of guide rods 112 extending in the z direction and
20 perpendicular to the z direction is the x direction.

[0015]

4. Spring Seat, Spring, and Turnbuckle

 The spring 108 is arranged over the base ring 110 so that its center axis extends in the z direction and is disposed between the spring seat 106 and the
25 base ring 110 in a compressed state. Although the spring 108 is sandwiched between the base ring 110 and the spring seat 106, it is not welded or bolted.

[0016]

As shown in FIG. 1, a pair of cutoffs each sandwiching the guide rod 112

is provided at both ends of the spring seat 10. Although not illustrated, a pair of openings into which the guide rods 112 can be inserted may be provided in the spring seat 106 instead of the pair of cutoffs. As an optional component, nuts 124 and 126 with holes may be attached to the cutoffs or the openings of the spring seat 106 so as to sandwich the spring seat 106. Washers are inserted between the nut 124 and the spring seat 106 and between the nut 126 and the spring seat 106, as appropriate. The nut 124 and the nut 126 surround the guide rod 112 but slide on the guide rods 112. Thus, the spring seat 106 can reversibly slide in the z direction (*i.e.*, up and down) along the guide rods 112 as the piping moves up and down, *i.e.*, as the turnbuckle 116 moves up and down, without dropping from the guide rods 112. Note that each guide rod 112 is provided with two nuts 128 and 130 which engage the thread and are vertically shifted from each other. The positions of the nuts 128 and 130 are determined by rotating them around the guide rod 112. Therefore, the upper and lower limit positions of the spring seat 106 are determined by adjusting the positions of the nuts 128 and 130.

[0017]

The spring seat 106 is further provided with an opening (or slit, the same is applied hereinafter) through which the pair of securing rods 102 pass. One opening 106a may be provided, or a pair of openings 106a may be provided, where the spring seat 106 is configured so that one securing rod 102 passes through one opening 106a. As can be understood from the schematic top view (FIG. 4) showing the positional relationship in the z direction between the spring seat 106, the openings 106a thereof, the spring 108, and the base ring 110, the openings 106a are provided so as to overlap the inside of the spring 108 and the opening 110a of the base ring 110 in the z direction. A portion of the opening 106a may overlap the spring 108 and the base ring 110 in the z direction. When the pair of securing rods 102 pass through one opening 106a, the opening 106a may be formed so that a longitudinal direction thereof is consistent with the y direction or

is inclined within $\pm 90^\circ$ from the y direction, although not illustrated.

[0018]

As described below, the securing rods 102 prevent the spring 108 from moving in the xy plane, thereby preventing the spring 108 from falling out of the pipe support 100. Therefore, similar to the top surface of the base ring 110, there is no need to provide a structure (depressions, projections, ribs, or the like) on the bottom surface of the spring seat 106 to prevent the movement of the spring 108, and the bottom surface may be flat over the entire spring seat 106.

[0019]

The turnbuckle 116 is arranged so that a longitudinal direction thereof faces in the z direction, and its upper end is secured to the spring seat 106 by welding, a bolt 132, or the like. When the bolt 132 is used, the bolt 132 may be inserted into the opening 106a. The turnbuckle 116 is arranged so as to be surrounded by the spring 108 and the base ring 110 in a state suspended from the spring seat 106. Meanwhile, a pipe clamp 140 is connected at the lower end to connect the piping to the turnbuckle 116. The method of fixing the turnbuckle 116 and the pipe clamp 140 is arbitrary, and the turnbuckle 116 and the pipe clamp 140 may be connected by bolting using an opening 116a provided at the lower end of the turnbuckle 116, for example.

[0020]

5. Securing Rod

The pair of securing rods 102 extends in the z direction and passes through the openings 106a of the spring seat 106. Furthermore, the pair of securing rods 102 is surrounded by the spring 108 and the base ring 110. That is, the pair of securing rods 102 extends inside the spring 108. The pair of securing rods 102 may be arranged so as to overlap in the y direction as shown in FIG. 1 and FIG. 4 or may be arranged so that an angle between a straight line existing in the xy plane and connecting the center axes of the pair of securing rods

102 and the y direction is within $\pm 90^\circ$. The shape of the cross-section of the securing rod 102 in the xy plane may also be arbitrarily determined, may be a rectangle, a circle, or an oval, or may be composed of a curve and a line.

[0021]

5 Furthermore, each of the pair of securing rods 102 bends so that its lower end extends perpendicularly to the z direction as shown in FIG. 1 and FIG. 3. Thus, the portion extending perpendicularly to the z direction is located under the spring 108 and the base ring 110, overlaps the spring 108 and the base ring 110, and serves as a supporting portion 102a for supporting the base ring 110 (see FIG. 4). The supporting portions 102a of the pair of securing rods 102 are preferably configured to extend in opposite directions to each other. The supporting portions 102a contact the base ring 110, but need not be welded or bolted to the base ring 110.

[0022]

15 On the other hand, the upper ends of the securing rods 102 may be connected to each other via a hooking plate 114 overlapping the hanger plate 104. The pair of securing rods 102 may be integrated with the hooking plate 114. In this case, the pair of securing rods 102 and the hooking plate 114 straddle the hanger plate 104. In other words, the portion of the hanger plate 104 which is located over the top surface of the hanger plate 104 can be regarded as the hooking plate 114, and the other portion sandwiching the hanger plate 104 can be regarded as the securing rods 102. The hooking plate 114 and the securing rods 102 may be fixed to the hanger plate 104 by welding or bolting. However, the restoring force of the compressed spring 108 pushes the spring seat 106 upward, resulting in an upward force on the guide rods 112 and the hanger plate 104 through the nuts 128. Therefore, only the frictional force created by this force may be used to secure the hanger plate 104 to the hooking plate 114 and the securing rods 102. The supporting portions 102a and the base ring 110 are also

secured to each other by the frictional force resulting from the restoring force of the spring 108.

[0023]

5 An opening 114a is formed in the hanger plate 104 formed in a direction perpendicular to the z direction, and the pipe support 100 can be suspended at an appropriate position by using the opening 114a. The size and the shape of the opening 114a are not restricted and may be designed appropriately in consideration of the sizes and the weights of the pipe support 100 and the piping to be supported.

10 [0024]

Alternatively, the securing rods 102 may be provided to downwardly extend from a lower surface or a side surface of the hanger plate 104 as shown in FIG. 5A and FIG. 5B. In this case, the securing rods 102 are fixed to the hanger plate 104 by welding or bolting. On the other hand, a suspension ring 134 is provided
15 on the top surface of the hanger plate 104 for suspending the pipe support 100. Similar to the opening 114a, the structure of the suspension ring 134 is not restricted and may be designed appropriately in consideration of the sizes and weights of the pipe support 100 and the piping to be supported.

[0025]

20 As described above, the spring 108 is arranged between the base ring 110 and the spring seat 106 in a compressed state. Therefore, since an upward force is always applied to the spring seat 106 by the restoring force of the spring 108, the spring seat 106 takes the upper limit position determined by the nuts 128 in the initial state. That is, the pipe support 100 takes the state in which the nuts
25 124 and 128 are in contact with each other. Thus, the upward force is also applied to the hanger plate 104 via the guide rods 112. However, as shown in FIG. 1, FIG. 2, FIG. 5A, and FIG. 5B, the supporting portions 102a of the pair of securing rods 102 extending from the hooking plate 114 or the hanger plate 104

are located under the base ring 110. Thus, the hanger plate 104 remains in contact with the hooking plate 114, and the distance between the hanger plate 104 and the base ring 110 is fixed.

[0026]

5 When fluid passes through a piping, the weight and heat of the fluid applies downward displacement to the piping. Following this displacement, the turnbuckle 116 moves downward (see the arrow in FIG. 2), and in turn, the spring seat 106 moves downward along the guide rods 112 to compress the spring 108 (FIG. 6). Since the restoring force generated at this time works in the upward
10 direction, the turnbuckle 116 follows the vertical displacement of the piping. As a result, breakage of the piping and damage to the equipment caused by the vertical displacement of the piping can be effectively prevented.

[0027]

 As described above, the spring 108 is sandwiched between the base ring
15 110 and the spring seat 106, but is not welded or bolted thereto. Therefore, a rotational force is also applied to the spring 108 around its center axis extending in the z direction when the spring 108 is extended or compressed, which may cause movement in the xy plane. Such movement may cause the spring 108 to drop out. In addition, a buckling phenomenon may occur during the expansion
20 and contraction process, depending on the number of turns, pitch, length, and coil diameter d (see FIG. 2), and center diameter of the spring 108. However, the pipe support 100 is provided with the pair of securing rods 102 extending inside the springs 108 in the z direction. Therefore, even if the spring 108 moves in the xy plane, the spring 108 interferes with the securing rods 102, and as a result, the
25 spring 108 can be prevented from falling out or buckling.

[0028]

 The pipe support 100 having the aforementioned structure can effectively prevent the spring 108 from falling out or buckling without the use of a cover or the

like covering the side surface of the spring 108. Therefore, the pipe support 100 can be made lighter, and at the same time, high air permeability can be secured for the spring 108 and the turnbuckle 116 disposed inside the spring 108. As a result, corrosion caused by rainwater or the like can be significantly suppressed, and the durability of the pipe support 100 is improved. In addition, since almost all the portions of the spring 108 and the turnbuckle 116 can be visually observed from the outside, the condition of the spring 108 and the turnbuckle 116 can be easily grasped. Therefore, even if damage occurs in each part such as the spring 108 and the turnbuckle 116, it can be detected at an early stage. These features enable easy maintenance work and contribute to higher efficiency of maintenance work. In addition, the pipe support 100 can be manufactured at low cost because each component can also be connected and fixed just by bolting without welding.

[0029]

The aforementioned modes described as the embodiments of the present invention can be implemented by appropriately combining with each other as long as no contradiction is caused. Furthermore, any mode which is realized by persons ordinarily skilled in the art through the appropriate addition, deletion, or design change of elements or through the addition, deletion, or condition change of a process on the basis of each embodiment is included in the scope of the present invention as long as they possess the concept of the present invention.

[0030]

It is understood that another effect different from that provided by each of the aforementioned embodiments is achieved by the present invention if the effect is obvious from the description in the specification or readily conceived by persons ordinarily skilled in the art.

REFERENCE SIGN LIST

[0031]

100: Pipe support, 102: Securing rod, 102a: Supporting portion, 104: Hanger plate, 106: Spring seat, 106a: Opening, 108: Spring, 110: Base ring, 110a: Opening, 112: Guide rod, 112a: Head, 114: Hooking plate, 114a: Opening, 116: Turnbuckle, 116a: Opening, 120: Nut, 124: Nut, 126: Nut, 128: Nut, 130: Nut, 132: Bolt, 134: Suspension ring, 140: Pipe clamp

CLAIMS

1. A pipe support comprising:
 - a base ring;
 - a spring over and overlapping the base ring;
 - 5 a hanger plate over the spring;
 - a pair of guide rods fixed to the hanger plate, downwardly extending from the hanger plate, and sandwiching the spring;
 - a spring seat located between the spring and the hanger plate, configured to reversibly move up and down along the guide rods, and having an opening
 - 10 overlapping an inside of the spring;
 - a pair of securing rods arranged so as to pass through the opening, the inside of the spring, and the base ring and fixing the hanger plate to the base ring; and
 - a turnbuckle suspended from the spring seat and surrounded by the spring
 - 15 and the base ring.
2. The pipe support according to claim 1,
 - wherein the pair of securing rods is connected to each other via a hooking
 - 20 plate, and
 - the hooking plate is located over and overlaps the hanger plate.
3. The pipe support according to claim 2,
 - wherein the pair of securing rods and the hooking plate are integrated.
 - 25
4. The pipe support according to claim 2,
 - wherein the hooking plate has an opening extending in a direction perpendicular to a center axis of the spring.

5. The pipe support according to claim 1,
wherein the pair of securing rods is connected to a lower surface or a side
surface of the hanger plate.

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6. The pipe support according to claim 5,
wherein the hanger plate has a suspension ring on an upper surface
thereof.

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7. The pipe support according to claim 1,
wherein each of the pair of securing rods has a supporting portion
perpendicularly extending to a center axis of the spring at a lower end, and
wherein the supporting portion overlaps and supports the base ring.

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