

Description

Title of Invention

EXPANSION FLEXIBLE JOINT

Technical Field

[0001]

This invention relates to an expansion flexible joint, and particularly to a technique of connecting a pipe to be connected such a water pipe in an expansion flexible manner, so that even if fluctuations of a burying ground occur due to an earthquake or the like, a load in a bending direction is not applied to a buried piping, thereby preventing the buried pipe or the like from being damaged.

Background Art

[0002]

Conventionally, as this type of joint, there has been known a joint disclosed in Patent Literature 1. As is clear from claim 1 of the scope of claims and description of Fig. 1, in an expansion flexible joint including paired cases connectable to respective opposed end portions of pipe bodies, each of the cases having a partially spherical inner circumferential surface, paired spherical rings that are fitted in the respective cases while holding water-tightness and are slidable while contacting inner surfaces of the cases, pressing rings secured to terminal opening portions of the respective

cases so as to be movable along outer circumference surfaces of the respective spherical rings, and a coupling pipe that is fitted in both the spherical rings while holding water-tightness, and is relatively slidable in a pipe axis direction across a region between stoppers provided in an intermediate portion and in both end portions of an outer circumferential surface of the coupling pipe, locking projected portions on which terminal opening surfaces of the pressing rings and the stopper in the intermediate portion in the coupling pipe can abut are provided in opening end portions opposed to each other in the respective spherical rings.

[0003]

According to the above-described joint, as shown in Fig. 2 of Patent Literature 1, when any one of the pipe bodies connected to the respective cases is displaced vertically, and the coupling pipe fitted in the respective spherical rings swings at a maximum, the terminal opening surface of the pressing ring abuts on the locking projected portion provided in the opening end portion of the spherical ring, which prevents the pressing ring and the coupling pipe from being strongly pressed to make contacts with each other. Accordingly, the flexibility of the coupling pipe is not impaired, so that possibility of damaging the function as an expansible joint, which has conventionally been a problem, can be solved.

Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Patent Application
Laid-Open No. 10-274371

Summary of Invention

[0005]

In the above-described conventional joint, when the coupling pipe is connected, it is necessary that after inserting one of the end portions of the coupling pipe into the spherical ring, a stopper ring is fitted in an annular depressed groove formed in the end portion to be combined and fixed by bolts. However, fixing work of this stopper ring is performed inside the spherical ring, which makes workability poor. Additionally, while liquid contact portions such as the stopper ring, the bolts and the like are subjected to coating treatment after the fixing work, a gap or the like is caused between the stopper ring and the annular depressed groove or between the stopper ring and the bolts, depending on mechanical tolerance, so that there is a possibility that water or the like enters the gap, thereby causing rust. Moreover, since the coupling pipe inserted between the paired spherical rings is a single pipe, and a product length and a flexible amount largely depend on a length of the coupling pipe, there is a limit to correspond to change in the length and the amount, and the correspondence is difficult.

[0006]

This invention solves the problems that the conventional

joint has, and an object thereof is to provide an expansion flexible joint that can eliminate conventional fixing work of a stopper ring poor in workability, and restrain a gap from occurring to thereby eliminate rusting, and enables secure coating treatment and easy correspondence to a product length and a flexible amount.

Solution to Problem

[0007]

In order to solve the above-described problem, according to the invention described in claim 1, an expansion flexible joint includes a coupling pipe having a predetermined length, a turning spherical body that is fitted on one end portion of this coupling pipe so as to be relatively slidable in a pipe axis direction while holding water-tightness and has a partially spherical outer circumferential surface, a case that is turnably fitted on this turning spherical body in sliding contact in an inner circumferential surface forming the same spherical surface as the outer circumferential surface of this turning spherical body while holding water-tightness, a slip-off stopper integrally provided in a one-end outer circumferential surface of the coupling pipe, a male screw having a diameter sufficient to go through the turning spherical body provided in an other-end outer circumferential surface, and a detachable flange with a stopper provided by screwing the male screw into a female screw provided in an inner circumferential surface of the flange.

[0008]

According to the invention described in claim 2, an expansion flexible joint includes a coupling pipe having a predetermined length, paired turning spherical bodies that are fitted on both end portions of this coupling pipe so as to be relatively slidable in a pipe axis direction while holding water-tightness and each have a partially spherical outer circumferential surface, paired cases that are each turnably fitted on this turning spherical body in sliding contact in an inner circumferential surface forming the same spherical surface as the outer circumferential surface of each of these turning spherical bodies while holding water-tightness, a slip-off stopper integrally provided in a one-end outer circumferential surface of the coupling pipe on the side of each of the turning spherical bodies, a male screw having a diameter sufficient to go through each of the turning spherical bodies provided in an other-end outer circumferential surface thereof, and a detachable flange with a stopper provided by screwing the male screw into a female screw provided in an inner circumferential surface of the flange.

[0009]

According to the invention described in claim 3, in claim 1 or 2, in the case, a flange portion is integrally provided in a one-end outer circumferential surface on the opposite side of the turning spherical body, and in the turning spherical body, a short pipe-like sliding portion extending in an axis direction is integrally provided in another end portion on the opposite

side of the case.

[0010]

According to the invention described in claim 4, in claim 3, in the flange with the stopper, bolt holes for attachment are provided at positions where the holes form the same diameter from a pipe central axis as that of bolt holes provided in the flange portion of the case.

[0011]

According to the invention described in claim 5, in any of claims 2 to 4, the coupling pipe is made up of paired single pipes, an opposed end portion of each of these single pipes is formed into a small-diameter pipe portion slightly inwardly depressed, in an end portion of the small-diameter pipe portion, the male screw is provided in the outer circumferential surface having the same diameter as that of a portion other than the small-diameter pipe portion, and the male screw is screwed into the female screw provided in the inner circumferential surface of the flange with the stopper, so that the single pipes are combined and fixed by bolts and nuts inserted into the bolt holes provided in these flanges while holding water-tightness.

[0012]

According to the invention described in claim 6, in claim 5, the flanges are each provided so that the rod-like stopper extends parallel to a pipe axis up to a vicinity of a base end position of the small-diameter pipe portion. According to the invention described in claim 7, in claim 5 or 6, the coupling pipe has an extension pipe between the opposed end portions of

the single pipes, and both end portions of this extension pipe and the opposed end portions of the signal pipes are combined and fixed by bolts and nuts while holding water-tightness.

Advantageous Effects of Invention

[0013]

According to this invention, as described above, the slip-off stopper is integrally provided in the one-end outer circumferential surface of the coupling pipe, the male screw having the diameter sufficient to go through the turning spherical body is provided in the other-end outer circumferential surface, so that the detachable flange with the stopper is provided by screwing the male screw into the female screw provided in the inner circumferential surface of the flange, or the slip-off stopper is integrally provided in the one-end outer circumferential surface of the coupling pipe on the side of each of the turning spherical bodies, and the male screw having the diameter sufficient to go through each of the turning spherical bodies is provided in the other-end outer circumferential surface thereof, so that the detachable flange with the stopper is provided by screwing the male screw into the female screw provided in the inner circumferential surface of the flange, which can eliminate the conventional fixing work of the stopper ring poor in workability, so that the workability is enhanced. In addition, the slip-off stopper is integrally provided, so that the gap does not occur as in the convention joint, thereby eliminating rusting and enabling secure coating

treatment to be applied. Also, there is an excellent effect of enabling easy correspondence to the product length and the flexible amount.

Brief Description of Drawings

[0014]

Fig. 1 is a front view of a broken-out upper half portion, showing an expansion flexible joint in a first embodiment of this invention.

Fig. 2 is an enlarged cross-sectional view showing a connection portion of a divided coupling pipe of the same.

Figs. 3(A) to 3(E) show a flange with stoppers of the same, Fig. 3(A) being a left side view of the same, Fig. 3(B) being a front cross-sectional view of the same, Fig. 3(C) being a right side view of the same, Fig. 3(D) being an enlarged detailed front view of an outer circumferential portion of the same, and Fig. 3(E) being an enlarged detailed right side view of the outer circumferential portion of the same.

Fig. 4 is a front view of a right-half portion of the same.

Fig. 5 is a view for describing actions of expansion flexibility of the same.

Fig. 6 is a front view of a broken-out upper half portion, showing an expansion flexible joint in a second embodiment.

Description of Embodiments

[0015]

Hereinafter, sequentially referring to the drawings,

embodiments of an expansion flexible joint according to this invention will be described.

[0016]

<First Embodiment>

Fig. 1 is a front view of a broken-out upper half portion of the expansion flexible joint, and in this figure, reference numeral 1 denotes a coupling pipe made up of paired single pipes 1a, 1b. Reference numerals 2, 2 denote paired turning spherical bodies that are fitted on both end portions of the coupling pipe 1 slidably in a pipe axis direction, and each have a partially spherical outer circumferential surface, reference numerals 3, 3 denote paired cases each arranged in sliding contact in an inner circumferential surface forming the same spherical surface as the outer circumferential surface of each of these turning spherical bodies 2, 2. Short pipe-like sliding portions 4 extending in an axis direction are integrally provided in other end portions of the turning spherical bodies 2, 2 on the opposite side of the cases 3, 3, and a plurality of O rings 5 are disposed in the pipe axis direction between an inner circumferential surface of each of the sliding portions and an outer circumferential surface of the coupling pipe 1, for example, so as to be fitted in annular grooves formed in the inner circumferential surface of the sliding portion 4. A flange portion 6 is provided in an outward one-end outer circumferential surface of each of the cases 3, 3, and in the flange portion, there are circumferentially bored a plurality of bolt holes 7 to combine and fix, by bolts and nuts, the flange

portion 6 and a connection flange formed in an opposed end portion of a pipe to be connected, such as a water pipe not shown.

[0017]

In an inward other-end inner circumferential surface of each of the cases 3, 3, an annular depression is formed, to which an annular packing 8 is attached and pressed by a pressing ring 10 disposed in contact with the outer circumferential surface of each of the turning spherical bodies 2, 2, and in flange portions of both the members in contact with each other, bolt holes 11, 12 to combine and fix the members by bolts and nuts are bored. The annular packing 8 is made of, for example, natural rubber, synthetic rubber, synthetic resin, other flexible materials or the like so as to hold water-tightness in a state where the outer circumferential surface of each of the turning spherical bodies 2, 2 and the inner circumferential surface of each of the cases 3, 3 are in sliding contact with each other.

[0018]

The coupling pipe 1 has a configuration in which the paired single pipes 1a, 1b are combined and connected in opposed end portions thereof. In a one-end outer circumferential surface of each of these single pipes 1a, 1b on the side of each of the turning spherical bodies 2, 2, an annular stopper 15 is integrally provided. An other-end opposed portion of each of the single pipes 1a, 1b is formed into a small-diameter pipe portion 16 slightly inwardly depressed, and in an outer circumferential surface having the same diameter as that of a

portion other than the small-diameter pipe portion in an end portion of the small-diameter pipe portion, a male screw 17 is formed as shown in detail in Figs. 2, 3 as well. The male screw 17 is screwed into a female screw 19 formed in an inner circumferential surface of an annular flange 18 with stoppers to be attached. In each of the annular flanges 18, a plurality of (16 in the figure) bolt holes 20 are bored in the circumferential direction so as to combine and fix the annular flanges 18 by bolts and nuts. These bolt holes 20 and the bolt holes 7 provided in the flange portions 6 of the cases 3, 3 are provided at positions where these holes form the same diameter with respect to a pipe central axis. Moreover, a rod-like stopper 21 is provided between the bolt hole 20 and the bolt hole 20 at arbitrary positions in each of the annular flanges 18 so as to extend parallel to a pipe axis up to a vicinity of a base end position of the small-diameter pipe portion 16, and accordingly, a plurality of (4 in the figure) stoppers 21 are provided. Reference numeral 22 denotes a rib for the stopper 21, and reference numeral 23 denotes an annular gasket for water-tightness interposed between the end portions of the small-diameter pipe portions 16 of the single pipes 1a, 1b.

[0019]

Fig. 4 shows dimensions of lengths and diameters of the respective portions of the single pipe 1a of the coupling pipe 1, the turning spherical body 2, and the case 3, and as described before, the bolt holes 20 of the annular flange 18 with the stoppers and the bolt holes 7 provided in the flange portion

6 of the case 3 are provided at the positions where the these bolt holes forms the same diameter from the pipe central axis, and they correspond to each other in a size and a number of the holes. By providing the bolt holes 20 at the positions of the same diameter as that of the bolt holes 7, the pipe to be connected to the flange portion 6 can also be connected to the flange portion 18.

[0020]

Moreover, an outer diameter $D1$ from the pipe central axis of the annular stopper 15 is larger than an inner diameter $D2$ of the sliding portion 4 of the turning spherical body 2 and an inner diameter $D3$ of the flange portion 6 of the case 3 ($D3 < D2 < D1$). Thereby, after assembling, the annular stoppers 15 of the single pipes 1a, 1b of the coupling pipe 1 abut on inward annular end portions 25 of the sliding portions 4 in the turning spherical bodies 2, 2 and stops the single pipes 1a, 1b from slipping off, resulting in a maximum distance. On the other hand, the stoppers 21 abut on outward annular end portions 26 of the sliding portions 4, resulting in a minimum distance. Fig. 1 shows a state of an intermediate distance between the maximum distance and the minimum distance.

[0021]

Assembling of the expansion flexible joint as described above will be described. In the assembling, first, the single pipes 1a, 1b in a separated state before combination of the coupling pipe 1 are inserted from the side of the small-diameter pipe portions 16 thereof into the turning spherical bodies 2,

2 through the side of spherical surface portions. At this time, since the end portion outer circumference of each of the small-diameter pipe portions 16 formed with the male screw 17 has the same diameter as that of the other portion, the insertion is not obstructed. Thereafter, the turning spherical bodies 2, 2 are fitted in the cases 3, 3 so as to bring the inner circumferential surfaces of the cases 3, 3 into sliding contact with the outer circumferential surfaces of the turning spherical bodies 2, 2, which are spherical surfaces, and the annular packings 8 and the pressing rings 10 are sequentially arranged to be combined and fixed by the bolts and the nuts inserted into the bolt holes 11, 12. In tandem, the male screws 17 of the single pipes 1a, 1b are screwed into the female screws 19 of the annular flanges 18 to be attached, and after the gasket 23 is interposed between the end portions of the small-diameter pipe portions 16, the single pipes 1a, 1b are combined and fixed by the bolts and the nuts inserted into the bolt holes 20 of the flanges 18. Thereby, the expansion flexible joint is assembled as shown in Fig. 1.

[0022]

That is, since in the assembling, the single pipes 1a, 1b are enabled to be inserted from the side of the small-diameter pipe portions 16, the annular stoppers 15 provided in the one-end outer circumferential surfaces on the side of the turning spherical bodies 2, 2, which is the opposite side of the insertion, can be provided integrally with the single pipes 1a, 1b. This makes work of combining and fixing a separate

stopper ring by bolts after the insertion as in the conventional joint unnecessary, which enhances workability. In addition, unlike the conventional joint, a gap does not occur in the stopper ring and the like, which prevents rusting, and coating treatment can be securely performed. Moreover, in the conventional joint, since the coupling pipe inserted between the paired spherical rings is a single pipe, and a product length and a flexible amount largely depend on a length of the coupling pipe, there is a limit to correspond to change in the length and the amount, and the correspondence is difficult. However, in the joint of the first embodiment, the configuration enables easy correspondence to the product length and the flexible amount, in which the male screw 17 having a diameter sufficient to go through each of the turning spherical bodies 2, 2 is provided in the other-end outer circumferential surface, and this male screw 17 is screwed into the female screw 19 provided in the inner circumferential surface of the flange 18 with the stoppers, which makes the flange 18 detachable, and that the single pipe 1b of the coupling pipe 1 and pipes to be connected A, B can be connected to the flange 18.

[0023]

When the expansion flexible joint having the above-described configuration is used to perform piping, the pipes to be connected A, B are arranged on both sides of the expansion flexible joint, flanges thereof are jointed and combined to the flanges 6 of the cases 3, 3 of the expansion flexible joint, respectively, by which the pipes to be connected

A, B are connected to the single pipes 1a, 1b of the coupling pipe 1, thus completing the piping. Since in this piping work, the flanges of the pipes to be connected A, B only need to be coupled to the flanges 6, the work is extremely easy, and ends in an extremely short time.

[0024]

When in the piping state as described above, any one of the pipes to be connected A, B, which have been connected to the cases 3, 3, is displaced downward due to ground sinking or the like such as an earthquake, the coupling pipe 1 and the turning spherical bodies 2, 2 slide relatively, resulting in expansion and contraction as shown in Fig. 5, and the turning spherical bodies 2, 2 turn inside the cases 3, 3, by which the coupling pipe 1 swings to thereby absorb the displacement of the pipes to be connected A, B. Fig. 5 shows a connection state of the pipes to be connected A, B when in a state where the respective annular stoppers 15 of the single pipes 1a, 1b of the coupling pipe 1 abut on the inward annular end portions 25 of the sliding portions 4 in the turning spherical bodies 2, 2, resulting in the maximum distance, a central axis line X - X of the pipes to be connected A, B, which have been connected and a central axis line Y - Y of the coupling pipe 1, that is, the turning spherical bodies 2, 2 cross at an angle α (here, 20°). In this case, the outer circumferential surfaces of the turning spherical bodies 2, 2 slide on the inner circumferential surfaces of the cases 3, 3, so that the turning spherical bodies 2, 2 each turn at a desired angle around a center c of each of

the turning spherical bodies 2, 2. Reference character β in Fig. 5 denotes a displacement amount. The above-described piping work is extremely easy and ends in a short time. Obviously, the inclination angle α between the coupling pipe 1 and the cases 3, 3 may have a numerical value other than the foregoing.

[0025]

<Second Embodiment>

Fig. 6 shows a second embodiment of this invention, in which there are portions similar to those of the first embodiment, and thus, these portions will be given the same reference numerals, description thereof will be omitted, and different points will be mainly described.

[0026]

While in the first embodiment, the single pipes 1a, 1b of the coupling pipe 1 are connected to each other, in this second embodiment, an extension pipe 28 having flanges in both-end outer circumferential surfaces thereof is further connected between the single pipe 1a and the single pipe 1b of the coupling pipe 1. Using the above-described extension pipe 28 by being connected at the flanges has additional advantages that the length of the coupling pipe 1 can be adjusted as needed, and can further increase the displacement amount. In addition, since the bolt holes 20 of the annular flanges 18 with the stoppers and the bolt holes 7 provided in the flange portions 6 of the case 3 are provided at the positions of the same diameter, the pipes to be connected A, B can also be used as the extension

pipe 28. As is clear from this connection example, as the expansion flexible joint, a configuration can also be employed, in which any one of the single pipes 1a, 1b of the coupling pipe 1, any one of the turning spherical bodies 2, 2, and any one of the cases 3, 3 are used. That is, the joint may be configured as shown in Fig. 4, in which the pipe to be connected A may be connected to the flange portion 6 of the case 3, and the pipe to be connected B may be connected to the annular flange 18 with the stoppers.

[0027]

In the respective embodiments, only the preferable examples are described, and this invention further includes different appropriate embodiments within the scope of claims. The coupling pipe 1, the turning spherical bodies 2, 2 and the cases 3, 3 described in the respective embodiments are only preferable examples, and specific shapes, structures and the like can be replaced by any other ones.

Reference Signs List

[0028]

- 1 Coupling pipe
- 1a, 1b Single pipe
- 2, 2 Turning spherical body
- 3, 3 Case
- 4 Sliding portion
- 5 O ring
- 6 Flange portion

7, 11, 12, 20 Bolt hole
8 Annular packing
10 Pressing ring
15 Annular stopper
16 Small-diameter pipe portion
17 Male screw
18 Annular flange
19 Female screw
21 Stopper
23 Annular gasket
A, B Pipe to be connected

Claims

Claim 1

An expansion flexible joint comprising: a coupling pipe having a predetermined length; paired turning spherical bodies that are fitted on both end portions of the coupling pipe so as to be relatively slidable in a pipe axis direction while holding water-tightness and each have a partially spherical outer circumferential surface; and paired cases that are each turnably fitted on the turning spherical body in sliding contact in an inner circumferential surface forming the same spherical surface as the outer circumferential surface of each of these turning spherical bodies while holding water-tightness,

wherein the coupling pipe is made up of paired single pipes, a slip-off stopper is integrally provided in a one-end outer circumferential surface of these single pipes on the side of each of the turning spherical bodies, an opposed end portion of each of these single pipes is formed into a small-diameter pipe portion slightly inwardly depressed, in an end portion of the small-diameter pipe portion, a male screw having a diameter sufficient to go through each of the turning spherical bodies is provided in the outer circumferential surface having the same diameter as that of a portion other than the small-diameter pipe portion, a detachable flange with a stopper is provided by screwing the male screw into a female screw provided in an

inner circumferential surface of the flange, the single pipes are combined and fixed by bolts and nuts inserted into the bolt holes provided in these flanges while holding water-tightness, and the flanges are each provided so that the rod-like stopper extends parallel to a pipe axis up to a vicinity of a base end position of the small-diameter pipe portion.

Claim 2

The expansion flexible joint according to claim 1, wherein in the case, a flange portion is integrally provided in a one-end outer circumferential surface on the opposite side of the turning spherical body, and in the turning spherical body, a short pipe-like sliding portion extending in an axis direction is integrally provided in another end portion on the opposite side of the case.

Claim 3

The expansion flexible joint according to claim 2, wherein in the flange with the stopper, bolt holes for attachment are provided at positions where the holes form the same diameter from a pipe central axis as that of bolt holes provided in the flange portion of the case.

Claim 4

The expansion flexible joint according to claim 1, wherein the coupling pipe has an extension pipe between the opposed end portions of the single pipes, and both end portions of the extension pipe and the opposed end portions

of the signal pipes are combined and fixed by bolts and nuts while holding water-tightness.