

SPECIFICATION

TITLE OF THE INVENTION : PIPE JOINT CONSTRUCTION

FIELD OF THE INVENTION

[0001] This invention relates to a pipe joint construction, especially, a pipe joint construction which mutually connects pipes.

BACKGROUND ART

[0002] Conventionally, a flare joint as shown in figure 16 is widely known. Generally, this flare joint, as shown in figure 16, is formed by plastic work of a flared portion f on an end portion of a pipe P by working tools (jigs). The end portion of the pipe P is disposed on a tapered portion a of a flare joint main body h, fastened with a cap nut n, held between a tapered face t of the cap nut n and a tapered face a of the flare joint main body h to secure sealing by mutual press fit of the metal faces (refer to patent document 1, for example). When the flared portion f is formed with a special jig (working tool) on the connected pipe P on working sites, cracks tend to be generated on a corner portion f_1 on a small diameter portion of the flared portion f by great plastic deformation of the tapered direction. Especially, in case that the material of the pipe P is aluminum, crack generation ratio is high. And, there is also a problem that fluctuation of quality is easily generated by the flare work on the working sites.

Therefore, a pipe joint construction as shown in figure 14 and figure 15 is proposed (refer to patent document 2).

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0003] Patent document 1 : Japanese Patent Provisional Publication NO. 2005-42858.

Patent document 2 : Japanese Patent Provisional Publication NO. 2010-270846.

OUTLINE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] The pipe joint construction shown in figure 14 and figure 15 has a flare joint main body 82 and a cap nut 83, in which a draw-stopping member 81 is provided inside. Although this construction has an excellent point that flare work or other work on the forth end of the pipe can be omitted, the draw-stopping member 81 having an extremely superfine claw 80 is necessary. Therefore, there is still a problem that production is difficult and production cost is high. And, when rotational torque works on the pipe P, pipe draw is generated with forming spiral groove by the claw 80 in some cases.

Further, in the pipe joint construction in figure 14 and figure 15, sealing materials such as (plural) O-rings 84 and 85 are necessary. It is difficult to resist great temperature change of -50°C to $+130^{\circ}\text{C}$ with these sealing materials such as the O-rings 84 and 85 of rubber, and problems of durability and sealing ability still remain.

[0005] Therefore, it is an object of the present invention, solving the problems above, to provide a pipe joint construction of union type with which superfine parts can be omitted, production is easy and cost can be reduced, being

compact, and connecting work can be easily and stably conducted. Especially, it is another object to provide a pipe joint construction which sufficiently resists severe temperature change of the sealed fluid, has a long life, and connects preferable pipes (of union type) mutually.

MEANS FOR SOLVING THE PROBLEMS

[0006] Therefore, in the present invention, a flare joint main body having a male screw portion and a forth end diminishing tapered portion on each of both sides in axial direction, and a cap nut having a female screw portion screwed to the male screw portion, are provided, a forth end enlarged pipe portion is formed from a forth end face of each of two pipes mutually connected for a predetermined axis dimension, and a tapered stage portion is formed on a border of the forth end enlarged pipe portion and a basic diameter pipe portion, an inner core, having a connecting cylinder portion inserted into the forth end enlarged pipe portion of the pipe and sloped face which contacts the forth end diminishing tapered portion, is provided, a closed circular ring, mounted to the forth end enlarged pipe portion through the tapered stage portion of the pipe by screwing the cap nut to the flare joint main body, is disposed within the cap nut, sealed state of the forth end enlarged pipe portion of the pipe with the connecting cylinder portion of the inner core is kept by diminishing pushing force of the ring in radial inner direction, and, press-fit sealed state of the forth end diminishing tapered portion of the flare joint main body with the sloped face of the inner core is kept by force

in axial direction along the screwing of the cap nut to the flare joint main body transmitted to the inner core through the ring.

And, plural independent small ridges, of which cross section is triangular or Fujiyama-shaped, are formed on a peripheral face of the connecting cylinder portion of the inner core.

[0007] And, in the present invention, a joint main body on which a male screw portion, a staged portion, and a pipe connecting cylinder portion are serially formed on each of both sides in axial direction, and two cap nuts each of which has a female screw portion screwed to the male screw portion, are provided, a forth end enlarged pipe portion is formed from a forth end face of each of two pipes mutually connected for a predetermined axis dimension, and a tapered stage portion is formed on a border of the forth end enlarged pipe portion and a basic diameter pipe portion, a closed circular ring, mounted to the forth end enlarged pipe portion through the tapered stage portion of the pipe by screwing the cap nut to the joint main body in a state that the pipe connecting cylinder portion of the joint main body is inserted to the forth end enlarged pipe portion of the pipe, is disposed within the cap nut, and, sealed state of the forth end enlarged pipe portion of the pipe with the pipe connecting cylinder portion of the joint main body is kept by diminishing pushing force of the ring in radial inner direction.

And, plural independent small ridges, of which cross

section is triangular or Fujiyama-shaped, are formed on a peripheral face of the pipe connecting cylinder portion protruding from the joint main body..

And, sealing material for sealing is completely omitted, and all construction parts are made of metal.

And, a thickness dimension T_{25} of the closed circular ring and a thickness dimension T_p of the pipe are set as to fulfill a formula 1 below.

$$1.0 \cdot T_p \leq T_{25} \leq 2.5 \cdot T_p \quad (\text{formula 1})$$

EFFECTS OF THE INVENTION

[0008] According to the present invention, the pipe joint can be relatively easily produced omitting superfine parts, and, strong anti-drawing force can be given to the pipe. Sealing materials of rubber such as O-rings can be omitted, the joint sufficiently resists temperature change from extreme low temperature to super high temperature, for example, -70°C to $+150^{\circ}\text{C}$, and anti-drawing force of the pipe can be kept sufficiently high.

Although a forth end enlarged pipe portion is necessary to be preliminarily worked on the pipe end, this work can be easily and certainly conducted without high skill with working tools (jigs) for soldering conventionally used for a long period of time. The forth end enlarged pipe portion makes an inner diameter dimension of a flowing duct equal to the inner diameter dimension of the pipe itself, and fluid passage resistance can be restricted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

[Figure 1] A cross-sectional view of a state during connection work showing an embodiment of the present invention.

[Figure 2] An enlarged view of a principal portion of figure 1.

[Figure 3] A cross-sectional view showing a later state of connection work.

[Figure 4] A cross-sectional view of a principal portion showing a connection completed state.

[Figure 5] An entire cross-sectional view showing the connection completed state.

[Figure 6] A cross-sectional view of a state during connection work showing another embodiment of the present invention.

[Figure 7] A cross-sectional view of a joint main body.

[Figure 8] A cross-sectional view showing a later state of connection work.

[Figure 9] A cross-sectional view showing a connection completed state.

[Figure 10] A cross-sectional view of a connection completed state showing still another embodiment.

[Figure 11] A cross-sectional explanatory view of a principal portion in disassembled state.

[Figure 12] Cross-sectional views to explain a principal portion of a forming work tool and enlarging method of a forth end enlarged pipe portion.

[Figure 13] A cross-sectional view to explain soldering work practiced from older times to the present, and the soldered

end portion of the pipe.

[Figure 14] A cross-sectional view showing a conventional example during connection work.

[Figure 15] A cross-sectional view showing the conventional example in connection completed state.

[Figure 16] A cross-sectional view showing another conventional example.

EMBODIMENTS OF THE INVENTION

[0010] Preferred embodiments of the present invention will be described with reference to the accompanying drawings.

In an embodiment of the present invention shown in figure 1 through figure 5, on each of 2 pipes P to be connected, a forth end enlarged pipe portion 5 is formed from a forth end face 3 for a predetermined axis dimension L_5 .

A tapered stage portion 10 is formed on a border of the forth end enlarged pipe portion 5 and a basic diameter pipe portion 6 having an original basic diameter D_0 of the pipe.

[0011] A mark 20 represents a flare joint main body having a pair of a male screw portion 20A and a forth end diminishing tapered portion 20B on both of left and right sides to be symmetric. The flare joint main body 20, a flare joint defined by JIS B 8607, is similar to the flare joint main body h shown in figure 16.

A mark 15 represents a cap nut having a female screw portion 15A to be screwed on the male screw portion 20A of the flare joint main body 20.

The female screw portion 15A of large diameter, a

middle diameter portion 15C, and a forth end small diameter portion 15F are serially formed on a hole portion 16 of the cap nut 15 from a base end to a forth end (refer to figure 2).

As described above, the pipe joint construction relating to the present invention is provided with the flare joint main body 20 having the male screw portion 20A and the forth end diminishing tapered portion 20B, and the pair of (two) cap nuts 15 each of which has the female screw portion 15A to be screwed on the male screw portion 20A.

[0012] A mark 30 represents an inner core within the cap nut 15 as shown in figure 4 in connection completed state. The inner core 30 is provided with a connecting cylinder portion 31 inserted to the forth end enlarged pipe portion 5 of the pipe P, and a sloped face 32 which contacts the forth end diminishing tapered portion 20B of the flare joint main body 20. Further, as shown in figure 1 and figure 5, two inner cores 30 are disposed symmetric on left and right sides of the flare joint main body 20.

To describe concretely further, the inner core 30 has a through hole 33 along the axis, and, the sloped face 32 is formed on a base end side of the through hole 33, tapered as to enlarge in diameter toward the base end, and also preferable to be slightly convex (convex R-shaped). And, the base end portion of the inner core 30 is a thick large diameter portion 34 larger than the connecting cylinder portion 31 in diameter, and, a staged portion 35 is formed between the thick large diameter portion 34 and the connecting cylinder portion 31

having smaller diameter (refer to figure 2).

[0013] And, plural independent small ridges 36, of which cross section is triangular or Fujiyama-shaped, are formed on a peripheral face of the connecting cylinder portion 31 of the inner core 30.

And, a mark 25 represents a closed circular ring composed of a short cylindrical body. The ring 25 is, as shown in figure 1 and figure 2, slidably mounted to the pipe P before the forming work of the forth end enlarged pipe portion 5, then, the forth end enlarged pipe portion 5 is formed as (later-described) figure 12, the ring 25, stopped by the tapered stage portion 10, does not drop out to the forth end side of the pipe P (in leftward direction in figure 2).

[0014] As shown from figure 2 to figure 3, when the cap nut 15 is lightly moved in leftward direction (by hand), the ring 25 fits to the middle diameter portion 15C of the cap nut 15. That is to say, the cap nut 15 has an inner brim portion 17 on the forth end position (the small diameter portion 15F is formed on an inner peripheral face of the inner brim portion 17), and a right angle inner face 17A of the inner brim portion 17 contacts the forth end face of the ring 25 (refer to figure 3, figure 4, and figure 5).

[0015] As from figure 2 to figure 3, the cap nut 15 is made close to the joint main body 20, then, the cap nut 15 is screwed to the male screw portion 20A of the joint main body 20, the ring 25 within the cap nut 15, being pushed to axial inner direction by the right angle inner face 17A of the inner brim

portion 17, is gradually moved towards the forth end of the pipe, and made contact with the tapered stage portion 10 of the pipe P.

[0016] The inner diameter dimension of the ring 25 is set to be smaller than the outer diameter dimension of the forth end enlarged pipe portion 5 of the pipe P in free state. Therefore, when the cap nut 15 is screwed further, as from figure 3 to figure 4 and figure 5, the ring 25 is mounted to the forth end enlarged pipe portion 5 through the tapered stage portion 10 of the pipe P, and, strong force (squeezing force) in diminishing direction is given to make the independent small ridges 36 bite to the inner peripheral face of the forth end enlarged pipe portion 5, as shown in figure 4, the inner peripheral face of the forth end enlarged pipe portion 5 and the peripheral face of the connecting cylinder portion 31 of the inner core 30 are in mutual biting state (press-fit state) of metal for sealing to stop outer leakage of the sealed fluid (gas or liquid).

[0017] In other words, sealed state of the forth end enlarged pipe portion 5 of the pipe P with the connecting cylinder portion 31 of the inner core 30 can be kept by diminishing pushing force (elastic pushing force) of the ring 25 of metal in radial inner direction.

Further, press-fit sealed state of the forth end diminishing tapered portion 20B of the flare joint main body 20 with the sloped face 32 of the inner core 30 can be kept by force in axial direction along the screwing of the cap nut 15

to the flare joint main body 20 transmitted to the inner core 30 through the ring 25 (refer to figure 3, figure 4, and figure 5).

And, it is preferable to complete the connection of one of the left or right side before conduct connection of the other side when the connection work is conducted as shown in figure 1 through figure 5.

[0018] As clearly shown in figure 1 through figure 5, in the pipe joint construction relating to the present invention, sealing materials of rubber or synthetic resin such as O-rings are completely omitted. That is to say, constructional parts are made of metal. To show concrete examples, the pipe P is made of copper or aluminum, the flare joint main body 20 is made of brass, the cap nut is made of brass, the inner core 30 is made of brass or stainless steel, and the ring 25 is made of hard aluminum or stainless steel.

[0019] Next, it is preferable to make a thickness dimension T_{25} of the ring 25 sufficiently large in comparison with a thickness dimension T_p of the pipe P to give large elastic pushing force in diminishing direction to the forth end enlarged pipe portion 5 of the pipe P.

For example, these are set to fulfill a following formula 1.

$$1.0 \cdot T_p \leq T_{25} \leq 2.5 \cdot T_p \quad (\text{formula 1})$$

Further preferably, these are set to fulfill a following formula 2.

$$1.2 \cdot T_p \leq T_{25} \leq 2.2 \cdot T_p \quad (\text{formula 2})$$

[0020] When T_{25} is less than the minimum value, the squeezing force in radial inner direction becomes excessively weak, and sealing ability is insufficient. On the contrary, over the maximum value, it is difficult to mount the ring 25 as the state shown in figure 3 to figure 4, or later described figure 8 to figure 9 by the screwing of the cap nut 15.

[0021] Next, in figure 6 through figure 9, another embodiment of the present invention is described.

A mark 40 represents a joint main body on which a male screw portion 37, a staged portion 38, and a pipe connecting cylinder portion 41 are serially formed on each of (left and right) both sides in axial direction as one unit. A protruding portion 39 on which working tools such as spanners and wrenches are hitched (held) is also formed on a central position in the axial direction as one unit.

[0022] Although the cap nut 15 has approximately similar construction to that is explained with figure 1 through figure 5, the dimension in axial direction is short. The female screw portion 15A of the cap nut 15 is screwed to the male screw portion 37 of the joint main body 40.

A forth end enlarged pipe portion 5 is formed from a forth end face 3 of each of two pipes P mutually connected for a predetermined axis dimension L_5 , and a tapered stage portion 10 is formed on a border of the forth end enlarged pipe portion 5 and a basic diameter pipe portion 6.

[0023] In the embodiment shown in figure 6 through figure 9, the closed circular rings 25 (described with figure 1 through

figure 5) are omitted, and, the forth end diminishing tapered portion 20B is also omitted.

However, in the embodiment, a pipe connecting cylinder portion 41 is formed to protrude from the joint main body 40 as one unit, and plural independent small ridges 36, of which cross section is triangular or Fujiyama-shaped, are formed on a peripheral face of the connecting cylinder portion 41.

[0024] A staged dimension ΔD of the staged portion 38 is sufficiently large, and a thickness dimension T_{41} of the pipe connecting cylinder portion 41 is formed small (refer to figure 7).

And, a closed circular ring 25, moving in an arrow K direction, mounted to the forth end enlarged pipe portion 5 through the tapered stage portion 10 of the pipe P by screwing (as shown in figure 8) the cap nut 15 to the joint main body 40 in a state that the pipe connecting cylinder portion 41 of the joint main body 40 is inserted to the forth end enlarged pipe portion 5 of the pipe P as shown in figure 9, is disposed within the cap nut 15.

[0025] In a connection completed state shown in figure 9, sealed state of the forth end enlarged pipe portion 5 of the pipe P with the pipe connecting cylinder portion 41 of the joint main body 40 is kept by diminishing pushing force of the ring 25 in radial inner direction

That is to say, strong force (squeezing force) in diminishing direction is given by the ring 25 to make the independent small ridges 36 bite to the inner peripheral face

of the forth end enlarged pipe portion 5, as shown in figure 9, the inner peripheral face of the forth end enlarged pipe portion 5 and the peripheral face of the connecting cylinder portion 41 of the joint main body 40 are in mutual biting state (press-fit state) of metal for sealing to stop outer leakage of the sealed fluid.

[0026] In other words, sealed state of the forth end enlarged pipe portion 5 of the pipe P with the connecting cylinder portion 31 of the joint main body 40 can be kept by diminishing pushing force (elastic pushing force) of the ring 25 of metal in radial inner direction.

[0027] As clearly shown in figure 6 through figure 9, in the pipe joint construction relating to the present invention, sealing materials of rubber or synthetic resin such as O-rings are completely omitted. That is to say, constructional parts are made of metal. To show concrete examples, the pipe P is made of copper or aluminum, the joint main body 40 is made of brass, the cap nut is made of brass, and the ring 25 is made of hard aluminum or stainless steel.

[0028] Next, it is preferable to make a thickness dimension T_{25} of the ring 25 sufficiently large in comparison with a thickness dimension T_p of the pipe P to give large elastic pushing force in diminishing direction to the forth end enlarged pipe portion 5 of the pipe P.

[0029] That is to say, in still another embodiment shown in figure 10 and figure 11, the thickness dimension T_{25} of the ring 25 can be set large (in comparison with the embodiment of figure

6 through figure 9).

As clearly shown by comparison of figure 10 and figure 11 with the above-described figure 6 through figure 9, the outer diameter dimension of the staged portion 38 can be set to be sufficiently large by that the outer diameter dimensions of the male screw portion 37 and the protruding portion 39 of the joint main body 40 are set to be sufficiently large, and the configuration and dimensions of the connecting cylinder portion 41 are set to be the same. That is to say, the staged dimension ΔD can be sufficiently large.

[0030] The dimension in the radial direction of the cap nut 15 is increased. That is to say, the female screw portion 15A and the middle diameter portion 15C of the cap nut 15 are set to be large, and the outer diameter dimension can be greatly increased. The reason is that the joint main body 40 shown in figure 6 through figure 11 has a new configuration not relating to JIS standard, and the dimension in the radial direction can be increased.

[0031] In the embodiment shown in figure 6 through figure 9, and figure 10 and figure 11, the thickness dimension T_{25} of the ring 25 can be also set large (proportionally) because the staged dimension ΔD is sufficiently large. As described above, the ring 25 of the large thickness dimension T_{25} can give the large elastic pushing force in diminishing direction to the forth end enlarged pipe portion 5 of the pipe P.

[0032] For example, these are set to fulfill a following formula 3.

$$1.2 \cdot T_p \leq T_{25} \leq 3.0 \cdot T_p \quad (\text{formula 3})$$

Further preferably, these are set to fulfill a following formula 4.

$$1.4 \cdot T_p \leq T_{25} \leq 2.8 \cdot T_p \quad (\text{formula 4})$$

[0033] When T_{25} is less than the minimum value, the squeezing force in radial inner direction becomes rather excessively weak, and sealing ability is rather insufficient. On the contrary, over the maximum value, it is difficult to mount the ring 25 as the state shown in figure 8 to figure 9, or later described figure 11 to figure 10 by the screwing of the cap nut 15.

In the embodiment shown in figure 10 and figure 11, anti-drawing force of the pipe is large and sealing ability is kept extremely high by making the thickness dimension T_{25} large as shown by the formulas 3 and 4.

[0034] In the present invention, the forth end enlarged pipe portion 5 formed on the pipe P to be connected is a basic component. Therefore, the forth end enlarged pipe portion 5 is described below.

As shown in figure 12, a forth end of a pipe P_0 to be worked is inserted to a hole portion 26A of a divided mold 26, and a diameter-expanding piece 27, of which cross section is sectorized in 4 (or more) segments, is inserted to the pipe P_0 to a predetermined depth. When a tapered male mold 28 is pushed in an arrow E direction into a tapered hole portion 29 formed by the divided diameter-expanding piece 27, the diameter-expanding piece 27 moves in radial outer direction R as from figure 12(A) to (B), and the forth end enlarged pipe portion 5

is formed (worked).

[0035] And, a tapered portion 27A is disposed on the diameter-expanding piece 27 and a tapered portion 26B is disposed on the hole portion 26A of the mold 26 to form the tapered staged portion 10.

Then, the mold 26 is dividedly moved in diameter-expanding directions, and the worked pipe P_0 is drawn out to make the pipe P with the forth end enlarged pipe portion 5 to be connected as shown in figure 1 through figure 6, and figure 8 through figure 11, etc.

[0036] A hand tool for diameter expansion shown in figure 12 has been widely known since old times. The reason is that a soldered pipe connection 63 as shown in figure 13 has been used for pipes for cooling media and household hot (or cold) water supply since old times. That is to say, it is necessary to preliminarily work the forth end enlarged pipe portion 5 as shown in figure 1 through figure 6, and figure 8 through figure 11, etc. on a pipe 61 for the soldered pipe connection 63 being practiced since old times (Another pipe 62 is inserted to the enlarged pipe portion 5 without work, and a mutual fit face portion X_5 is soldered).

As described above, the inventor of the present invention noticed the diameter-expanding working tool widely used for pipe connecting work with soldering and the forth end enlarged pipe portion which can be easily worked with the working tool, and hereby proposes the pipe joint construction in which the characteristic configurations and constructions

as shown in figure 1 through figure 11 are combined, the work can be safely conducted without heat for soldering, the superfine biting claw 80 of the conventional example in figure 14 is not provided, and workability of pipe connection is excellent.

[0037] In the present invention, as described above, excellent sealing ability is shown for a long period of time without considering durability of sealing material against sealed fluid because the flare joint main body 20 having the male screw portion 20A and the forth end diminishing tapered portion 20B on each of both sides in axial direction, and the cap nut 15 having the female screw portion 15A screwed to the male screw portion 20A, are provided, the forth end enlarged pipe portion 5 is formed from the forth end face 3 of each of two pipes P mutually connected for the predetermined axis dimension L_5 , and the tapered stage portion 10 is formed on the border of the forth end enlarged pipe portion 5 and the basic diameter pipe portion 6, the inner core 30, having the connecting cylinder portion 31 inserted into the forth end enlarged pipe portion 5 of the pipe P and the sloped face 32 which contacts the forth end diminishing tapered portion 20B, is provided, the closed circular ring 25, mounted to the forth end enlarged pipe portion 5 through the tapered stage portion 10 of the pipe P by screwing the cap nut 15 to the flare joint main body 20, is disposed within the cap nut 15, sealed state of the forth end enlarged pipe portion 5 of the pipe P with the connecting cylinder portion 31 of the inner core 30 is kept by diminishing pushing

force of the ring 25 in radial inner direction, and press-fit sealed state of the forth end diminishing tapered portion 20B of the flare joint main body 20 with the sloped face 32 of the inner core 30 is kept by force in axial direction along the screwing of the cap nut 15 to the flare joint main body 20 transmitted to the inner core 30 through the ring 25. And, the problem of quality fluctuation by flare work on working sites is solved, parts having extremely superfine claw 80 (refer to figure 14 and figure 15) can be omitted, and strong anti-drawing force is shown. High sealing ability can be kept stably for a long period of time under severe environment in which temperature change is extremely large and high pressure works. Making great contribution to the technical field as a union type pipe joint (connecting serially pipes P) most frequently used for pipes sending fluid, the pipe joint can stably keep strong anti-drawing force and high sealing ability under extremely great temperature change of -70°C to $+150^{\circ}\text{C}$ and high pressure.

[0038] And, the pipe joint can certainly bite into the inner peripheral face of the forth end enlarged pipe portion 5 sufficiently deep to show large anti-drawing force and high sealing ability against various sealed fluid because plural independent small ridges 36, of which cross section is triangular or Fujiyama-shaped, are formed on the peripheral face of the connecting cylinder portion 31 of the inner core 30.

[0039] And, the present invention shows excellent sealing

ability for a long period of time without considering durability of sealing material against sealed fluid because the joint main body 40 on which the male screw portion 37, the staged portion 38, and the pipe connecting cylinder portion 41 are serially formed on each of both sides in axial direction, and two cap nuts 15 each of which has the female screw portion 15A screwed to the male screw portion 37, are provided, the forth end enlarged pipe portion 5 is formed from the forth end face 3 of each of two pipes P mutually connected for the predetermined axis dimension L_5 , and the tapered stage portion 10 is formed on the border of the forth end enlarged pipe portion 5 and the basic diameter pipe portion 6, the closed circular ring 25, mounted to the forth end enlarged pipe portion 5 through the tapered stage portion 10 of the pipe P by screwing the cap nut 15 to the joint main body 40 in the state that the pipe connecting cylinder portion 41 of the joint main body 40 is inserted to the forth end enlarged pipe portion 5 of the pipe P, is disposed within the cap nut 15, and the sealed state of the forth end enlarged pipe portion 5 of the pipe P with the pipe connecting cylinder portion 41 of the joint main body 40 is kept by diminishing pushing force of the ring 25 in radial inner direction. Especially, number of parts is small, and the joint is made compact and simplified in construction. And, sealing ability is improved further (sealed positions against outer leakage are reduced to the half) because press-fit sealing portions of mutual tapered faces are completely omitted.

Further, the problem of quality fluctuation by flare work on working sites is solved, parts having extremely superfine claw 80 (refer to figure 14 and figure 15) can be omitted, and strong anti-drawing force is shown. For example, high sealing ability can be kept stably for a long period of time only with mutual strong press fit of metal under severe environment in which temperature change is extremely large and high pressure works.

[0040] And, the pipe joint can certainly bite into the inner peripheral face of the forth end enlarged pipe portion 5 sufficiently deep to show large anti-drawing force and high sealing ability against sealed fluid because plural independent small ridges 36, of which cross section is triangular or Fujiyama-shaped, are formed on the peripheral face of the pipe connecting cylinder portion 41 protruding from the joint main body 40. Further, extremely high sealing ability is kept through the entire pipe joint because fluid leakage can possibly be generated between the joint main body 40 and the pipe P only on the connecting cylinder portion 41 on which the independent small ridges 36 are formed.

[0041] And, the union type pipe joint construction excellent in durability shows stable sealing ability under extremely severe environment from super low temperature (-70°C) to super high temperature ($+150^{\circ}\text{C}$) because sealing materials for sealing are completely omitted, and all constructional parts are made of metal.

[0042] And, strong elastic diminishing force of the ring 25 of

metal is generated in radial inner direction, the pipe P of metal can be press-fit to the connecting cylinder portion 31 (41) sufficiently strong, and, stable and high sealing ability is shown against great temperature change from low to high temperature, and the durability is also excellent because the thickness dimension T_{25} of the closed circular ring 25 and the thickness dimension T_p of the pipe P are set as to fulfill a formula, $1.0 \cdot T_p \leq T_{25} \leq 2.5 \cdot T_p$.

EXPLANATION OF THE MARKS

[0043]

- 3 A forth end face
- 5 A forth end enlarged pipe portion
- 6 A basic diameter pipe portion
- 10 A tapered stage portion
- 15 A cap nut
- 15A A female screw portion
- 20 A flare joint main body
- 20A A male screw portion
- 20B A forth end diminishing tapered portion
- 25 A closed circular ring
- 30 An inner core
- 31 A connecting cylinder portion
- 32 A sloped face
- 36 An independent small ridge
- 37 A male screw portion
- 38 A staged portion
- 40 A joint main body

41	A connecting cylinder portion
P	A pipe
L_5	A predetermined axis dimension
T_{25}	A thickness dimension of the ring
T_p	A thickness dimension of the pipe

CLAIMS

[Claim 1] A pipe joint construction characterized by that:

a flare joint main body (20) having a male screw portion (20A) and a forth end diminishing tapered portion (20B) on each of both sides in axial direction, and a cap nut (15) having a female screw portion (15A) screwed to the male screw portion (20A), are provided;

a forth end enlarged pipe portion (5) is formed from a forth end face (3) of each of two pipes (P) mutually connected for a predetermined axis dimension (L_5), and a tapered stage portion (10) is formed on a border of the forth end enlarged pipe portion (5) and a basic diameter pipe portion (6);

an inner core (30), having a connecting cylinder portion (31) inserted into the forth end enlarged pipe portion (5) of the pipe (P) and a sloped face (32) which contacts the forth end diminishing tapered portion (20B), is provided;

a closed circular ring (25), mounted to the forth end enlarged pipe portion (5) through the tapered stage portion (10) of the pipe (P) by screwing the cap nut (15) to the flare joint main body (20), is disposed within the cap nut (15);

sealed state of the forth end enlarged pipe portion (5) of the pipe (P) with the connecting cylinder portion (31) of the inner core (30) is kept by diminishing pushing force of the ring (25) in radial inner direction; and

press-fit sealed state of the forth end diminishing tapered portion (20B) of the flare joint main body (20) with the sloped face (32) of the inner core (30) is kept by force

in axial direction along the screwing of the cap nut (15) to the flare joint main body (20) transmitted to the inner core (30) through the ring (25).

[Claim 2] The pipe joint construction as set forth in claim 1, wherein plural independent small ridges (36), of which cross section is triangular or Fujiyama-shaped, are formed on a peripheral face of the connecting cylinder portion (31) of the inner core (30).

[Claim 3] A pipe joint construction characterized by that:

a joint main body (40) on which a male screw portion (37), a staged portion (38), and a pipe connecting cylinder portion (41) are serially formed on each of both sides in axial direction, and two cap nuts (15) each of which has a female screw portion (15A) screwed to the male screw portion (37), are provided;

a forth end enlarged pipe portion (5) is formed from a forth end face (3) of each of two pipes (P) mutually connected for a predetermined axis dimension (L_5), and a tapered stage portion (10) is formed on a border of the forth end enlarged pipe portion (5) and a basic diameter pipe portion (6);

a closed circular ring (25), mounted to the forth end enlarged pipe portion (5) through the tapered stage portion (10) of the pipe (P) by screwing the cap nut (15) to the joint main body (40) in a state that the pipe connecting cylinder portion (41) of the joint main body (40) is inserted to the forth end enlarged pipe portion (5) of the pipe (P), is disposed within the cap nut (15); and

sealed state of the forth end enlarged pipe portion (5) of the pipe (P) with the pipe connecting cylinder portion (41) of the joint main body (40) is kept by diminishing pushing force of the ring (25) in radial inner direction.

[Claim 4] The pipe joint construction as set forth in claim 3, wherein plural independent small ridges (36), of which cross section is triangular or Fujiyama-shaped, are formed on a peripheral face of the pipe connecting cylinder portion (41) protruding from the joint main body (40)..

[Claim 5] The pipe joint construction as set forth in claim 1, 2, 3, or 4, wherein sealing material for sealing is completely omitted, and all construction parts are made of metal.

[Claim 6] The pipe joint construction as set forth in claim 1, 2, 3, or 4, wherein a thickness dimension (T_{25}) of the closed circular ring (25) and a thickness dimension (T_p) of the pipe (P) are set as to fulfill a formula 1 below.

$$1.0 \cdot T_p \leq T_{25} \leq 2.5 \cdot T_p \quad (\text{formula 1})$$