

TUBE-FASTENING STRUCTURE

TECHNICAL FIELD

[0001]

The present invention relates to a tube-fastening structure for retaining, with a clip, an elastically deformable tube body such as a hose or a tube to a joint.

BACKGROUND ART

[0002]

As the tube-fastening structure of this type, there has been a tube-fastening structure in which a circular tightening part capable of tightening a hose from the outer circumference and an L-shaped hook extending from an axial direction end portion of the circular tightening part in an axial direction and extending in a circumferential direction are integrally provided in a clip that radially contracts and tightens, from the outer circumference, the hose fit on one end portion of a pipe, an L-shaped cutout is provided in a flare nut provided in the pipe, and the L-shaped hook is inserted into the L-shaped cutout in the axial direction and then rotated in the circumferential direction, whereby the L-shaped hook and the L-shaped cutout engage with each other immovably in the axial direction (see, for example, Patent Document 1).

There has also been a tube-fastening structure including a clamp obtained by bending a long belt-like plate material in a C shape, an engaging part (an engaging hole, a projected rib, and a recessed groove) formed adjacent to the clamp, and an engaged part (an engaging protrusion, a recessed groove, and a projecting rib) provided adjacent to the distal end of a hose on the outer circumferential surface of a pipe into which the hose is inserted, the engaging part of the clamp being engaged in the engaged part of the pipe from a radial direction outer side, whereby the engaging part and the engaged part concave/convex-fit in the radial direction of the hose (see, for example, Patent Document 2).

CITATION LIST

PATENT DOCUMENTS

[0003]

Patent Document 1: Japanese Patent Application Laid-Open No. 2010-169175

Patent Document 2: Japanese Patent Application Laid-Open No. 2006-57798

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004]

In the first place, a tube body such as a hose or a tube having flexibility formed of an elastic material such as synthetic resin or rubber has a characteristic that a dimension error easily occurs in an inner diameter and an outer diameter and thickness during manufacturing, a characteristic that, when the tube body is tightened from the outer circumference by a clip or the like, the elastic material in a tightened place is compression-deformed and the clip or the like bites into the tube body, and the elastic material compression-deformed by the biting escapes to a place adjacent to the tightened place and swells and the tube body is deformed, a characteristic that the thickness decreases according to use for a long period and the tube body is radially contracted and deformed, and a characteristic that the tube body is easily ruptured by slight scratching on the outer surface.

However, in such a conventional tube-fastening structure, in the case of Patent Document 1, since the L-shaped hook and the L-shaped cutout are engaged rotatably in the circumferential direction, when the hose rotates and twists during use, the L-shaped hook shifts in position in the circumferential direction together with the hose and the L-shaped hook is easily disengaged from the L-shaped cutout.

In particular, when rotational movement of the L-shaped hook in the circumferential direction by an operator is insufficient and the L-shaped hook is not completely engaged with the L-shaped cutout, the L-shaped hook more easily slips off the L-shaped cutout. There is a problem in that, in this state, when the hose is pulled, the hose slips off the pipe together with the clip and slipping-off strength is deteriorated.

In the case of Patent Document 2, even if the clamp bites into the outer circumferential surface of the hose according to the tightening by the clamp or the clamp is about to be further radially contracted and deformed according to radial contraction and deformation due to aged deterioration of the hose, in the structure, the engaging part is supported by the engaged part and hardly moves in the radial direction inner side. Therefore, the clamp cannot be smoothly radially contracted and deformed. Consequently, a gap is formed between the outer circumferential surface of the hose and the inner circumferential surface of the clamp and a tightening force decreases.

In particular, when a hose having an outer diameter smaller than a standard size is used because of a manufacturing error, a gap more easily occurs between the outer circumferential surface of the hose and the inner circumferential surface of the clamp. There is a problem in that, in this state, when the hose is pulled, the hose slips

off between the clamp and the pipe and slipping-off strength decreases.

Further, in the case of Patent Document 2, there is also a problem in that, when the elastic material equivalent to the biting into the outer circumferential surface of the hose according to the tightening by the clamp escapes to the place adjacent to the tightened place and swells and the hose is deformed, the entire clamp inclines and the engaging part easily slips off the engaged part.

[0005]

The present invention has been devised to cope with such problems and it is an object of the present invention to, for example, reliably retain a tube body with a simple structure irrespective of radial contraction and deformation of the tube body while preventing scratches on the outer surface of the tube body.

SOLUTION TO PROBLEM

[0006]

In order to attain such an object, the present invention provides a tube-fastening structure including: a nipple inserted into a tube body which is elastically deformable; a clip body elastically deformable in a radial direction in which the tube body is held between the clip body and the nipple and tightened; an operation part for elastic deformation provided in the clip body; and a hook provided in the clip body to project. The nipple includes: an insertion part inserted into the tube body; a locking flange provided at an end of the insertion part; and an engaging groove provided on the side opposite to the insertion part across the locking flange. The hook includes a flexed part that climbs over the locking flange in an axial direction according to radial direction deformation of the clip body. The distal end face of the flexed part is disposed on an axial direction extended line of the inner circumferential surface of the clip body, and disposed to be opposed to the locking flange and the engaging groove in the radial direction across a space part.

ADVANTAGEOUS EFFECTS OF THE INVENTION

[0007]

In the present invention having the characteristic explained above, even if the clip body is moved along the outer surface of the tube body into which the nipple is inserted, the distal end face of the flexed part does not collide with the outer surface of the tube body. While being kept radially expanded and deformed by the operation part, the clip body is moved toward the locking flange of the nipple and, after the flexed part of the hook climbs over the locking flange in the axial direction, the clip body is released

from the radial expansion by the operation part. As a result, the clip body is elastically and radially contracted and deformed, and the distal end face of the flexed part enters the engaging groove of the nipple through the use of the radial contraction and deformation. At the same time, the flexed part engages with the locking flange in the axial direction to be immovable. Thereafter, even if the tube body is radially contracted and deformed according to biting of the clip body into the outer surface of the tube body and aged deterioration, the flexed part moves in the radial direction inner side along the locking flange and an engaged state of the flexed part and the locking flange is maintained.

Therefore, it is possible to reliably retain the tube body with a simple structure irrespective of the radial contraction and deformation of the tube body while preventing scratches on the outer surface of the tube body.

As a result, compared with the conventional tube-fastening structure in which the L-shaped hook and the L-shaped cutout are engaged rotatably in the circumferential direction and the conventional tube-fastening structure in which, even if the clamp is about to be radially contracted and deformed according to the radial contraction and deformation of the hose, the engaging part is supported by the engaged part and hardly moves in the radial direction inner side and, when the place adjacent to the tightened place on the outer circumferential surface of the hose swells and the hose is deformed according to the tightening by the clamp, the clamp inclines and the engaging part easily slips off the engaged part, it is possible to maintain excellent slipping-off strength over a long period and prevent an accident due to slip-off of the tube body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is an explanatory diagram showing the overall configuration of a tube-fastening structure according to an embodiment of the present invention, wherein (a) is a front view, (b) is a sectional side view taken along line (1B)-(1B) of Fig. 1(a), and (c) is a longitudinal sectional front view taken along line (1C)-(1C) of Fig. 1(b).

Fig. 2 is a perspective view of a disassembled state, wherein (a) is an overall perspective view, (b) is a perspective view of a clip viewed from the opposite direction, (c) is a perspective view showing a radially expanded state of the clip, and (d) is a perspective view of the clip viewed from the opposite direction in the radially expanded state.

Fig. 3 is a perspective view and a side view showing a process for connecting a

tube body to a nipple, wherein (a) is a perspective view before insertion of the nipple into the tube body, (b) is a side view of the same state, (c) is a perspective view after the insertion of the nipple into the tube body, (d) is a side view of the same state, (e) is a perspective view after rotation of the clip, and (f) is a side view of the same state.

Fig. 4 is an enlarged perspective view showing of a modification of the clip.

Fig. 5 is an enlarged perspective view of another modification of the clip.

Fig. 6 is a longitudinal sectional front view showing a modification of the nipple.

Fig. 7 is a longitudinal sectional front view showing another modification of the nipple.

DESCRIPTIONS OF EMBODIMENTS

[0009]

An embodiment of the present invention is explained in detail below with reference to the drawings.

In a tube-fastening structure according to the embodiment of the present invention, as shown in Fig. 1 to Fig. 5, a nipple 1 of a joint B is inserted into a connection end portion of a tube body A and then the connection end portion of the tube body A is retained to the nipple 1 by a clip C.

That is, after the joint B is inserted into the tube body A, the tube body A is fastened (coupled) to the nipple 1 by the clip C to be immovable in a slipping-off direction F of the tube body A.

More specifically, the tube-fastening structure according to the embodiment of the present invention includes, as main components, the nipple 1 of the joint B inserted into the tube body A which is elastically deformable, a clip body 2 of the clip C elastically deformable in a radial direction in which the tube body A is held between the clip body 2 and the nipple 1 and tightened, operation parts 3 for elastic deformation provided in the clip body 2, and a hook 4 provided in the clip body 2 to project.

[0010]

The tube body A is, for example, a hose or a tube formed of a soft material having flexibility such as soft synthetic resin like vinyl chloride or silicon rubber or other rubber. The tube body A is desirably a tube body, an outer surface A1 and an inner surface A2 of which are flat.

As a specific example of the tube body A, as shown in Fig. 1 to Fig. 3, a hose of a single-layer structure is used.

As other examples, although not shown in the figures, it is also possible to use,

for example, a stacked hose (a blade hose) in which a plurality or a singularity of synthetic resin blade (a reinforced string) is embedded in a spiral shape as an intermediate layer between an outer layer and an inner layer, which are transparent or non-transparent, a spiral reinforced hose (a Vohran hose) in which a belt-like reinforcing material, for example, rectangular in section made of synthetic resin or metal and a linear reinforcing material, for example, circular in section are wound in a spiral shape and integrated as an intermediate layer, and a spiral reinforced hose in which a metal line material or a hard synthetic resin material is embedded in a spiral shape.

[0011]

The joint B includes the nipple 1 on one end side in an axial direction thereof.

The nipple 1 is formed of an undeformable rigid material such as metal like brass or hard synthetic resin in a substantially cylindrical shape having an outer diameter substantially the same as the inner diameter of the tube body A or formed in a thin cylindrical shape by pressing or otherwise molding a plate material made of a deformable hard material such as stainless steel.

Further, the nipple 1 includes, on the outer circumferential surface, an insertion part 11 inserted into a connecting end portion of the tube body A, a locking flange 12 formed at an end of the insertion part 11, and an engaging groove 13 provided on the side opposite to the insertion part 11 in the axial direction (an inserting direction G opposite to a slipping-off direction F) across the locking flange 12.

The locking flange 12 is desirably formed in an annular shape projecting in the radial direction on the outer circumferential surface of the nipple 1 and includes a notched part 12a through which a flexed part 41 (a second flange side surface 12d) of the hook 4 explained below can pass in the axial direction. As shown in Fig. 1 to Fig. 3, the notched part 12a is desirably formed in a concave shape such that the bottom surface thereof is disposed shallower than the depth of the inner bottom surface of the engaging groove 13. As another example, although not shown in the figures, it is also possible to form the notched part 12a in the concave shape such that the bottom surface is still shallower than the illustrated example or not to form the notched part 12a in the concave shape.

Further, it is desirable to form one or more (a singularity or a plurality of) notched parts 12a in a concave shape partially in the circumferential direction of the locking flange 12.

The engaging groove 13 is formed in the circumferential direction to be adjacent to the locking flange 12 and is set to be deeper than a projection amount of the

locking flange 12 and shallower than the outer circumferential surface of the nipple 1.

[0012]

The clip C includes a clip body 2 disposed to cover the outer circumference of the connection end portion of the tube body A, the operation parts 3 for elastically deforming the clip body 2, and at least one or more (a singularity or a plurality of) hooks 4 provided at an axial direction one end of the clip body 2.

The clip body 2 is formed by bending, in an annular shape, a strip member made of metal excellent in elastic resiliency such as spring steel or other elastic materials. The clip body 2 has an inner circumferential surface 2a elastically deformable in the radial direction.

The operation parts 3 are provided at circumferential direction both ends or one end of the strip member bent in the annular shape functioning as the clip body 2. The operation parts 3 are moved in the circumferential direction resisting a spring force of the clip body 2, whereby the annular strip member is elastically deformed in the radial direction to expand the inner diameter of the clip body 2.

In the example shown in Fig. 1 to Fig. 3, the clip body 2 and the hook 4 are integrally formed and the hook 4 is also made elastically deformable.

As another example, although not shown in the figure, it is also possible to separately form the clip body 2 and the hook 4 and integrate the clip body 2 and the hook 4 through welding or adhesion thereof. In this case, the hook 4 is also desirably formed of an elastically deformable material.

[0013]

The inner diameter of the clip body 2 is set to be substantially the same as or slightly smaller than the outer diameter of the tube body A in an initial state in which the nipple 1 is not inserted as shown in Figs. 2(a) and 2(b) and Figs. 3(a) and 3(b) at radial contraction time when the operation parts 3 are not operated to move. As shown in Figs. 1(a) to 1(c) and Figs. 3(e) and 3(f), in a connected state in which the clip body 2 is disposed to cover the outer circumference of the tube body A into which the nipple 1 is inserted, the inner diameter is set to be smaller than the outer diameter of the tube body A. The connection end portion of the tube body A is held in the radial direction between the clip body 2 and the insertion part 11 and elastically tightened.

At radial expansion time when the operation parts 3 are moved in the circumferential direction, as shown in Figs. 2(c) and 2(d) and Figs. 3(c) and 3(d), the inner diameter of the clip body 2 is set to be larger than not only the outer diameter of the tube body A in the initial state in which the nipple 1 is not inserted but also the outer diameter of the tube body A into which the nipple 1 is inserted. Consequently, a

gap is formed between the inner circumferential surface 2a of the clip body 2 and the outer surface A1 of the tube body A into which the nipple 1 is inserted. It is possible to freely move the clip body 2 of the clip C in the axial direction and the circumferential direction with respect to the outer surface A1 of the tube body A into which the nipple 1 is inserted.

[0014]

As a specific example of the clip C, as shown in Fig. 1 to Fig. 5, the clip C includes a pair of operation parts 3 respectively bent and formed at circumferential direction both ends of the strip member bent in the annular shape functioning as the clip body 2, a through-hole 2b formed from a circumferential direction one end portion of the strip member to one operation part 3, and a movable part 2c formed contiguously from the operation part 3 to be movable in the circumferential direction in the through-hole 2b.

At the radial contraction time by non-operation of the operation parts 3, as shown in Figs. 2(a) and 2(b) and Figs. 3(a) and 3(b), the through-hole 2b and the movable part 2c are disposed to overlap each other in the axial direction such that the operation parts 3 separate from each other. As shown in Figs. 2(c) and 2(d) and Fig. 3(c) and 3(d), the two operation parts 3 are pinched and moved to come close to each other by a tool, fingers, or the like, whereby the movable part 2c smoothly moves in the through-hole 2b. An overlapping amount on the through-hole 2b decreases and the through-hole 2b is radially expanded and deformed. By releasing the pinch of the operation parts 3 from the radially expanded state, the through-hole 2b is radially contracted deformed by a spring force of the clip body 2.

As another example, although not shown in the figures, it is also possible to form the operation parts 3 only at a longitudinal direction one end of the strip member functioning as the clip body 2 and change the shapes of the through-hole 2b, the movable part 2c, and the operation parts 3.

[0015]

A singularity or a plurality of hooks 4 are integrally formed or integrally fixedly attached to project in the axial direction and the radial direction in a part of the circumferential direction at an axial direction one end of the clip body 2. The hook 4 includes a flexed part 41 extending in the radial direction along the locking flange 12 of the nipple 1 and capable of climbing over the locking flange 12 in the axial direction according to the radial direction deformation of the clip body 2.

The flexed part 41 includes a first protrusion 41a extending to the radial direction outer side along a first flange side surface 12b of the locking flange 12, a

cylindrical part 41b extending from the distal end of the first protrusion 41a in the axial direction along a flange outer surface 12c of the locking flange 12, and a second protrusion 41c extending from the distal end of the cylindrical part 41b to the radial direction inner side toward the engaging groove 13 of the nipple 1 along the second flange side surface 12d of the locking flange 12.

The second protrusion 41c of the flexed part 41 is set to climb over the locking flange 12 in the axial direction according to the movement of the tube body A, into which the nipple 1 is inserted because of the radial expansion and deformation of the clip body 2, with respect to the outer surface A1 and enter the engaging groove 13 according to radial contraction and deformation of the clip body 2 thereafter.

[0016]

Further, the second protrusion 41c of the flexed part 41 has a distal end face 41d opposed to the inner bottom surface of the engaging groove 13 of the nipple 1 in the radial direction. The distal end face 41d of the second protrusion 41c is disposed to be opposed to the locking flange 12 and the engaging groove 13 across a space part S in the radial direction in a state in which the second protrusion 41c enters the engaging groove 13 of the nipple 1 according to the radial contraction and deformation of the clip body 2.

In the examples shown in Figs. 2(a) to 2(d), the distal end face 41d of the second protrusion 41c is disposed in substantially the same shape as the inner circumferential surface 2a of the clip body 2 in the axial direction.

As another example, although not shown in the figure, it is also possible to dispose the distal end face 41d of the second protrusion 41c in a concave shape further to the radial direction outer side than an axial direction extended line of the inner circumferential surface 2a of the clip body 2.

The space part S includes a first space S1 sectioned and formed between the cylindrical part 41b of the flexed part 41 and the flange outer surface 12c of the locking flange 12 and a second space S2 sectioned and formed between the second protrusion 41c of the flexed part 41 and the inner bottom surface of the engaging groove 13. When the tube body A is tightened between the clip body 2 and the insertion part 11 of the nipple 1 is radially contracted and deformed, the cylindrical part 41b of the flexed part 41 comes close to the flange outer surface 12c of the locking flange 12 in association with the radial contraction and deformation. At the same time, the second protrusion 41c of the flexed part 41 comes close to the inner bottom surface of the engaging groove 13. The second protrusion 41c of the flexed part 41 can be moved to the radial direction inner side along the second flange side surface 12d of the locking flange 12.

It is desirable that, in the flexed part 41, a space for rotation 41e wider in the

axial direction than the locking flange 12 of the nipple 1 is formed between the first protrusion 41a and the second protrusion 41c and the second protrusion 41c is rotated along the second flange side surface 12d of the locking flange 12 and the engaging groove 13.

[0017]

A method of connecting the tube body A to the joint B in the tube-fastening structure according to the embodiment of the present invention is explained according to process order.

First, in an initial state shown in Fig. 3(a), the tube body A is inserted through the clip body 2 of the clip C and then the nipple 1 of the joint B is inserted into the connection end portion of the tube body A. In the example shown in Fig. 3(a), the connection end portion of the tube body A is pushed in an inserting direction G against the nipple 1 of the joint B.

In the initial state, as shown in Fig. 3(b), the operation part 3 of the clip C is not operated to move, the clip body 2 is radially contracted. In this case, when the inner diameter of the clip body 2 is set substantially the same as the outer diameter of the tube body A, the inner circumferential surface 2a of the clip body 2 slides along the outer surface A1 of the tube body A. Therefore, it is possible to smoothly insert the clip C.

When the inner diameter of the clip body 2 is set to be slightly smaller than the outer diameter of the tube body A, the operation parts 3 of the clip C are moved close to the clip body 2 and the clip body 2 is radially expanded and deformed. Then, gaps are formed between the inner circumferential surface 2a of the clip body 2 and the distal end face 41d of the flexed part 41 and the outer surface A1 of the tube body A. Therefore, it is possible to smoothly insert the clip C.

[0018]

Subsequently, as shown in Figs. 3(c) and 3(d), while the clip body 2 is kept radially expanded and deformed by the operation parts 3 of the clip C, the clip body 2 and the hook 4 are moved in the inserting direction G to come close to the locking flange 12 of the nipple 1. Consequently, the flexed part 41 (the second protrusion 41c) of the hook 4 climbs over the locking flange 12 in the axial direction.

In the example shown in the figures, the distal end face 41d of the second protrusion 41c disposed substantially in the same shape in the axial direction as the inner circumferential surface 2a of the clip body 2 is moved in the inserting direction G. Consequently, the distal end face 41d smoothly passes in the axial direction without coming into contact with the bottom surfaces of the notched parts 12a and easily climbs

over the locking flange 12.

As another example, although not shown in the figure, it is also possible to partially elastically deform and move, in the inserting direction G, the entire hook 4 or at least the flexed part 41 (the second protrusion 41c) to make a change such that the distal end face 41d of the second protrusion 41c climbs over the bottom surfaces of the notched parts 12a formed in a concave shape shallower than the illustrated example and the flexed part 41 (the second protrusion 41c) of the hook 4 climbs over the locking flange 12 in the axial direction.

Note that, if a deformation amount of the clip body and the hook 4 is large, the notched parts 12a do not have to be formed in a concave shape.

[0019]

After the flexed part 41 of the hook 4 climbs over the locking flange 12 in the inserting direction G according to the movement, as shown in Figs. 3(e) and 3(f), the operation parts 3 are moved oppositely and the radial expansion and deformation of the clip body 2 is released. Then, the clip body 2 is elastically and radially contracted and deformed and nips and tightens the connection end portion of the tube body A between the clip body 2 and the nipple 1 of the joint B.

At the same time, the distal end face 41d of the flexed part 41 enters the engaging groove 13 of the nipple 1.

Consequently, the second protrusion 41c of the flexed part 41 engages with the second flange side surface 12d of the locking flange 12 in the slipping-off direction F to be immovable. Therefore, the connection end portion of the tube body A is retained to the nipple 1 of the joint B by the clip C. The tube body A is reliably connected to the joint B.

[0020]

With the tube-fastening structure according to the embodiment of the present invention explained above, in a preparation process for setting the clip C to the connection end portion of the tube body A into which the nipple 1 of the joint B is inserted, even if the clip body 2 is moved in the inserting direction G along the outer surface A1 of the tube body A, the distal end face 41d of the flexed part 41 does not collide with the outer surface A1 of the tube body A. Therefore, it is possible to prevent scratches on the outer surface A1 of the tube body A.

Subsequently, while the clip body 2 is kept radially expanded and deformed by the operation parts 3, the clip body 2 is moved toward the locking flange 12 of the nipple 1. After the flexed part 41 of the hook 4 climbs over the locking flange 12 in the inserting direction G, the clip body 2 is released from the radial expansion by the

operation parts 3. As a result, the clip body 2 is elastically and radially contracted and deformed, and the distal end face 41d of the flexed part 41 enters the engaging groove 13 of the nipple 1 through the use of the radial contraction and deformation. At the same time, (the second protrusion 41c of) the flexed part 41 engages with (the second flange side surface 12d of) the locking flange 12 in the axial direction to be immovable.

After the connection end portion of the tube body A is connected and fixed to the joint B by the clip C, even if the connection end portion of the tube body A is radially contracted and deformed according to biting of the clip body 2 into the outer surface A1 of the tube body A and aged deterioration, the second protrusion 41c of the flexed part 41 moves in the radial direction inner side along the second flange side surface 12d of the locking flange 12 and an engaged state of the flexed part 41 and the locking flange 12 is maintained.

Consequently, it is possible to reliably retain the tube body A irrespective of the radial contraction and deformation in the connection end portion of the tube body A.

Therefore, it is possible to maintain excellent slipping-off strength over a long period and prevent an accident due to slip-off of the tube body A.

[0021]

In particular, as in the illustrated example, when the locking flange 12 of the nipple 1 includes the notched parts 12a through which the flexed part 41 of the hook 4 can pass in the axial direction and the flexed part 41 includes the space for rotation 41e wider than the locking flange 12, as shown in Fig. 3(c), the flexed part 41 (the second protrusion 41c) of the hook 4 is caused to pass in the axial direction along the notched parts 12a of the locking flange 12, whereby the flexed part 41 (the second protrusion 41c) climbs over the locking flange 12 in the axial direction.

Further, when the notched parts 12a are formed in a concave shape shallower than the depth of the engaging groove 13, even if the operation parts 3 of the clip C are not forced to move close to the clip body 2 to radially expand the clip body 2 more than necessary, the flexed part 41 (the second protrusion 41c) of the hook 4 climbs over the locking flange 12. When the pinch of the operation parts 3 is released, even if the hook 4 is not rotated along the locking flange 12 (the second flange side surface 12d) according to the rotation operation of the clip body 2, the distal end face 41d of the flexed part 41 enters the engaging groove 13 of the nipple 1. The flexed part 41 (the second protrusion 41c) engages with the locking flange 12 (the second flange side surface 12d) in the axial direction to be immovable.

Therefore, even if a radial expansion and deformation amount of the clip body 2 by the operation parts 3 is small, it is possible to reliably retain the clip body 2 and

engage the clip body 2 with the locking flange 12.

Thereafter, as shown in Fig. 3(e), it is desirable to further rotate the clip body 2 to rotate the hook 4 along the locking flange 12 (the second flange side surface 12d) and move the flexed part 41 (the second protrusion 41c) to a place where the notched parts 12a are absent in the locking flange 12 (the second flange side surface 12d).

In this case, the flexed part 41 (the second protrusion 41c) is more reliably engaged with the locking flange 12 (the second flange side surface 12d) in the axial direction. Integrity can be improved.

When the hook 4 is configured such that the distal end face 41d of the second protrusion 41c is disposed in a concave shape further on the radial direction outer side than the axial direction extended line of the inner circumferential surface 2a of the clip body 2, the distal end face 41d of the second protrusion 41c and the outer surface A1 of the tube body A are further separated.

Consequently, it is possible to reliably prevent scratches on the outer surface A1 of the tube body A due to the distal end face 41d of the second protrusion 41c.

Note that, when the hook 4 is configured such that the flexed part 41 (the second protrusion 41c) of the hook 4 climbs over the locking flange 12 according to elastic deformation of the entire or a part of the hook 4, as shown in Fig. 3(e), it is unnecessary to further rotate the clip body 2.

Example 1

[0022]

Examples of the present invention are explained with reference to the drawings.

In an Example 1, as shown in Fig. 1 to Fig. 3, an annular recessed part 11a that fits in the radial direction with the tube body A tightened by the clip body 2 is provided in the circumferential direction in the insertion part 11 of the nipple 1, in a position opposed in the radial direction to, across the tube body A, an end portion 2d of the clip body 2, which is positioned in the axial direction with respect to the locking flange 12 by the hook 4.

[0023]

In the example shown in Fig. 1 to Fig. 3, a plurality of annular recessed parts 11a are formed in the insertion part 11. Any one of the annular recessed part 11a and the end portion 2d disposed on the side opposite to the hook 4 in the slipping-off direction F of the tube body A in the clip body 2 are disposed to be opposed to each other in the radial direction.

More specifically, a plurality of (a pair of) recessed grooves 11b are formed as the annular recessed part 11a to be spaced apart at a predetermined interval from each other in the axial direction. An edge is disposed as the end portion 2d of the clip body 2 to be opposed in the radial direction to a first step part 11c disposed in the most forward position in the slipping-off direction F of the tube body A among the recessed grooves 11b.

Further, the first step part 11c disposed in the most forward position in the slipping-off direction F of the tube body A among the recessed grooves 11b is erected substantially perpendicularly in the radial direction from the inner bottom surfaces of the recessed grooves 11b. Second step parts 11d respectively disposed in the direction opposite to the slipping-off direction F in the recessed grooves 11b, that is, in the inserting direction G of the tube body A incline to be gradually radially expanded from the inner bottom surfaces of the recessed grooves 11b toward the inserting direction G.

Consequently, the tube body A is tightened toward the insertion part 11 by the clip body 2 including the movable part 2c and is elastically deformed along the annular recessed part 11a. Therefore, the inner surface A2 of the tube body A engages with the annular recessed part 11a. The end portion 2d of the clip body 2 disposed on the side opposite to the hook 4 and the first step part 11c of the recessed grooves 11b engage in the axial direction.

As another example, although not shown in the figure, it is also possible to form one or three or more annular recessed parts 11a in the insertion part 11 and arrange step parts of the annular recessed parts 11a to be opposed to the end portion 2d of the clip body 2 in the radial direction.

[0024]

With the tube-fastening structure according to the Example 1 of the present invention, the clip body 2 positioned in the axial direction with respect to the locking flange 12 of the nipple 1 by the hook 4 is elastically and radially contracted and deformed, whereby the end portion 2d of the clip body 2 holds the tube body A and fits with the annular recessed part 11a (the first step part 11c) of the insertion part 11 in the radial direction. Therefore, frictional resistance in the axial direction of the inner surface A2 of the tube body A against the insertion part 11 of the nipple 1 further increases.

Therefore, it is possible to make the tube body A less easily slip off the nipple 1.

As a result, there is an advantage that it is possible to attain further improvement of slipping-off strength of the tube body A against the nipple 1.

[0025]

In particular, in the example shown in Fig. 1 to Fig. 3, an engaging hole 2e is pierced and drilled separately from the through-hole 2b in the strip member functioning as the clip body 2.

The engaging hole 2e is disposed such that a part of a hole edge thereof is opposed to, across the tube body A, a first step part 11c erected substantially perpendicularly in the radial direction from the inner bottom surface of a recessed groove 11b.

The shape of the engaging hole 2e is not limited to an illustrated example and can be changed.

Consequently, the hole edge of the engaging hole 2e bites into, through tightening of the clip body 2, the outer surface A1 of the tube body A, into which the nipple 1 is inserted, shown in Figs. 1(a) to 1(c) and Figs. 3(e) and 3(f) and increases the frictional resistance of the outer surface A1 and the clip body 2. At the same time, a part of the hole edge of the engaging hole 2e fit with the first step part 11c of the annular recessed part 11a in the radial direction across the tube body A. Therefore, the frictional resistance in the axial direction of the inner surface A2 of the tube body A against the insertion part 11 of the nipple 1 further increases.

As another example, as shown in Fig. 4, the engaging hole 2e does not have to be provided.

[0026]

Further, in the example shown in Fig. 1 to Fig. 3, in the nipple 1, further on the axial direction other end side than the engaging groove 13, a tool engaging part 14 with which a tool (not shown in the figure) such as a spanner or a wrench engages and a connecting part 15 for connection to another tube connection port (not shown in the figure) formed by another apparatus or another tube body are respectively integrally formed.

As the tool engaging part 14, a hexagonal nut is formed.

In the connecting part 15, when an inner thread is cut on the inner circumferential surface of a tube connection port in another apparatus, another tube body, or the like connected to the joint B, an outer thread corresponding to the inner thread is cut. When an outer thread is cut on the outer circumferential surface of the tube connection port, an inner thread corresponding to the outer thread is cut. In the illustrated example, an outer thread is cut as the connecting part 15.

As another example, although not shown in the figure, it is also possible to separately form the nipple 1 and the joint B and detachably attach the nipple 1 and the joint B.

[0027]

Further, it is also possible to connect the nipple 1 of the joint B and another apparatus or another tube body with the connecting part 15 to allow the nipple 1 and the other apparatus or the other tube body to electrically communicate with each other.

In particular, when the joint B, the clip body 2 of the clip C, and the hook 4 are formed of a conductive material such as metal, in a connection state of the tube body A and the joint B, the hook 4 of the clip body 2 in contact with the outer surface A1 of the tube body A is in contact with the locking flange 12 of the nipple 1. Therefore, the outer surface A1 of the tube body A is in an electrically communicating state with the nipple 1 or another apparatus or another tube body via the clip body 2.

In addition, when a conductive part or an outermost layer made of a conductive material is provided on the outer surface A1 of the tube body A in order to remove static electricity generated by transfer of fluid flowing through the tube body A, the static electricity generated by the transfer of the fluid can be earthed to the nipple 1 side from the outer surface A1 of the tube body A through the clip body 2. Consequently, it is possible to provide the tube-fastening structure excellent in safety.

[0028]

When the connecting part 15 is connected to another tube connection port by a thread, depending on a screwing state of the connecting part 15, it is likely that the notched parts 12a of the locking flange 12 are disposed at an angle at which the notched parts 12a are less easily seen from the operator.

Therefore, in the illustrated example, the plurality of (the pair of) notched parts 12a are respectively formed at every predetermined interval in the circumferential direction in the locking flange 12.

As another example, although not shown in the figure, it is also possible to form three or more notched parts 12a respectively at every predetermined interval in the circumferential direction in the locking flange 12.

Example 2

[0029]

An Example 2 is different from the Example 1 shown in Fig. 1 to Fig. 4 in a configuration in which, as shown in Fig. 5, a plurality of hooks 4 are respectively provided at every predetermined interval in the circumferential direction at the axial direction one end of the clip body 2 and, in the locking flange 12, the notched parts 12a equal to or more than the number of hooks 4 are respectively formed at every predetermined interval in the circumferential direction. Otherwise, the Example 2 is

the same as the Example 1 shown in Fig. 1 to Fig. 4.

[0030]

In an example shown in Fig. 5, at an axial direction one end of the clip body 2, a pair of hooks 4 is formed at every predetermined interval in the circumferential direction to be opposed to the pair of notched part 12a formed in the locking flange 12.

As another example, although not shown in the figure, it is also possible to form, at the axial direction one end of the clip body 2, three or more hooks 4 respectively at every predetermined interval in the circumferential direction.

[0031]

With the tube-fastening structure according to the Example 2 of the present invention explained above, the clip body 2 engages with the locking flange 12 of the nipple 1 in the circumferential direction with a plurality of hooks 4 in a well-balanced state. It is possible to prevent backlash of the clip body 2 with respect to the locking flange 12 of the nipple 1.

Consequently, there is an advantage that the tightening by the clip body 2 is more stabilized and excellent slipping-off strength can be maintained for a longer period than in the Example 1 shown in Fig. 1 to 4 and it is possible to prevent an accident due to slip-off of the tube body A.

Note that, in the example shown in Fig. 5, the engaging hole 2e is pierced through and drilled in the strip member functioning as the clip body 2. However, not only this, but, as in the example shown in Fig. 4, the engaging hole 2e does not have to be provided.

Example 3

[0032]

An Example 3 is different from the Example 1 shown in Fig. 1 to Fig. 4 and the Example 2 shown in Fig. 5 in a configuration in which, as shown in Fig. 6 and Fig. 7, in the insertion part 11 of the nipple 1, an annular seal member 16 that comes into press contact with, in the radial direction, the inner surface A2 of the tube body A tightened by the clip body 2 is provided in a position opposed to the clip body 2, which is positioned in the axial direction by the hook 4 with respect to the locking flange 12, across the tube body A in the radial direction. Otherwise, the Example 3 is the same as the Example 1 shown in Fig. 1 to Fig. 4 and the Example 2 shown in Fig. 5.

[0033]

In an example shown in Fig. 6, an annular projected part 11e is formed in the insertion part 11. The annular seal member 16 is embedded in the annular projected

part 11e such that the outer circumferential end of the annular seal member 16 projects from the outer circumferential surface of the insertion part 11. The disposition positions of the annular projected part 11e and the annular seal member 16 are aligned to overlap, in the radial direction, the strip member of the clip body 2 positioned in the axial direction by the hook 4 with respect to the locking flange 12.

More specifically, in the annular projected part 11e, a locking groove 11f is annularly recessed. By fitting the annular seal member 16 in the inside of the locking groove 11f, the outer circumferential end of the annular seal member 16 is held immovably in the axial direction to partially project from the outer circumferential surface of the annular projected part 11e.

As the annular seal member 16, it is desirable to use a gasket 16a formed of an elastically deformable O-ring or the like made of an elastic body such as rubber. The gasket 16a is disposed to be opposed to the movable part 2c, which is disposed in the axial direction substantially center part of the clip body 2, in the radial direction across the tube body A.

[0034]

In an example shown in Fig. 7, a plurality of (a pair of) annular seal members 16 are embedded in a plurality of annular recessed parts 11a formed in the insertion part 11 such that the external circumferential ends of the respective annular seal members 16 project from the inner bottom surfaces of the recessed grooves 11b. The disposition positions of the annular projected part 11e and the annular seal members 16 are aligned such that the annular projected part 11e and the annular seal members 16 overlap, in the radial direction, the strip member of the clip body 2 positioned in the axial direction by the hook 4 with respect to the locking flange 12.

More specifically, in the recessed grooves 11b of the annular recessed parts 11a, the locking grooves 11f are recessed in an annular shape. The annular seal members 16 are fit in the insides of the locking grooves 11f, whereby the outer circumferential ends of the annular seal members 16 are held immovably in the axial direction to partially project from the inner bottom surfaces of the recessed grooves 11b.

As the annular seal members 16, it is desirable to use gaskets 16b formed of elastically deformable O-rings or the like made of an elastic body such as rubber. A plurality of (a pair of) gaskets 16b are disposed to be opposed to axial direction both end parts of the clip body 2 in the radial direction across the tube body A.

[0035]

With the tube-fastening structure according to Example 3 of the present invention, the clip body 2 positioned in the axial direction by the hook 4 with respect to

the locking flange 12 of the nipple 1 is elastically and radially contracted and deformed, whereby the inner surface A2 of the tube body A is strongly pressed against the annular seal member 16 (the outer circumferential ends of the gaskets 16a and 16b) and the inner surface A2 of the tube body A and the annular seal members 16 strongly adhere to each other.

Therefore, it is possible to reliably seal the inner surface A2 of the tube body A and the insertion part 11 of the nipple 1 with adequate tightening of the clip body 2.

As a result, simply by adequately tightening the clip body 2, it is possible to further prevent a leak from the tube body A than the Example 1 shown in Fig. 1 to Fig. 4 and the Example 2 shown in Fig. 5. In particular, even if the inner surface A2 of the tube body A is deteriorated in elastic resiliency because of permanent strain through use for a long period like a hose made of synthetic resin, since the annular seal member 16 continues to be strongly compression-bonded to the inner surface A2, a gap is not formed. It is possible to maintain pipe connection without a leak for a long period.

Consequently, there is an advantage that even the tube body A having flexibility like the hose made of synthetic resin can be used as a pipe material in a place left as connected for a long period such as an indoor pipe of a house.

Note that, in the example shown in Fig. 6, one annular seal member 16 is disposed to be opposed to the axial direction substantially center part of the clip body 2 in the radial direction. In the example shown in Fig. 7, a plurality of (a pair of) annular seal members 16 are disposed to be opposed to the axial direction both end parts of the clip body 2. However, not only this, but it is also possible to dispose the annular seal members 16 to be opposed to places other than the axial direction substantially center part and the axial direction both end parts of the clip body 2 or dispose three or more annular seal members 16 or change the number of annular seal members 16.

REFERENCE SIGNS LIST

[0036]

- A Tube body
- A2 Inner surface
- 1 Nipple
- 11 Insertion part
- 11a Annular recessed part
- 12 Locking flange
- 12a Notched part

- 13 Engaging groove
- 2 Clip body
- 2a Inner circumferential surface
- 2d End portion
- 3 Operation parts
- 4 Hook
- 41 Flexed part
- 41d Distal end face
- 41e Space for rotation
- 16 Annular seal member
- S Space part

CLAIMS

Claim 1

A tube-fastening structure comprising:

- a nipple inserted into a tube body which is elastically deformable;
 - a clip body elastically deformable in a radial direction in which said tube body is held between the clip body and said nipple and tightened;
 - an operation part for elastic deformation provided in said clip body; and
 - a hook provided in said clip body to project, wherein
- said nipple includes: an insertion part inserted into said tube body; a locking flange provided at an end of said insertion part; and an engaging groove provided on the side opposite to said insertion part across said locking flange,
- said hook includes a flexed part that climbs over said locking flange in an axial direction according to radial direction deformation of said clip body, and
- a distal end face of said flexed part is disposed on an axial direction extended line of an inner circumferential surface of said clip body, and disposed to be opposed to said locking flange and said engaging groove in the radial direction across a space part.

Claim 2

The tube-fastening structure according to claim 1, wherein said locking flange of said nipple includes a notched part through which said flexed part of said hook can pass in the axial direction, and said flexed part has a space for rotation wider than said locking flange.

Claim 3

The tube-fastening structure according to claim 1 or 2, wherein an annular recessed part that fits in the radial direction with said tube body tightened by said clip body is provided in the circumferential direction in said insertion part of said nipple, in a position opposed in the radial direction to, across said tube body, an end portion of said clip body positioned in the axial direction with respect to said locking flange by said hook.

Claim 4

The tube-fastening structure according to claim 1, 2, or 3, wherein an annular seal member that is in press contact with, in the radial direction, an inner surface of the

tube body tightened by said clip body is provided in said insertion part of said nipple, in a position opposed in the radial direction to, across said tube body, said clip body positioned in the axial direction with respect to said locking flange by said hook.