CLAIMS

[Claim 1]

A protective unit comprising:

a reticulated tube that includes a plurality of openings that are reticulately formed, and that is configured to accommodate the plurality of optical fibers inserted through the reticulated tube; and

a tubular member that is inserted through the reticulated tube and that is configured to accommodate a plurality of optical fibers inserted through the tubular member, wherein

the reticulated tube includes

peripheral parts that form the openings, and

a branch part that is formed in a boundary of three or more openings, the branch part including three or more peripheral parts extending from the branch part,

the peripheral parts are restricted by the branch part and are bendable, and

the reticulated tube is disposed on an outer periphery of the tubular member while the reticulated tube is folded in a longitudinal direction with the peripheral parts bent.

[Claim 2]

The protective unit according to claim 1, wherein

the reticulated tube is disposed on the outer periphery of the tubular member while the reticulated tube is folded in the longitudinal direction to have a length shorter than a length of the tubular member, and

both ends of the tubular member extend from respective end parts on both sides of the reticulated tube.

[Claim 3]

The protective unit according to claim 1 or 2, wherein

an end part of the reticulated tube is temporarily fixed to the tubular member.

[Claim 4]
The protective unit according to any of claims 1 to 3, wherein
a bent section of the peripheral parts is configured to deform plastically, and
the peripheral parts are configured to hold a bent shape.

[Claim 5]
The protective unit according to any of claims 1 to 4, wherein
the reticulated tube comprises:
a plurality of first wires disposed in a spiral shape in a predetermined direction; and
a plurality of second wires disposed in a direction different from that of the first wires,
the first wires or the second wires constitute the peripheral parts, and
a bonding part at an intersection point of the first wire and the second wire constitutes the branch part.

[Claim 6]
The protective unit according to claim 5, wherein
the intersection point of the first wire and the second wire is fusion-bonded.

[Claim 7]
The protective unit according to any of claims 1 to 6, wherein
in a cross section of the reticulated tube that intersects the branch part, two or more branch parts are present.

[Claim 8]
The protective unit according to claim 7, wherein
in a cross section of the reticulated tube that intersects the branch part, three or more branch parts are present.

[Claim 9]
The protective unit according to any of claims 1 to 8, wherein

a value of S1/(S1 + S2) is less than or equal to 0.555, where

S1 is an area occupied by the openings with the reticulated tube being developed, and

S2 is an area occupied by the peripheral parts.

[Claim 10]

The protective unit according to any of claims 1 to 9, wherein

L1/L0 is less than or equal to 0.13, where

L0 is a length of the reticulated tube before contraction in the longitudinal direction, and

L1 is a length of the reticulated tube after contraction in the longitudinal direction.

[Claim 11]

The protective unit according to any of claims 1 to 10, wherein

the reticulated tube in a folded state is extendable in the longitudinal direction by pulling out an end part of the reticulated tube from the tubular member.

[Claim 12]

The protective unit according to claim 11, wherein

an opening of at least one end part of the tubular member is widened.

[Claim 13]

The protective unit according to claim 12, wherein

an outer diameter of the end part having a widened opening is greater than an inner diameter of the reticulated tube in the folded state.

[Claim 14]

A method for protecting an optical fiber, the method comprising:

preparing a protective unit comprising:

a reticulated tube including

a plurality of openings that are reticulately formed,

peripheral parts that form the openings, and

a branch part that is formed in a boundary of three or more openings, wherein

the branch part includes three or more peripheral parts extending from the branch part, and

the peripheral parts are restricted by the branch part and are bendable; and

a tubular member inserted through the reticulated tube that is folded in a longitudinal direction by bending the peripheral parts;

inserting a plurality of optical fibers through the reticulated tube while the reticulated tube is folded by inserting the plurality of optical fibers from an end part of the folded reticulated tube by inserting the plurality of optical fibers into the tubular member; and

extending the folded-state reticulated tube in the longitudinal direction by pulling out the end part of the reticulated tube from the tubular member, and inserting the plurality of optical fibers through the reticulated tube in an extended state.

[Claim 15]

The method for protecting an optical fiber according to claim 14, wherein

the reticulated tube includes a plurality of first wires disposed in a spiral shape in a predetermined direction, and a plurality of second wires disposed in a direction different from that of the first wires, and intersection points of the first wire and the second wire are bonded, and

when a pitch of the intersection points in a longitudinal direction of the reticulated tube is P (mm), an inner diameter of the reticulated tube is D (mm), and a diameter of a unit constituted

by the plurality of optical fibers is Y (mm),

the following equations are satisfied:

$0.6 \leq D/Y \leq 1.2$; and

$6.0 \text{ (mm)} \leq P \times D/Y \leq 20.0 \text{ (mm)}$.

[Claim 16]

A method for manufacturing a protective unit, comprising:

forming the reticulated tube including a plurality of openings that are reticulately formed, the reticulated tube being configured to accommodate a plurality of optical fibers inserted through the reticulated tube, the reticulated tube including

peripheral parts that form the openings, and

a branch part that is formed in a boundary of three or more openings, wherein the branch part includes three or more peripheral parts extending from the branch part, and

the peripheral parts are restricted by the branch part and are bendable; and

manufacturing the protective unit including the reticulated tube and the tubular member by disposing the reticulated tube folded in a longitudinal direction by bending the peripheral parts on an outer periphery of the tubular member that is configured to accommodate insertion of the plurality of optical fibers.

[Claim 17]

The method for manufacturing the protective unit according to claim 16, comprising:

supplying a plurality of first wires to a heating section while twisting the plurality of first wires in a predetermined direction;

supplying a plurality of second wires to the heating section while twisting the plurality of second wires in a reverse direction to the first wires; and

fusing an intersection point of the first wire and the second wire in the heating section,

thus forming the reticulated tube in which the first wires

or the second wires constitute the peripheral parts, and a bonding part formed by fusing the intersection point of the first wire and the second wire constitutes the branch part.

[Claim 18]

The method for manufacturing the protective unit according to claim 16, further comprising:

winding, in a spiral arrangement in a predetermined direction, a plurality of first wires around an outer surface of a guiding section that is disposed through a hollow shape of a heating section, and winding, in a spiral arrangement in a reverse direction to the predetermined direction, a plurality of second wires around the outer surface of the guiding section; and

fusing intersection points of the first wires and the second wires in the heating section by passing the plurality of the first wires and the plurality of the second wires wound around the outer surface of the guiding section through a gap formed between an inner surface of the heating section and an outer surface of the guiding section,

thus forming the reticulated tube in which the first wires or the second wires constitute the peripheral parts, and bonding parts formed by fusing the intersection points of the first wires and the second wires constitute the branch part.

[Claim 19]

The method for manufacturing the protective unit according to any of claims 16 to 18, further comprising:

moving the reticulated tube along an outer surface of a tube contracting section by moving the reticulated tube to the tube contracting section, to dispose the reticulated tube outside the outer surface of the tube contracting section; and

folding the reticulated tube in the longitudinal direction by contracting the reticulated tube on the outer surface of the tube contracting section.

[Claim 20]
The method for manufacturing the protective unit according to claim 19, further comprising:

disposing the tubular member on a downstream side of the tube contracting section;

moving the reticulated tube folded in the longitudinal direction from the tube contracting section to the tubular member; and

cutting the reticulated tube to manufacture the protective unit including the reticulated tube and the tubular member.

[Claim 21]
The method for manufacturing the protective unit according to claim 19, further comprising:

cutting the tube contracting section together with the reticulated tube in a state where the reticulated tube is folded in the longitudinal direction on the outer surface of the tube contracting section, to manufacture the protective unit including the reticulated tube, and the tubular member constituted by the cut tube contracting section.