

DESCRIPTION

TITLE OF INVENTION

CAP

5 Technical Field

[0001] The present invention relates to a cap for attachment to a container, a container including this cap, and a method for manufacturing a cap.

10 Background Art

[0002] Caps for attachment to an infusion container include an elastic member made of rubber or the like to enable the stabbing of a syringe or catheter needle. Various types of such a cap have been conventionally proposed. For example, Patent Literature 1 discloses a cap having a structure in which an elastic member is sandwiched between the respective upper end portions of an outer frame member and an inner frame member that are tube-shaped, and the outer circumferential portion of the inner frame member is fitted into the lower end portion of the outer frame member. Also, Patent Literature 2 discloses a cap having a structure in which an elastic member is fixed to the inner wall surface of a tube-shaped frame member, and the elastic member is swaged by bending the upper end portion of the frame member inward. Furthermore, Patent Literature 3 discloses a cap in which a tube-shaped frame member and a thermoplastic elastic member are subjected to two-color molding.

[0003] However, the caps disclosed in the above documents have problems such as the following. The cap in Patent Literature 1 has a structure in which the outer circumferential portion of the inner frame member is simply fitted into the lower end
5 portion of the outer frame member, and therefore if the dimensional precision of the two members is poor, there is a risk of coming apart due to vibration on the transport path in the manufacturing line. Also, with the cap in Patent Literature 2, the upper end portion of the frame member is changed in shape
10 so as to swage the elastic member, and this has the problems of being time-consuming in manufacturing and leading to poor production efficiency. Furthermore, with the cap in Patent Literature 3, the frame member and the elastic member are fixed by two-color molding, and this has the problem of fluid leakage
15 due to low elastic member fixing strength and compression.

[0004] In view of this, Patent Literature 4 discloses a cap having a structure in which an elastic member is sandwiched between the respective lower end portion and upper end portion of an outer frame member and an inner frame member that are
20 tube-shaped, and the lower end portion of the outer frame member and the upper end portion of the inner frame member are fixed by ultrasonic welding. This cap is configured such that ultrasonic welded portions protrude radially inward while being melted, so as to compress the elastic member.

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Citation List

Patent Literature

[0005] Patent Literature 1: JP S59-169835U

Patent Literature 2: JP H3-88535U

Patent Literature 3: JP 2000-140068A

Patent Literature 4: JP H2-23544U

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Summary of Invention

[0006] However, with the cap in Patent Literature 4, there is a risk of the portions melted by the ultrasonic welding flowing radially outward as well and protruding outward of the cap. If
10 this protrusion of material occurs, the outer shape of the cap changes, and this has a risk of reducing positioning precision when attaching the cap to a container.

[0007] The present invention has been achieved in order to solve the aforementioned problems, and an object thereof is to provide
15 a cap that can prevent the material constituting the cap from protruding radially outward due to welding.

[0008] A cap according to the present invention is a cap for attachment to a container body, the cap including: an inner
20 frame member shaped as a tube having a first end portion and a second end portion in an axial direction, a flange portion that protrudes radially outward being formed on the second end portion side; an outer frame member that has a first end portion and a second end portion in an axial direction, and is shaped
25 as a tube to be placed around the inner frame member, an outer frame engaging portion being formed on the first end portion, and a cover portion that covers an outer periphery of the flange

portion being formed on the second end portion; and an elastic member that is sandwiched between the outer frame engaging portion of the outer frame member and the first end portion of the inner frame member, and blocks the first end portion of the inner frame member, wherein the cap has a weld portion in which the flange portion of the inner frame member and a portion of an inner wall surface of the outer frame member are fixed by welding, a gap located radially outward relative to the weld portion is formed between the cover portion of the outer frame member and the flange portion of the inner frame member, and the gap extends from the weld portion and is open on the second end portion side of the outer frame member in the axial direction.

[0009] According to this configuration, a gap is formed between the flange portion of the inner frame member and the cover portion of the outer frame member. This gap extends from the weld portion in which the inner frame member and the outer frame member are fixed, and is open on the second end portion side of the outer frame member in the axial direction. For this reason, even if material flows out of the weld portion, the material flows into the gap, thus making it possible to prevent the material from flowing to the outer periphery of the cap. Also, even if the melted material flows out of the gap, the gap is open on the second end portion side of the outer frame member, thus making it possible to prevent the material from flowing radially outward from the cap. Accordingly, the outer diameter of the cap does not change, thus making it possible to precisely

attach the cap to a container.

[0010] In the cap having the above configuration, the weld portion may be formed using various methods, one example being formation by ultrasonic welding. According to this
5 configuration, the outer frame member and the inner frame member can be assembled in advance and then fixed together by the application of ultrasound in that state.

[0011] In the cap having the above configuration, the weld portion may be formed by a protruding portion or a receding portion formed on the outer frame member and a receding portion
10 or a protruding portion formed on the inner frame member being fitted together. This configuration facilitates positioning when assembling the outer frame member and the inner frame member.

[0012] In the cap having the above configuration, the gap may be 0.1 to 1.0 mm. This is because if the gap is smaller than 0.1 mm, it is difficult for melted material to flow therein, and if the gap is larger than 1.0 mm, there is a risk of an unexpected failure due to the gap being unnecessarily large.

[0013] The cap having the above configuration may further include a thin film that blocks the first end portion of the inner frame member, wherein the elastic member may be arranged between the thin film and the outer frame engaging portion of the outer frame member. According to this configuration, it
20 is possible to prevent the contents of the container and the elastic member from coming into contact with each other.

[0014] In the cap having the above configuration, various

configurations are possible, and the outer frame member may include a tube-shaped main body portion that has a first end portion and a second end portion in an axial direction, and the cover portion provided integrally with an outer circumferential surface of the second end portion of the main body portion, and the weld portion may be formed by welding of an end surface of the second end portion of the main body portion and a surface of the flange portion that faces the first end portion side.

[0015] A first container according to the present invention is a container including: a container body that has a bag-like shape and is provided with tube-shaped port capable of discharging contents; and any of the above-described caps, wherein at least one of the second end portion of the outer frame member and the second end portion of the inner frame member is fixed to the port of the container body.

[0016] Also, a second container according to the present invention is a container including: a container body formed with a bag-like shape by overlaying a pair of films; and any of the above-described caps, wherein a tube-shaped insertion portion that extends in a direction opposite to the first end portion is provided on the second end portion of the inner frame member, and the insertion portion of the inner frame member is fixed between the pair of films of the container body.

[0017] A method for manufacturing a cap according to the present invention is a method for manufacturing a cap for attachment to a container body, including: preparing an inner frame member shaped as a tube having a first end portion and a second end

portion in an axial direction, a flange portion that protrudes radially outward being formed on the second end portion side; preparing an outer frame member that has a first end portion and a second end portion in an axial direction, and is shaped
5 as a tube to be placed around the inner frame member, an outer frame engaging portion being formed on the first end portion side, and a cover portion that covers an outer periphery of the flange portion being formed on the second end portion side; sandwiching an elastic member between the outer frame engaging
10 portion of the outer frame member and the first end portion of the inner frame member such that an opening of the first end portion of the inner frame member is blocked by the elastic member, and forming a gap between the cover portion of the outer frame member and the flange portion of the inner frame member,
15 the gap being open on the second end portion side of the outer frame member in the axial direction; and welding, by ultrasonic welding, the flange portion of the inner frame member and a portion of an inner wall surface of the outer frame member at a location radially inward of the gap.

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[0018] According to the present invention, it is possible to prevent the material constituting a cap from protruding radially outward due to welding.

25 Brief Description of Drawings

[0019] FIG. 1 is a cross-sectional diagram showing an embodiment of a cap according to the present invention.

FIG. 2 is a cross-sectional diagram showing an example of a method for manufacturing the cap in FIG. 1.

FIG. 3 is a cross-sectional diagram showing another example of a cap according to the present invention.

5 FIG. 4 is a cross-sectional diagram showing yet another example of a cap according to the present invention.

FIG. 5 is a cross-sectional diagram showing still another example of a cap according to the present invention.

10 Description of Embodiments

[0020] The following describes an embodiment in the case where a cap according to the present invention is attached to an infusion bag, with reference to the drawings. FIG. 1 is a cross-sectional diagram of a cap according to the present
15 embodiment. Hereinafter, the term "vertical" will refer to the vertical direction in FIG. 1 for the sake of convenience in the description, but the direction of the cap according to the present invention is not intended to be limited to this. Also, in the following embodiment, the upper end portions of the
20 members correspond to portions on the first end portion side of the present invention, and the lower end portions correspond to portions on the second end portion side of the present invention. Also, the vertical direction corresponds to the axial direction of the present invention.

25 [0021] 1. Structure of cap

As shown in FIG. 1, a cap 10 of the present embodiment is for attachment to a port 30 of an infusion bag 20, and is

constituted by assembling an inner frame member 1 and an outer frame member 2 that are tube-shaped, and sandwiching a disk-shaped elastic member 3 therebetween. A film-like closure member 4 is attached to the upper end opening of the cap 10.

[0022] The inner frame member 1 includes a cylindrical main body portion 11 and a flange portion 12 that protrudes radially outward from the lower end portion of the main body portion 11, and these two portions are formed integrally with each other. A thin film 13 that blocks the upper end opening of the main body portion 11 is integrally formed at a position somewhat downward from the upper end of the main body portion 11. Also, a ring-shaped groove 121 is formed in the upper surface of the flange portion 12.

[0023] The outer frame member 2 includes a cylindrical main body portion 21 and a cylindrical cover portion 22 that extends downward from the outer circumferential face of the lower end portion of the main body portion 21, and these two portions are formed integrally with each other. Accordingly, a step is formed on the inner circumferential surface and the outer circumferential surface of the connection portion between the main body portion 21 and the cover portion 22. The inner diameter of the main body portion 21 is larger than the outer diameter of the main body portion 11 of the inner frame member 1, and a ring-shaped protrusion portion 211 that fits into the groove 121 of the flange portion 12 of the inner frame member 1 is formed on the lower end surface of the main body portion

21. The length of the protrusion portion 211 and the depth of the groove 121 can be set to 0.5 to 3.0 mm, for example. Also, the inner diameter of the cover portion 22 is larger than the outer diameter of the flange portion 12 of the inner frame member 1, and the cover portion 22 is arranged so as to cover the outer circumferential surface of the flange portion 12. Here, it is preferable that a gap s between the inner circumferential surface of the cover portion 22 and the outer circumferential surface of the flange portion 12 is 0.1 to 1.0 mm. This is because if the gap is smaller than 0.1 mm, it is difficult for melted material to flow therein during the fixing of the members 1 and 2, as will be described later, and if the gap is larger than 1.0 mm, there is a risk of an unexpected failure due to the gap being unnecessarily large. Also, the lower end of the cover portion 22 and the lower end of the flange portion 12 of the inner frame member 1 are adjusted so as to be arranged at approximately the same position in the vertical direction.

[0024] The upper end portion of the main body portion 21 of the outer frame member 2 constitutes an outer frame engaging portion 212 for fixing the elastic member 3. Specifically, in the outer frame engaging portion 212, the upper end portion of the main body portion 21 is bent inward such that the tip portion thereof faces downward and opposes the upper end portion 111 of the inner frame member 1, thus forming a U-shaped cross-section. The tip of the outer frame engaging portion 212 opposes the upper end portion 111 of the main body portion 11 of the inner frame member 1 via a gap, and the elastic member 3 is sandwiched in a

liquid-tight manner in this gap.

[0025] The outer frame member 2 can be formed using various types of materials, one example of which is a thermoplastic resin such as polyethylene or polypropylene. Using this type of material
5 makes it possible to perform manufacturing using injection molding or the like. The inner frame member 1 can also be formed using a similar material and using injection molding or the like, and it is preferable that the inner frame member 1 is formed using a material that is compatible with the outer frame member
10 2 in order to weld the members 1 and 2 for fixing.

[0026] Next, the elastic member 3 and the closure member 4 will be described. The elastic member 3 is disk-shaped, and a ring-shaped groove 31 is formed in the vicinity of the outer periphery of the upper surface. The tip portion of the outer
15 frame engaging portion 212 of the outer frame member 2 is fitted into the groove 31. Also, the upper surface of the elastic member 3 (the portion inward of the groove 31) is formed so as to be flush with the upper end of the outer frame member 2, and the above-described closure member 4 is attached by heat welding
20 or the like so as to cover the upper end of the outer frame member 2 and the upper surface of the elastic member 3. A known peel film formed so as to be film-like can be employed as the closure member 4. As another example, a pull ring formed integrally with the upper end of the outer frame member 2 can be employed.
25 Note that the upper surface of the elastic member 3 and the upper end of the outer frame member 2 do not necessarily need to be flush, and, for example, somewhat of a gap can be formed between

the closure member 4 and the elastic member 3 by lowering the upper surface of the elastic member 3 relative to the upper end of the outer frame member 2.

[0027] A ring-shaped groove 32 is also formed in the lower surface of the elastic member 3 in the vicinity of the outer periphery thereof, and the upper end portion 111 of the main body portion 11 of the inner frame member 1 is fitted into the groove 32. When the elastic member 3 is fitted into the upper end portion 111, the lower surface of the elastic member 3 is arranged so as to come into contact with the upper surface of the thin film 13. Here, the upper end portion 111 fitted into the elastic member 3 corresponds to an inner frame engaging portion of the present invention.

[0028] There are no particular limitations on the material constituting the elastic member 3, and examples of materials that can be used include isoprene rubber, butyl rubber, and a thermoplastic elastomer.

[0029] 2. Cap manufacturing method

The following describes a method for manufacturing the cap configured as described above. First, as shown in FIG. 2, the elastic member 3 is sandwiched between the outer frame engaging portion 212 of the outer frame member 2 and the upper end portion 111 of the inner frame member 1, and the protrusion portion 211 of the outer frame member 2 is fitted into the groove 121 of the flange portion 12 of the inner frame member 1. At this time, the outer circumferential surface of the outer frame member 2 is fixed with a jig 6 or the like. Next, a tool horn

5 for ultrasonic welding is brought into contact with the upper end portion of the outer frame member 2. The tool horn 5 is brought into contact with a position directly above the protrusion portion 211. Next, ultrasound with a frequency of approximately 15 kHz, for example, is applied to the tool horn 5. The amplitude is amplified by the tool horn 5, and the ultrasonic amplitude is transmitted to the outer frame member 2. The ultrasonic amplitude thus propagates through the outer frame member 2 and generates heat at the contact surface between the protrusion portion 211 and the groove 121 of the flange portion 12 of the inner frame member 1. The contact portion between the protrusion portion 211 and the groove 121 is thus melted, and the outer frame member 2 and the inner frame member 1 are joined together. Although the welding time depends on the materials making up the inner frame member 1 and the outer frame member 2 and the frequency of the applied ultrasound, the ultrasonic welding used here is normally completed in one second or less, and therefore is favorable for an improvement in productivity. The protrusion portion 211 and the groove 121 that are joined by melting at this time correspond to weld portions of the present invention.

[0030] After the cap 10 is formed in the above-described steps, the cap 10 is attached to the port 30 of the bag-like container body 20 that constitutes the infusion bag. First, prior to attachment of the cap 10, a drug solution is injected into the container body 20 through the port 30. Next, the cap 10 is attached to the port 30. For example, the lower end portion

of the cover portion 22 of the outer frame member 2 and the lower end portion of the flange portion 12 of the inner frame member 1 (or at least one of them) can be attached to the port 30 by welding. Next, the closure member 4 is attached so as to cover
5 the upper end of the outer frame member 2 and the upper surface of the elastic member 3. The infusion bag is completed when the cap 10 is attached to the port 30 of the container body 20 in this way. Note that although there are no particular limitations on the method of welding the cap 10 to the port 30,
10 one example of a method includes heating the weld surfaces of the two members using a heater or the like, and then pressing them together.

[0031] 3. Method of use of infusion bag

The infusion bag manufactured as described above can be
15 used as follows, for example. First, the closure member 4 is removed from the cap 10. The needle of the infusion set is then stabbed into the elastic member 3. The needle passes through the elastic member 3 and the thin film 13, and comes into communication with the interior of the infusion bag 20 via the
20 interior space of the inner frame member 1 and the port 30. In this state, the drug solution in the infusion bag 20 is administered to a patient through the infusion set.

[0032] 4. Features

As described above, according to the present embodiment,
25 the gap s is formed between the flange portion 12 of the inner frame member 1 and the cover portion 22 of the outer frame member 2, and the gap s extends from the weld region where the inner

frame member 1 and the outer frame member 2 are fixed, and is open in the axial direction on the lower end portion side of the outer frame member 2. For this reason, even if the material making up the inner frame member 1 or the outer frame member 2 flows out of the weld region, the material flows into the gap s, thus making it possible to prevent the material from flowing to the outer periphery of the cap 10. Also, even if the melted material flows out of the gap s, the gap s is open on the lower end portion side of the outer frame member 2, thus making it possible to prevent the material from flowing radially outward from the cap 10. Accordingly, the outer diameter of the cap 10 does not change, thus making it possible to perform positioning with high precision when fixing the outer frame member 2 using the jig 6 or the like during manufacturing, and this results in making it possible to precisely attach the cap 10 to the infusion bag 20.

[0033] 5. Variations

Although an embodiment of the present invention has been described above, the present invention is not limited to the above embodiment, and various modifications can be made without departing from the spirit of the invention. The following are examples of modifications that can be made.

[0034] 5-1

In the above embodiment, the elastic member 3 is sandwiched by the outer frame engaging portion 212 of the outer frame member 2 and the upper end portion 111 of the inner frame member 1, but there are no particular limitations on the means

for fixing the elastic member 3 as long as it can be fixed between the outer frame member 2 and the inner frame member 1. Specifically, there are no particular limitations on the configurations of the outer frame engaging portion of the outer frame member 2 and the upper end portion of the inner frame member 1, and it need only be possible to fix the elastic member 3 in a liquid-tight manner. In one example of a structure, as shown in FIG. 3, the upper end portion of the inner frame member 1 and the thin film 13 are formed so as to be flush, and the elastic member 3 is supported by the entirety of the thin film 13. [0035] Also, in the above embodiment, the ring-shaped groove 32, into which the upper end portion 111 of the main body portion 11 of the inner frame member 1 is fitted, is formed in the lower surface of the elastic member 3, but the groove 32 does not necessarily need to be formed. Specifically, since the elastic member 3 is capable of elastic deformation, even if the groove 32 is not formed, the upper end portion 111 of the inner frame member 1 sinks into the lower surface of the elastic member 3. The inner frame member 1 and the elastic member 3 are fixed in a liquid-tight manner in this case as well.

[0036] 5-2

In the above embodiment, the inner frame member 1 is provided with the thin film 13, but the thin film does not need to be provided. Note that it is preferable to provide the thin film if there is a desire to avoid contact between the contents of the infusion bag 20 and the elastic member 3. Also, the closure member 4 is not essential, and may be attached as

necessary.

[0037] 5-3

In the above embodiment, the inner frame member 1 and the outer frame member 2 are fixed by ultrasonic welding, but there is no limitation on the fixing method as long as these members are fixed by weld. For example, the protrusion portion 211 of the outer frame member 2 and the groove 121 of the inner frame member 1 can be joined by heating and melting them using a heater or the like and then welding them together. Alternatively, high-frequency welding can be employed depending on the material making up of the inner frame member 1 and the outer frame member 2.

[0038] 5-4

In the above embodiment, the gap s between the cover portion 22 of the outer frame member 2 and the flange portion 12 of the inner frame member 1 is formed so as to extend in the vertical direction (the axial direction), but there are no particular limitations on the path of the gap s as long as the opening on the lower end side of the gap s extends to the lower end portion of the outer frame member 2 in the axial direction and does not face radially outward. In one example, as shown in FIG. 4, the outer circumferential surface of the flange portion 12 is inclined outward in a tapered shape, and the inner wall surface of the cover portion 22 is inclined in accordance with this. Accordingly, the gap s is formed so as to be inclined radially outward as it extends downward between the flange portion 12 and the cover portion 22. Note that the lower end

portion of the gap s in this case is open downward and does not face radially outward. Accordingly, it is possible to prevent material that melted during welding from protruding out from the outer circumferential surface of the cap 10.

5 [0039] 5-5

In the above embodiment, the lower end of the cover portion 22 of the outer frame member 2 and the lower end of the flange portion 12 of the inner frame member 1 are adjusted so as to be arranged at approximately the same position in the vertical direction, and these lower ends are attached to the port 30 of the infusion bag 20, but there are no particular limitations on the method of attachment to the port 30. For example, as shown in FIG. 5, a tube-shaped insertion portion 15 that extends downward beyond the flange portion 12 of the inner frame member 1 can be provided integrally. The insertion portion 15 can be directly fixed, using welding or the like, to the films of a container body not provided with a port. Specifically, a pair of films are overlaid on each other, and the insertion portion 15 is inserted therebetween and welded. The peripheral edges of the pair of films are then fixed by welding or the like, thus forming a bag-like container. The infusion bag is thus completed. Note that the flange portion 12 does not need to be provided at the lowest portion of the inner frame member 1, and need only be arranged lower than the upper end portion.

25 [0040] 5-6

In the above embodiment, the cap 10 is attached to the infusion bag 20, but there is no limitation to being attached

to an infusion bag, and the cap 10 can be attached to various types of containers.

Reference Signs List

5	[0041]	10	Cap
		1	Inner frame member
		111	Upper end portion (inner frame engaging portion)
		12	Flange portion
		121	Groove (weld portion)
10		2	Outer frame member
		211	Outer frame engaging portion
		22	Cover portion
		3	Elastic member
		20	Infusion bag (container)
15		s	Gap

CLAIMS

1. A cap for attachment to a container body, the cap comprising:

5 an inner frame member shaped as a tube having a first end portion and a second end portion in an axial direction, a flange portion that protrudes radially outward being formed on the second end portion side;

an outer frame member that has a first end portion and
10 a second end portion in an axial direction, and is shaped as a tube to be placed around the inner frame member, an outer frame engaging portion being formed on the first end portion side, and a cover portion that covers an outer periphery of the flange portion being formed on the second end portion side; and

15 an elastic member that is sandwiched between the outer frame engaging portion of the outer frame member and the first end portion of the inner frame member, and blocks an opening of the first end portion of the inner frame member,

wherein the cap has a weld portion in which the flange
20 portion of the inner frame member and a portion of an inner wall surface of the outer frame member are fixed by welding,

a gap located radially outward relative to the weld portion is formed between the cover portion of the outer frame member and the flange portion of the inner frame member, and

25 the gap extends from the weld portion and is open on the second end portion side of the outer frame member in the axial direction.

2. The cap according to claim 1, wherein the weld portion is formed by ultrasonic welding.

5 3. The cap according to claim 1 or 2, wherein the weld portion is formed by a protruding portion or a receding portion formed on the outer frame member and a receding portion or a protruding portion formed on the inner frame member being fitted together.

10 4. The cap according to any of claims 1 to 3, wherein the gap is 0.1 to 1.0 mm.

5. The cap according to any of claims 1 to 4,
further comprising a thin film that blocks the opening
15 of the first end portion of the inner frame member,
wherein the elastic member is arranged between the thin film and the outer frame engaging portion of the outer frame member.

20 6. The cap according to any of claims 1 to 5,
wherein the outer frame member includes a tube-shaped main body portion that has a first end portion and a second end portion in an axial direction, and the cover portion provided integrally with an outer circumferential surface of the second
25 end portion of the main body portion, and
the weld portion is formed by welding of an end surface of the second end portion of the main body portion and a surface

of the flange portion that faces the first end portion side.

7. A container comprising:

a container body that has a bag-like shape and is provided
5 with tube-shaped port capable of discharging contents; and

the cap according to any of claims 1 to 6,

wherein at least one of the second end portion of the outer
frame member and the second end portion of the inner frame member
is fixed to the port of the container body.

10

8. A container comprising:

a container body formed with a bag-like shape by
overlaying a pair of films; and

the cap according to any of claims 1 to 6,

15 wherein a tube-shaped insertion portion that extends in
a direction opposite to the first end portion is provided on
the second end portion of the inner frame member, and

the insertion portion of the inner frame member is fixed
between the pair of films of the container body.

20

9. A method for manufacturing a cap for attachment to a
container body, comprising:

preparing an inner frame member shaped as a tube having
a first end portion and a second end portion in an axial direction,
25 a flange portion that protrudes radially outward being formed
on the second end portion side;

preparing an outer frame member that has a first end

portion and a second end portion in an axial direction, and is shaped as a tube to be placed around the inner frame member, an outer frame engaging portion being formed on the first end portion side, and a cover portion that covers an outer periphery
5 of the flange portion being formed on the second end portion side;

sandwiching an elastic member between the outer frame engaging portion of the outer frame member and the first end portion of the inner frame member such that an opening of the
10 first end portion of the inner frame member is blocked by the elastic member, and forming a gap between the cover portion of the outer frame member and the flange portion of the inner frame member, the gap being open on the second end portion side of the outer frame member in the axial direction; and

15 welding, by ultrasonic welding, the flange portion of the inner frame member and a portion of an inner wall surface of the outer frame member at a location radially inward of the gap.