

DESCRIPTION

CONNECTOR

5 Technical Field

 The present invention relates to a connector which connects an opening portion of a pipe, e.g., a three-way cock with a syringe.

10 Background Art

 With one of opening portions of a three-way cock connected with an infusion line or the like being used as a connection port, there has been conventionally carried out mixture injection of a chemical or the like into the
15 infusion line from a syringe connected with the connection port. In this operation, the opening portion of the three-way cock must be liquid-tightly connected with the syringe so that the chemical injected into the infusion line from the syringe must be prevented from coming into contact with
20 outside air or occurrence of liquid leak must be avoided.

 Thus, as a connector which liquid-tightly connects the three-way cock with the syringe, one described in the specification of, e.g., U.S. Patent No. 6036171 has been known. A connector 31 described in this specification
25 comprises a cylindrical sleeve member 32 which is fitted around an opening portion 12c of a three-way cock 11 and a valve body 3 which is included in the sleeve member 32 and

seals the opening portion 12c as shown in FIG. 4.

The valve body 3 is an elastic body consisting of, e.g., a flexible synthetic resin. Further, the sleeve member 32 of the connector 31 comprises a large-diameter portion 4 which is fitted around the opening portion 12c and a small-diameter portion 5 which communicates with the large-diameter portion 4, and a step 33 is formed between the large-diameter portion 4 and the small-diameter portion 5.

The connector 31 is attached to the three-way cock 11 by fitting the large-diameter portion 4 of the sleeve member 32 on the opening portion 12c. With this configuration, since the valve body 3 is composed of the flexible synthetic resin, an opening end portion 9a of the cylindrical portion 9 is pushed and elastically appressed by the opening portion 12c, and the opening portion 12c is thereby sealed by the valve body 3.

On the other hand, when the connector 31 is attached to the three-way cock 11, a bottom portion 10 of the valve body 3 is pressed and fitted into the small-diameter portion 5 of the sleeve member 32. In this state, a slit 10a provided on the bottom portion 10 is usually closed, but the slit 10a is opened and appressed against a non-illustrated cylinder end portion of the syringe when the cylinder end portion is inserted.

As a result, the opening portion 12c and the syringe are liquid-tightly connected with each other by the

connector 31.

However, since the valve body 3 is composed of the flexible synthetic resin, there is a disadvantage that the resin is deteriorated by repeatedly inserting/removing the cylinder end portion of the syringe, or the resin creeps and the elasticity is thereby reduced when the cylinder end portion is kept inserted for a long period in time. If the elasticity of the resin forming the valve body 3 is reduced, the valve body 3 is kept pushed in the large-diameter portion 4 of the sleeve member 32 and cannot be again fitted into the small-diameter portion 5 when the cylinder end portion of the syringe is inserted, or the valve body 3 is inclined in the sleeve member 32. As a result, a gap is formed between the opening end portion 9a of the cylindrical portion 9 and the opening portion 12c or between the slit 10a and the cylinder end portion of the syringe, and there is the possibility of the contact of a chemical injected from the syringe with outside air or occurrence of liquid leak.

Disclosure of the Invention

In view of the above-described problems, it is an object of the present invention to provide a connector which can assuredly prevent a chemical injected from a syringe from coming into contact with outside air or avoid occurrence of liquid leak.

To achieve this aim, according to the present

invention, there is provided a connector comprising: a cylindrical sleeve member having a large-diameter portion which is fitted around an opening portion of a pipe and a small-diameter portion which communicates with the large-diameter portion; and a valve body which includes a cylindrical portion and a bottom portion which closes one end portion of the cylindrical portion, and is composed of a flexible synthetic resin elastic body including a slit-like valve hole at the bottom portion, the valve body being accommodated in the sleeve member in such a manner that an opening end portion of the cylindrical portion is positioned on the opening portion side of the pipe and the bottom portion is positioned on the side opposite to the opening portion, the large-diameter portion of the sleeve member being fitted around the opening portion to push the valve body against the opening portion so that the opening portion is sealed, the valve hole being opened when a cylinder end portion of a syringe is inserted into the valve hole, the opening portion and the syringe being liquid-tightly connected with each other when the opened valve hole is appressed against the cylindrical end portion, wherein the sleeve member comprises a tapered portion which connects the large-diameter portion with the small-diameter portion, and also comprises a plurality of ribs which extend on an inner peripheral surface of the large-diameter portion along a lengthwise direction of the sleeve member.

According to the connector of the present

invention, since the tapered portion which connects the large-diameter portion and the small-diameter portion of the sleeve member with each other is provided, the valve body pushed into the large-diameter portion can be guided by the tapered portion to be again fitted in the small-diameter portion without being locked by a step between the large-diameter portion and the small-diameter portion.

Further, according to the connector of the present invention, since the ribs are provided on the inner peripheral surface of the large-diameter portion of the sleeve member, the valve body is supported by the ribs in the sleeve member so that its posture is controlled, thereby avoiding the inclination.

Therefore, according to the connector of the present invention, the valve body can be assuredly pushed to the opening portion, and the valve hole can be securely appressed against the cylinder end portion of the syringe, thereby assuredly preventing a chemical injected from the syringe from coming into contact with outside air and avoiding occurrence of liquid leak.

The present invention is characterized in that, when the sleeve member comprises a male screw portion on an outer peripheral surface of the small-diameter portion and the syringe comprises a lock cylinder on the outer peripheral side of the cylinder end portion, the lock cylinder is screwed to the male screw portion. Although the syringe may not comprise the lock cylinder on the outer

peripheral side of the cylinder end portion, the syringe is assuredly connected with the opening portion of the pipe when screwed to the male screw portion provided to the sleeve member if the syringe comprises the lock cylinder on the outer peripheral side of the cylinder end portion.

As the pipe, there is, e.g., a three-way cock.

Brief Description of the Drawings

FIG. 1 is a partially cutaway explanatory cross-sectional view showing a connector according to the present invention;

FIG. 2 is an explanatory cross-sectional view showing a configuration of a sleeve member used in the connector according to the present invention;

FIG. 3 is a cross-sectional view taken along a line III-III depicted in FIG. 2; and

FIG. 4 is a partially cutaway explanatory cross-sectional view showing a conventional connector.

Best Mode for Carrying out the Invention

An embodiment according to the present invention will now be described in detail hereinafter with reference to the accompanying drawings. FIG. 1 is a partially cutaway explanatory cross-sectional view showing a connector according to this embodiment, FIG. 2 is an explanatory cross-sectional view showing a configuration of a sleeve member used in the connector according to this

embodiment, and FIG. 3 is a cross-sectional view taken along a line III-III depicted in FIG. 2.

A connector 1 according to this embodiment depicted in FIG. 1 liquid-tightly connects, e.g., a three-way cock 11 and a syringe 21 with each other.

In this example, the three-way cock 11 comprises a first opening portion 12a connected with a non-illustrated infusion line and a second opening portion 12b in a linear direction and also comprises a third opening portion 12c in a direction orthogonal to the opening portions 12a and 12b, and the connector 1 is attached to the opening portion 12c. Any two or all of the respective opening portions 12a, 12b and 12c communicate with each other by switching a cock 13.

Specifically, the connector 1 liquid-tightly connects the opening portion 12c of the three-way cock 11 with the syringe 21, and comprises a sleeve member 2 and a valve body 3 accommodated in the sleeve member 2.

As shown in FIGS. 2 and 3, the sleeve member 2 comprises a large-diameter portion 4 which is fitted around the opening portion 12c of the three-way cock 11 and a small-diameter portion 5 communicating with the large-diameter portion 4, and also comprises a tapered portion 6 whose diameter is reduced from the large-diameter portion 4 side toward the small-diameter portion 5 side. Further, ribs 7 extending along a lengthwise direction of the sleeve member 2 are provided on an inner peripheral surface of the large-diameter portion 4. In the sleeve member 2 according

to this embodiment, four ribs 7 are provided at equal intervals in a circumferential direction.

Furthermore, the sleeve member 2 comprises a male screw portion 8 on an outer peripheral surface of the small-diameter portion 5, and a lock cylinder 23 provided on the outer peripheral side of the cylinder end portion 22 of the syringe 21 is screwed to the male screw portion 8. It is to be noted that the lock cylinder 23 comprises a female screw portion 24 on an inner peripheral surface thereof.

On the other hand, the valve body 3 comprises an elastic body formed of a flexible synthetic resin such as silicone rubber, and it is a cylindrical body with a bottom comprising a cylindrical portion 9 and a bottom portion 10 closing one end portion of the cylindrical portion 9. Moreover, the valve body 3 is accommodated in the sleeve member 2 in such a manner that an opening end portion 9a of the cylindrical portion 9 is placed on the opening portion 12c side and the bottom portion 10 is placed on the side opposite to the opening portion 12c.

When the large-diameter portion 4 is fitted around the opening portion 12c with the valve body 3 being accommodated in the above-described manner, the sleeve member 2 is attached to the three-way cock 11. As a result, in the valve body 3, the opening end portion 9a of the cylindrical portion 9 is pushed and elastically appressed by the opening portion 12c, and the bottom portion 10 is

pressed and fitted in the small-diameter portion 5 of the sleeve member 2. It is to be noted that the ribs 7 formed on the inner peripheral surface of the large-diameter portion 4 are in contact with the outer peripheral surface of the valve body 3.

Although the slit 10a forming the valve hole is usually closed, it is opened when the cylinder end portion 22 of the syringe 21 is inserted, and the opened slit 10a is appressed against the cylinder end portion 22. At this time, the opening end portion 9a of the cylindrical portion 9 is elastically appressed against the opening portion 12c and sealed, as mentioned above. Therefore, the connector 1 liquid-tightly connects the opening portion 12c and the syringe 21 with each other when the slit 10a is appressed against the cylinder end portion 22.

With the sleeve member 2, when the cylinder end portion 22 of the syringe 21 is inserted into the slit 10a, the valve body 3 is pushed into the large-diameter portion 4. However, since the tapered portion 6 is provided between the large-diameter portion 4 and the small-diameter portion 5, the valve body 3 is guided by the tapered portion 6 to easily return to the state in which the bottom portion 10 is fitted in the small-diameter portion 5 when the cylinder end portion 22 is removed.

Additionally, with the sleeve member 2, when the cylinder end portion 22 is inserted into the slit 10a, the ribs 7 are in contact with the outer peripheral surface of

the cylindrical portion 9 and the cylindrical portion 9 is supported by the ribs 7. Therefore, a posture of the valve body 3 can be controlled by the ribs 7 so that the valve body 3 can be prevented from being inclined in the large-diameter portion 4.

As a result, according to the connector of this embodiment, the valve body 3 is not kept being pushed in the large-diameter portion 4 nor inclined, the valve body 3 is assuredly pushed to the opening portion 12c and sealed, and the slit 10a is securely appressed against the cylinder end portion 22 of the syringe 21. Therefore, the contact between a chemical injected from the syringe 21 and outside air and the liquid leak can be assuredly avoided.

An embodiment according to the present invention and comparative examples will now be described.

[Embodiment 1]

In this embodiment, 25 products each having a configuration in which the connector 1 comprising the sleeve member 2 and the valve body 3 is attached to the opening portion 12c of the three-way cock 11 (shown in FIG. 1) were prepared, they were left with the cylindrical end portion 22 of the syringe 21 being kept inserted in the slit 10a of each valve body 3, the cylindrical end portions 22 were removed each day, and the number of connectors 1 which are in the state where the valve body 3 was kept being pushed in the large-diameter portion 4 (which will be referred to as a depressed state hereinafter) was confirmed.

Table 1 shows a result until the fourth day.

Then, nine products (Samples 1 to 9) each having a configuration in which the connector 1 comprising the sleeve member 2 and the valve body 3 was attached to the opening portion 12c of the three-way cock 11 shown in FIG. 1 were prepared, the operation of obliquely inserting the cylinder end portion 22 of the syringe 21 into the slit 10a of the valve body 3, applying a load to the valve body 3 and then removing the cylinder end portion 22 was performed for 100 times, and presence/absence of the depressed state was confirmed each time. Table 2 shows a result in which "o" represents the connector 1 which did not enter the depressed state even though the operation was carried out for 100 times and "x" represents the connector 1 which entered the depressed state within 100 times. Incidentally, as to the connector 1 which entered the depressed state within 100 times, the number of the operation at which the connector 1 entered the depressed state is written in parentheses after "x".

[Comparative Example 1]

In this comparative example, the same preparation as Embodiment 1 was made except that a connector 31 shown in FIG. 4 was used in place of the connector 1. Each product was left with the cylinder end portion 22 of the syringe 21 being kept inserted in the slit 10a of each valve body 3, each cylinder end portion was removed every other day and the number of the connectors 31 having the

valve body 3 in the depressed state was confirmed. It is to be noted that the connector 31 comprises a sleeve member 32 in place of the sleeve member 2 of the connector 1.

Table 1 shows a result until the fourth day.

5 Then, the same preparation as Embodiment 1 was made except that the connector 31 shown in FIG. 4 was used in place of the connector 1. The operation of obliquely inserting the cylinder end portion 22 of the syringe 21 into the slit 10a of the valve body 3, applying a load to
10 the valve body 3 and then removing the cylinder end portion 2 was performed for 100 times, and presence/absence of the depressed state of the valve body 3 was confirmed each time. Table 2 shows a result in the same manner as Embodiment 1. [Comparative Example 2]

15 In this comparative example, the same preparation as Embodiment 1 was made except a use of a sleeve member (not shown) which has the same shape as the sleeve member 2 except that the tapered portion 6 is not provided even though the ribs 7 are provided and a step is formed between
20 the large-diameter portion 4 and the small-diameter portion 5. Each product was left with the cylinder end portion 22 of the syringe 21 being kept inserted in the slit 10a of each valve body 3, each cylinder end portion 22 was removed every other day, and the number of the connectors having
25 the valve body 3 in the depressed state was confirmed. Table 1 shows a result until the fourth day.

 Then, the same preparation as Embodiment 1 was

made except a use of the sleeve member (not shown) which has the same shape as the sleeve member 2 except that the tapered portion 6 is not provided even though the ribs 7 are provided and a step is formed between the large-diameter portion 4 and the small-diameter portion 5. The operation of obliquely inserting the cylinder end portion 22 of the syringe 21 into the slit 10a of the valve body 3, applying a load to the valve body 3 and then removing the cylinder end portion 22 was performed for 100 times, and presence/absence of the depressed state of the valve body 3 was confirmed each time. Table 2 shows a result in the same manner as Embodiment 1.

[Comparative Example 3]

In this comparative example, the same preparation as Embodiment 1 was made except a use of the sleeve member (not shown) which has the same shape as the sleeve member 2 except that the ribs 7 are not provided even though the tapered portion 6 is provided. Each product was left with the cylinder end portion 22 of the syringe 21 being kept inserted in the slit 10a of each valve body 3, each cylinder end portion 22 was removed every other day, and the number of the connectors having the valve body 3 in the depressed state was confirmed. Table 1 shows a result until the fourth day.

Then, the same preparation as Embodiment 1 was made except a use of the sleeve member (not shown) which has the same shape as the sleeve member 2 except that the

ribs 7 are not provided even though the tapered portion 6 is provided. The operation of obliquely inserting the cylinder end portion 22 of the syringe 21 into the slit 10a of the valve body 3, applying a load to the valve body 3 and then removing the cylinder end portion 22 was performed for 100 times, and presence/absence of the depressed state of the valve body 3 was confirmed each time. Table 2 shows a result in the same manner as Embodiment 1.

It is to be noted that, in the connector 1, the cylinder end portion 22 of the syringe 21 is usually inserted into the slit 10a of the valve body 3 to inject a chemical or the like and the cylinder end portion 22 is immediately removed upon completion of injection, but oblique insertion of the cylinder end portion 22 into the slit 10a of the valve body 3 is not usually performed in itself. Therefore, as in Embodiment 1 and Comparative Examples 1 to 3, leaving the product with the cylinder end portion 22 of the syringe 21 being kept inserted in the slit 10a of the valve body 3 more than one day or repeating the operation of obliquely inserting the cylinder end portion 22 into the slit 10a of the valve body 3 and then removing the cylinder end portion 22 are very severe conditions.

[Table 1]

	Embodiment 1	Comparative Example 1	Comparative Example 2	Comparative Example 3
1st day	0	5	0	1
2nd day	0	4	0	0
3rd day	0	6	0	0
4th day	0	3	1	2
Total	0	18	1	2

It is apparent from Table 1 that there is no connector 1 according to Embodiment 1 in which the valve body 3 is in the depressed state under the severe conditions even though the fourth day is reached, and the connector 1 according to Embodiment 1 is superior in the effect of avoiding occurrence of the depressed state of the valve body 3 as compared with Comparative Example 1 using the sleeve member 32 which does not include both the tapered portion and the ribs 7, Comparative Example 2 using the sleeve member which includes the ribs 7 but no tapered portion 6 and Comparative Example 3 using the sleeve member which includes the tapered portion 6 but no ribs 7.

[Table 2]

	Embodiment 1	Comparative Example 1	Comparative Example 2	Comparative Example 3
Sample 1	○	× (21st time)	× (80th time)	○
Sample 2	○	× (1st time)	○	× (77th time)
Sample 3	○	× (6th time)	○	○
Sample 4	○	× (28th time)	○	× (75th time)
Sample 5	○	× (25th time)	○	○
Sample 6	○	× (24th time)	○	○
Sample 7	○	× (3rd time)	○	× (85th time)
Sample 8	○	× (1st time)	○	× (88th time)
Sample 9	○	× (5th time)	○	○

It is apparent from Table 2 that there is no connector 1 according to Embodiment 1 in which the valve body 3 is in the depressed state even when insertion and removal of the cylinder end portion 22 with respect to the slit 10a are repeated for 100 times under the severe

conditions, and the connector 1 according to Embodiment 1 is superior in the effect of avoiding occurrence of the depressed state of the valve body 3 as compared with Comparative Example 1 using the sleeve member 32 which does not include both the tapered portion 6 and the ribs 7, Comparative Example 2 using the sleeve member which includes the ribs 7 but no tapered portion 6 and Comparative Example 3 using the sleeve member which includes the tapered portion 6 but no ribs 7.

Therefore, according to the connector 1 of Embodiment 1, the effect of assuredly avoiding the contact of a chemical injected from the syringe 21 with outside air and the liquid leak can be expected.

It is to be noted that the description has been given as to the connector 1 which is attached to the opening portion 12c of the three-way cock 11 in this embodiment, but the connector 1 may be attached to an opening portion of any pipe other than the three-way cock 11.

Furthermore, although the description has been given as to the sleeve member 2 which includes the male screw portion 8 on the outer peripheral surface of the small-diameter portion 5 in this embodiment, the sleeve member 2 may not include the male screw portion 8.

CLAIMS

1. A connector comprising: a cylindrical sleeve member having a large-diameter portion fitted around an opening portion of a pipe and a small-diameter portion communicating with the large-diameter portion; and a valve body which is formed of a flexible synthetic resin elastic body which comprises a cylindrical portion and a bottom portion closing one end portion of the cylindrical portion, and includes a slit-like valve hole at the bottom portion,

the valve body being accommodated in the sleeve member in such a manner that an opening end portion of the cylindrical portion is placed on the opening portion side of the pipe and the bottom portion is placed on the side opposite to the opening portion, the large-diameter portion of the sleeve member being fitted around the opening portion, the valve body being thereby pushed to the opening portion to seal the opening portion, the valve hole being opened when a cylinder end portion of a syringe is inserted into the valve hole, the opened valve hole being appressed against the cylinder end portion, thereby liquid-tightly connecting the opening portion with the syringe,

wherein the sleeve member comprises a tapered portion which connects the large-diameter portion with the small-diameter portion, and a plurality of ribs extending along a lengthwise direction of the sleeve member on an inner peripheral surface of the large-diameter portion.

2. The connector according to claim 1, wherein the sleeve member comprises a male screw portion on an outer peripheral surface of the small-diameter portion and, when the syringe comprises a lock cylinder on the outer peripheral side of the cylinder end portion, the lock cylinder is screwed to the male screw portion.

3. The connector according to claim 1 or claim 2, wherein the pipe comprises a three-way cock.