collar of the work robot. This elastic body produces an airtight seal between the periphery of the flange of the lateral pipe lining material and the pressure bag, allowing the lateral pipe lining material to be everted and inserted into the lateral pipe without pressurized fluid leaking out.

SUMMARY OF THE INVENTION

However, the configuration proposed in Japanese Laid-open Publication No. H04-355115 is disadvantageous because the removable tube must be temporarily fixed to the lateral pipe lining material and it raises the production cost of the lateral pipe lining material. This configuration also requires an operation to peel off the removable tube after the lateral pipe lining material has been everted and inserted into the lateral pipe, and presents a problem in that the inside of the lateral pipe lining material may get damaged as a result, reducing the quality of the lining.

The configuration disclosed in Japanese Laid-open Publication No. 2008-168468 does not require a removable tube, but is problematic in that a tubular sealing member comprising a metal or a hard plastic must be integrally provided to the flange of the lateral pipe lining material, which increases the production cost of the lateral pipe lining material.

An embodiment~~object~~ of the present invention seeks~~is~~ to provide a lateral pipe lining method and a lateral pipe lining apparatus

capable of improving the airtight connection between a lateral pipe lining material and a pressure bag or a head collar that is secured in an airtight manner to the pressure bag, and reliably everting and inserting the lateral pipe lining material into the lateral pipe to thereby line the lateral pipe with the lining material at a high quality.

According to a first aspect of the present invention, there is provided a lateral pipe lining method in which a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof, comprising: preparing a head collar having a curved section and a cylindrical section projecting from the curved section and having a smaller outside diameter than the inside diameter of the flange of the lateral pipe lining material; mounting to the outer circumferential surface of the cylindrical section of the head collar an expanding member capable of expanding by feeding a pressurized fluid thereto, the lateral pipe lining material being installed on the head collar so that the cylindrical section of the head collar to which the expanding member is mounted is located within the flange of the lateral pipe lining material; expanding the expanding member so that the outer circumferential surface of

the expanding member comes into close contact with the inner circumferential surface near the flange and the inner circumferential surface of the expanding member comes into close contact with the outer circumferential surface of the cylindrical section of the head collar; and everting and inserting the lateral pipe lining material into the lateral pipe with the expanding member expanded to line the lateral pipe with the lateral pipe lining material.

According to a second aspect of the present invention, there is provided a lateral pipe lining apparatus in which a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof, the apparatus comprising: a head collar having a curved section and a cylindrical section projecting from the curved section so that the outside diameter thereof is less than the inside diameter of the flange of the lateral pipe lining material; an expanding member mounted to the outer circumferential surface of the cylindrical section of the head collar, the expanding member being capable of expanding by feeding a pressurized fluid thereto, the lateral pipe lining material being installed on the head collar so that the cylindrical section of the head collar to which the expanding

member is mounted is located within the flange of the lateral pipe lining material; a pressure bag to which the head collar is hermetically mounted and which stores a non-everted portion of the lateral pipe lining material; and a work robot for guiding the pressure bag so that the flange of the lateral pipe lining material is brought into close contact with the periphery of the lateral pipe opening of the main pipe, wherein the expanding member is caused to expand so that the outer circumferential surface of the expanding member comes into close contact with the inner circumferential surface near the flange, and the inner circumferential surface of the expanding member comes into close contact with the outer circumferential surface of the cylindrical section of the head collar, and the lateral pipe lining material within the pressure bag is everted and inserted into the lateral pipe with the expanding member expanded to line the lateral pipe with the lateral pipe lining material.

In an embodiment of the present invention, a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof. A head collar is prepared which has a curved section and a cylindrical section projecting from the curved section and having a smaller outside

diameter than the inside diameter of the flange of the lateral pipe lining material. The head collar is airtightly connected to a pressure bag that stores the lining material. An annular expanding member capable of expanding by feeding a pressurized fluid thereto is mounted to the outer circumferential surface of the cylindrical section of the head collar. The lateral pipe lining material is installed on the head collar so that the cylindrical section of the head collar to which the expanding member is mounted is located within the flange of the

lateral pipe lining material. The expanding member is expanded so that the outer circumferential surface of the expanding member comes into close contact with the inner circumferential surface of the flange and the inner circumferential surface thereof comes into close contact with the outer circumferential surface of the cylindrical section of the head collar. The lateral pipe lining material is everted and inserted into the lateral pipe with the expanding member expanded to line the lateral pipe with the lateral pipe lining material.

With such an arrangement in the embodiment of the present invention, a hermetical connection is established between the lateral pipe lining material and the head collar when the expanding member is expanded. This prevents any leakage of a pressurized fluid for everting and inserting the lateral pipe lining material from the area where the lateral pipe lining material is connected to the head collar, ensuring that the lateral pipe lining material can reliably be everted and inserted into the lateral pipe.

Further features of embodiments of the present invention, its nature and various advantages will be more apparent from the accompanying drawings and following detailed description of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a sectional view of a lateral pipe lining material used in the method of the present invention;

What Is Claimed Is:

1. A lateral pipe lining method in which a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof, comprising:

preparing a head collar having a curved section and a cylindrical section projecting from the curved section and having a smaller outside diameter than the inside diameter of the flange of the lateral pipe lining material;

mounting to the outer circumferential surface of the cylindrical section of the head collar an expanding member capable of expanding by feeding a pressurized fluid thereto, the lateral pipe lining material being installed on the head collar so that the cylindrical section of the head collar to which the expanding member is mounted is located within the flange of the lateral pipe lining material;

expanding the expanding member so that the outer circumferential surface of the expanding member comes into close contact with the inner circumferential surface near the flange and the inner circumferential surface of the expanding member comes into close contact with the outer circumferential

surface of the cylindrical section of the head collar; and

everting and inserting the lateral pipe lining material into the lateral pipe with the expanding member expanded to line the lateral pipe with the lateral pipe lining material.

2. A lateral pipe lining method according to claim 1, wherein the expanding member is wide in the direction in which the cylindrical section of the head collar extends, and large enough to tightly contact with substantially all of the cylindrical section projecting from the curved section of the head collar when the expanding member is expanded.

3. A lateral pipe lining method according to any one of preceding claims, wherein the expanding member is covered in whole by a protective cover.

4. A lateral pipe lining method according to any one of preceding claims, wherein the expanding member is a thin and long tube that is circular in cross section and is wound in multiple layers around the cylindrical section of the head collar.

5. A lateral pipe lining method according to claim 4, wherein the tube is wound around all of the cylindrical section projecting from the curved section of the head collar.

6. A lateral pipe lining method according to any one of preceding claims, wherein a pressurized fluid for expanding the expanding member is fed from the same pressurized fluid

source as the pressurized fluid for everting the lateral pipe lining material.

7. A lateral pipe lining method according to any one of preceding claims, wherein the pressurized fluid is a compressed gas or a liquid under pressure.

8. A lateral pipe lining method according to any one of preceding claims, wherein the head collar comprises an upper head collar having a curved section and a lower head collar formed with a cylindrical section, and the upper head collar and the lower head collar are joined so that the cylindrical section of the lower head collar projects from the curved section of the upper head collar.

9. A lateral pipe lining apparatus in which a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof, the apparatus comprising:

A head collar having a curved section and a cylindrical section projecting from the curved section so that the outside diameter thereof is less than the inside diameter of the flange of the lateral pipe lining material;

an expanding member mounted to the outer circumferential surface of the cylindrical section of the head collar, the expanding member being capable of expanding by feeding a pressurized fluid thereto, the lateral pipe lining material being installed on the head collar so that the cylindrical section of the head collar to which the expanding member is mounted is located within the flange of the lateral pipe lining material;

a pressure bag to which the head color is hermetically mounted and which stores a non-everted portion of the lateral pipe lining material; and

a work robot for guiding the pressure bag so that the flange of the lateral pipe lining material is brought into close contact with the periphery of the lateral pipe opening of the main pipe,

wherein the expanding member is caused to expand so that the outer circumferential surface of the expanding member comes into close contact with the inner circumferential surface near the flange, and the inner circumferential surface of the expanding member comes into close contact with the outer circumferential surface of the cylindrical section of the head collar, and

the lateral pipe lining material within the pressure bag is everted and inserted into the lateral pipe with the expanding member expanded to line the lateral pipe with the

lateral pipe lining material.

10. A lateral pipe lining apparatus according to claim 9, wherein the expanding member is wide in the direction in which the cylindrical section of the head collar extends, and large enough to tightly contact with substantially all of the cylindrical section projecting from the curved section of the head collar when the expanding member is expanded.

11. A lateral pipe lining apparatus according to any one of claims 9 to 10, wherein the expanding member is covered in whole by a protective cover.

12. A lateral pipe lining apparatus according to any one of claims 9 to 11, wherein the expanding member is a thin and long tube that is circular in cross section and is wound in multiple layers around the cylindrical section of the head collar.

13. A lateral pipe lining apparatus according to claim 12, wherein the tube is wound around all of the cylindrical section projecting from the curved section of the head collar.

14. A lateral pipe lining apparatus according to any one of claims 9 to 13, wherein a pressurized fluid for expanding the expanding member is fed from the same pressurized fluid source as the pressurized fluid for everting the lateral pipe lining material.

15. A lateral pipe lining apparatus according to any

one of claims 9 to 14, wherein the pressurized fluid is compressed air or a liquid under pressure.

16. A lateral pipe lining apparatus according to any one of claims 9 to 15, wherein the head collar comprises an upper head collar having a curved section and a lower head collar formed with a cylindrical section, and the upper head collar and the lower head collar are joined so that the cylindrical section of the lower head collar projects from the curved section of the upper head collar.

CLAIMS:

1. A lateral pipe lining method in which a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof, comprising: preparing a head collar having a curved section and a cylindrical section projecting from the curved section and having a smaller outside diameter than the inside diameter of the flange of the lateral pipe lining material; mounting to the outer circumferential surface of the cylindrical section of the head collar an expanding member capable of expanding by feeding a pressurized fluid thereto, the lateral pipe lining material being installed on the head collar so that the cylindrical section of the head collar to which the expanding member is mounted is located within the flange of the lateral pipe lining material; expanding the expanding member so that the outer circumferential surface of the expanding member comes into close contact with the inner circumferential surface near the flange and the inner circumferential surface of the expanding member comes into close contact with the outer circumferential surface of the cylindrical section of the head collar; and everting and inserting the lateral pipe lining material into the lateral pipe with the expanding member expanded to line the lateral pipe with the lateral pipe lining material.

2. A lateral pipe lining method according to claim 1, wherein the expanding member is wide in the direction in which the cylindrical section of the head collar extends, and large enough to tightly contact with substantially all of the cylindrical section projecting from the curved section of the head collar when the expanding member is expanded.

3. A lateral pipe lining method according to claim 1, wherein the expanding member is covered in whole by a protective cover.

4. A lateral pipe lining method according to claim 1, wherein the expanding member is a thin and long tube that is circular in cross section and is wound in multiple layers around the cylindrical section of the head collar.

5. A lateral pipe lining method according to claim 4, wherein the tube is wound around all of the cylindrical section projecting from the curved section of the head collar.

6. A lateral pipe lining method according to claim 1, wherein a pressurized fluid for expanding the expanding member is fed from the same pressurized fluid source as the pressurized fluid for everting the lateral pipe lining material.

7. A lateral pipe lining method according to claim 1, wherein the pressurized fluid is a compressed gas or a liquid under pressure.

8. A lateral pipe lining method according to claim 1, wherein the head collar comprises an upper head collar having a curved section and a lower head collar formed with a cylindrical section, and the upper head collar and the lower head collar are joined so that the cylindrical section of the lower head collar projects from the curved section of the upper head collar.

9. A lateral pipe lining apparatus in which a flange formed on one end of a lateral pipe lining material composed of a flexible tubular resin-absorbing material impregnated with a curable resin is brought into close contact with the periphery of a lateral pipe opening of a main pipe, and eversion pressure is applied to the lateral pipe lining material to evert and insert the lateral pipe lining material into a lateral pipe to line the inner circumferential wall thereof, the apparatus comprising: a head collar having a curved section and a cylindrical section projecting from the curved section so that the outside diameter thereof is less than the inside diameter of the flange of the lateral pipe lining material; an expanding member mounted to the outer circumferential surface of the cylindrical section of the head collar, the expanding member being capable of expanding by feeding a pressurized fluid thereto, the lateral pipe lining material being installed on the head collar so that the cylindrical section of the head collar to which the expanding member is mounted is located within the flange of the lateral pipe lining material; a pressure bag to which the head collar is hermetically mounted and which stores a non-everted portion of the lateral pipe lining material; and a work robot for guiding the pressure bag so that the flange of the lateral pipe lining material is brought into close contact with the periphery of the lateral pipe opening of the main pipe, wherein the expanding member is caused to expand so that the outer circumferential surface of the expanding member comes into close contact with the inner circumferential surface near the flange, and the inner circumferential surface of the expanding member comes into close contact with the outer circumferential

surface of the cylindrical section of the head collar, and the lateral pipe lining material within the pressure bag is everted and inserted into the lateral pipe with the expanding member expanded to line the lateral pipe with the lateral pipe lining material.

10. A lateral pipe lining apparatus according to claim 9, wherein the expanding member is wide in the direction in which the cylindrical section of the head collar extends, and large enough to tightly contact with substantially all of the cylindrical section projecting from the curved section of the head collar when the expanding member is expanded.

11. A lateral pipe lining apparatus according to claim 9, wherein the expanding member is covered in whole by a protective cover.

12. A lateral pipe lining apparatus according to claim 9, wherein the expanding member is a thin and long tube that is circular in cross section and is wound in multiple layers around the cylindrical section of the head collar.

13. A lateral pipe lining apparatus according to claim 12, wherein the tube is wound around all of the cylindrical section projecting from the curved section of the head collar.

14. A lateral pipe lining apparatus according to claim 9, wherein a pressurized fluid for expanding the expanding member is fed from the same pressurized fluid source as the pressurized fluid for everting the lateral pipe lining material.

15. A lateral pipe lining apparatus according to claim 9, wherein the pressurized fluid is compressed air or a liquid under pressure.

16. A lateral pipe lining apparatus according to claim 9, wherein the head collar comprises an upper head collar having a curved section and a lower head collar formed with a cylindrical section, and the upper head collar and the lower head collar are joined so that the cylindrical section of the lower head collar projects from the curved section of the upper head collar.