United States Patent [19]

Butterweck

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[54] **SEALED-END JACKED PIPE ASSEMBLY AND METHOD OF MAKING SAME**

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[30] **Foreign Application Priority Data**

Dec. 19, 1973 Germany 2164037

[52] **U.S. Cl.** **138/109,** 138/148

[51] **Int. Cl.** **G01l 9/00**

[58] **Field of Search** 138/109, 111–114, 138/148, 149; 277/58, 59, 226

[56] **References Cited**

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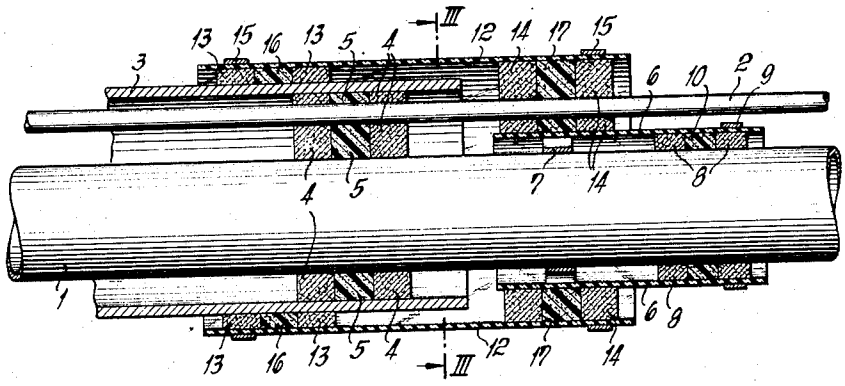
[57] **ABSTRACT**

An inner tube extending from the end of a protective casing is sealed by first providing two walls between the tube and the casing and filling the space between these walls with a hardenable synthetic resin. Two further walls are provided around the tube outside the casing and a thin body of synthetic-resin material, e.g., a sheet is wrapped around them and again a synthetic-resin mass is introduced into the space between these second walls. Two third walls are provided on the casing and two fourth walls on the tube, with another sheet wrapped around these third and fourth walls. Thereafter synthetic-resin material is again introduced into the space between the third walls and into the space between the fourth walls. Finally synthetic resin is poured into the chamber formed on one side by the second and fourth walls and on the other side by the first and third walls to completely seal the casing end.

6 Claims, 10 Drawing Figures



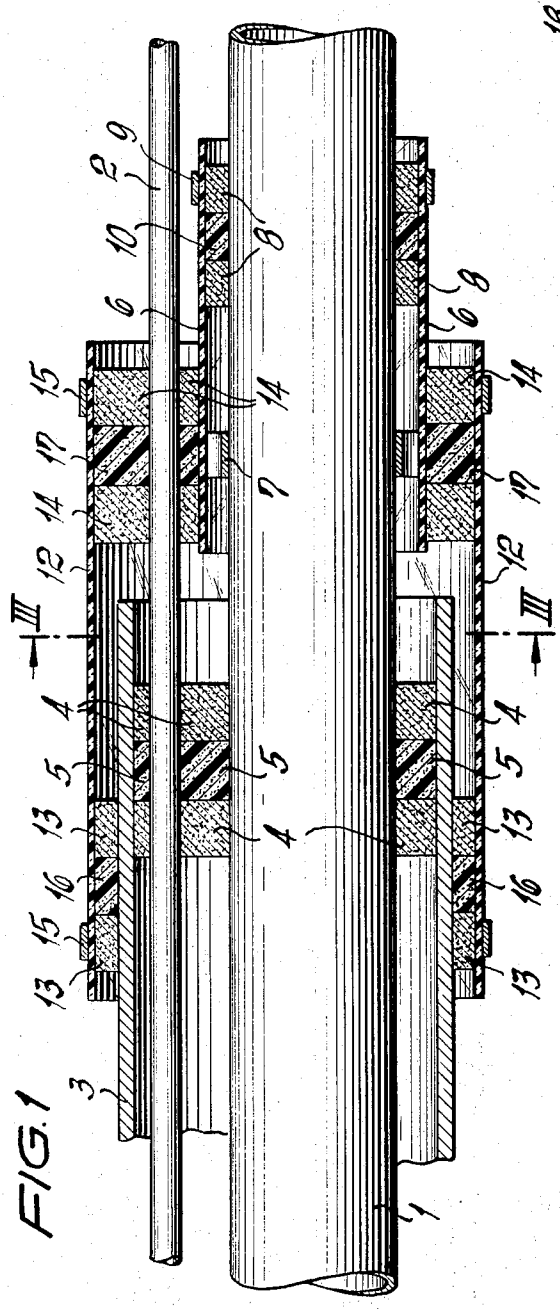


FIG. 1

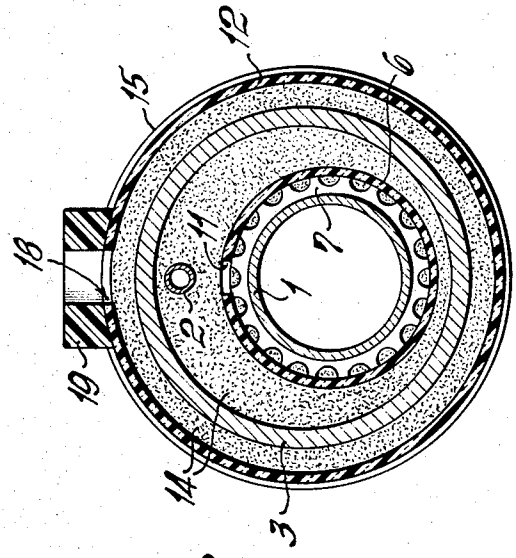


FIG. 3

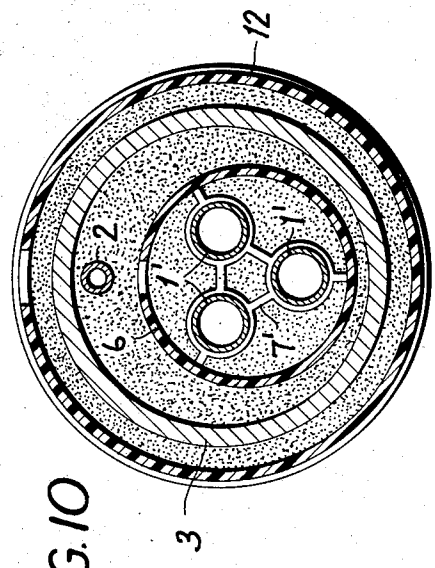


FIG. 10

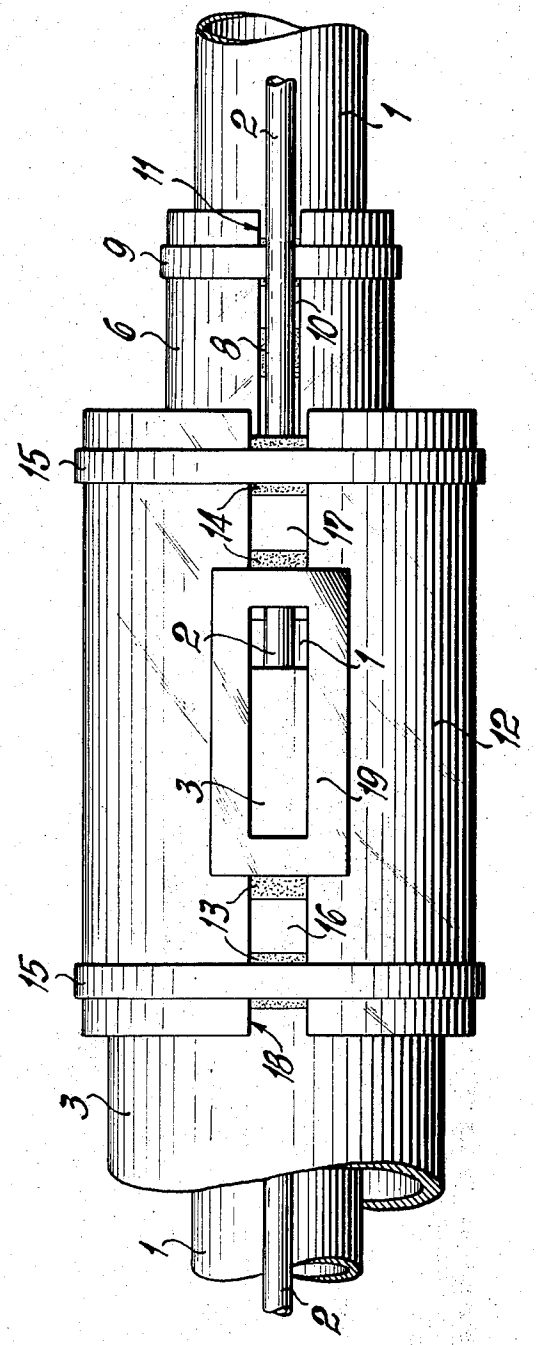


FIG.2

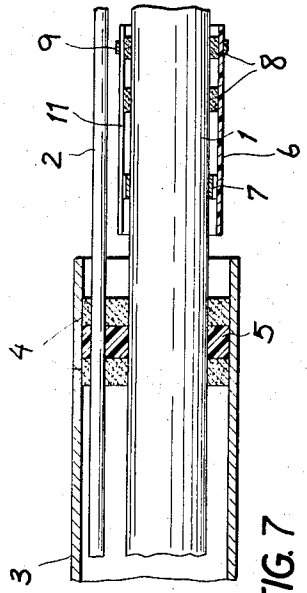


FIG. 7

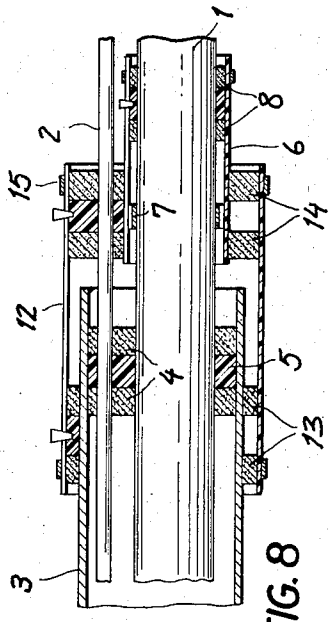


FIG. 8

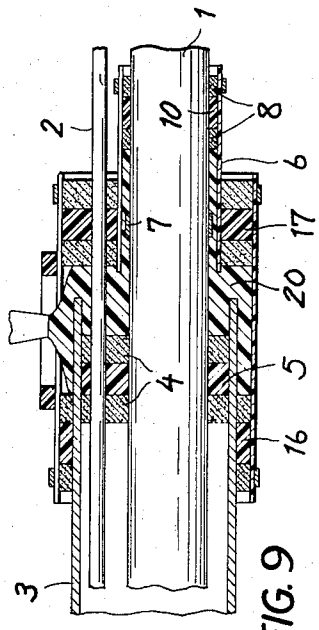


FIG. 9

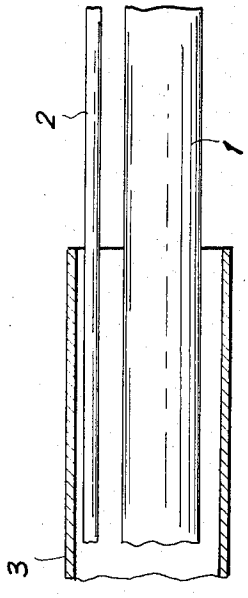


FIG. 4

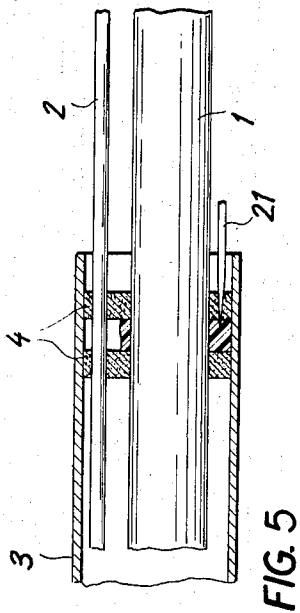


FIG. 5

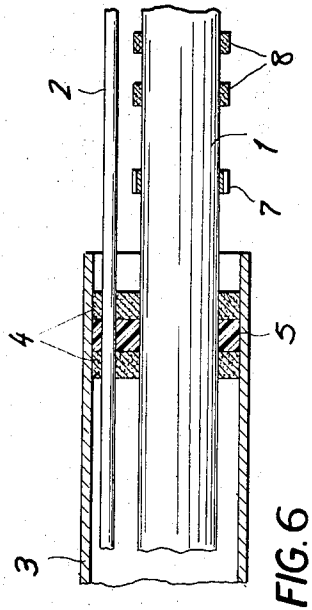


FIG. 6

SEALED-END JACKED PIPE ASSEMBLY AND METHOD OF MAKING SAME

FIELD OF THE INVENTION

The present invention relates to a jacketed-pipe installation and, more particularly, to the sealing of an end of such an installation.

BACKGROUND OF THE INVENTION

Jacketed pipes are used for carrying hot or cold fluid such as steam or refrigerants. Such arrangements are also employed for conducting electricity by means of supercooling of a conductor tube.

In both such installations it is paramount that the pipe end be tightly sealed. This is necessary in order to preserve the vacuum that is usually maintained between the inner tube and its casing.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved end seal for the above-described type of jacketed pipe.

SUMMARY OF THE INVENTION

This object is attained according to the present invention by the seal made by providing two walls between the inner tube and its casing, just inside the open casing end.

A mass of a foaming synthetic resin is introduced into the space between the two longitudinally spaced walls and allowed to harden, whereupon two second walls, in the form of rings, are fitted around the tube outside the casing.

A spacing body can be fitted around the tube longitudinally spaced from the two second walls, the outer diameters of the spacer and the two second walls being the same.

A sheet is next wrapped around the second walls and spacing body and a foaming synthetic-resin mass is introduced into the space between the two second walls and allowed to harden. Two longitudinally spaced third walls and two similar fourth walls are fitted around the casing and the sheet, respectively; while a second sheet is preferably wrapped around these third and fourth walls, which have like outer diameters, and a foaming synthetic-resin mass is introduced into the space between the two third walls and into the space between the two fourth walls.

Finally a foaming synthetic-resin mass is introduced into the chamber formed on one side by the first and third walls and on the other side by the second and fourth walls and is hardened.

Once the foamed masses between the four sets of walls have hardened it is possible to completely clean the exposed surfaces of the inner tube and the outer casing to ensure excellent adherence of the last synthetic-resin mass thereto, without the danger of any of the solvent used for cleaning getting in between the nested pipes.

According to other features of the present invention the two sheets are of a width insufficient to wrap completely around their respective annular walls so that a slip-like space is left. These spaces are left at the top so that the foaming synthetic resins may simply be poured in between the walls.

DESCRIPTION OF THE DRAWING

The above and other object, features, and advantages of the present invention will become apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a longitudinal section through a pair of nested tubes ready for sealing according to the present invention;

FIG. 2 is a top view of the structure of FIG. 1;

FIG. 3 is a section taken along line III—III of FIG. 1;

FIGS. 4 – 9 are longitudinal sectional views illustrating the steps in sealing nested pipes according to the present invention; and

FIG. 10 is a view similar to FIG. 3 showing an alternative embodiment of the present invention.

SPECIFIC DESCRIPTION

As seen in FIGS. 1 – 3, the jacketed-pipe arrangement according to the present invention has an inner tube 1 of a diameter between 15 and 120 cm and a tube 2 of substantially 8 cm in diameter surrounded by a casing 3 of sufficient diameter to be spaced from the tube 1 by at least 2 to 5 and from the tube 2 by a distance of 3 to 6 cm, which tube 2 is itself spaced from the tube 1 by a space of 3 to 6 cm. The inner tube 1 can be used as an electric conductor in a cryogenic power-transmission system, or for the transport of hot or cold fluids. The tube 2 may be a simple conduit for electrical cables or may be a return or vacuum line for the jacketed-pipe system.

FIG. 10 shows how instead of a single tube 1, three tubes 1′ of around 20 cm in diameter may be used. Such a system is especially adapted for three-phase electrical systems in which case the tube 2 would be a vacuum line and supercooled gases would be flowed, as liquids, through the conduits 1′.

FIGS. 4–9 show how the end of the jacketed-pipe is sealed according to the present invention.

First, as seen in FIG. 5, two rings 4 are fitted over the tubes 1 and 2 and slid into the tube 3, into which they fit snugly. A space is left between these fiber rings or glands 4 into which a foaming synthetic resin is injected by means of a needle 21 pierced through the outer ring 4. This forms, as shown in FIG. 6, an annular seal 5 between the rings 4 which constitutes a very tight closure of the end of the tube 3.

Subsequently, as shown in FIG. 6, a spider 7 (7′ in FIG. 10) and two further rings 8 are fitted over the tube 1 only. This spider 7 and the rings 8 have an inside diameter which is the same as the outside diameter of the tube 1, and an outside diameter some 5–10 cm greater.

FIG. 7 shows how a plate 6 is wrapped around the spider 7 and rings 8 and formed into a cylindrical sleeve therearound by means of a hose clamp or ring 9. The length of the plate 6 in the direction of the axes of the tubes 1 and 2 is sufficiently great to extend axially beyond both the rings 8 and the spider 7, and its width is insufficient to wrap completely around these elements so that an axial slot 10 is formed at the upper side of the structure. The end of the sleeve 6 closest to the end of the tube 3 lies outside this tube 3 by a distance of about 10 cm. The tube 2 also lies outside the sleeve 6.

Thereafter, as seen in FIG. 8 two rings 13 are fitted around the outside of the tube 3 with a space between them which lies to one side of the seal of rings 4 and 5, so that if the resin for the ring 5 is introduced through a lateral hole in the casing 3, this hole will be completely covered. Another pair of rings 14 of like outside diameter but out to fit snugly over the tubes 6 and 2 are fitted over the tube 6 with a space left between them that is just in line with the spider 7. The rings 14 could be mounted directly on the tube 1, in which case rings 8 and plate 5 could be dispensed with. A transparent polester plate 12 like the plate 6 is wrapped around the rings 13 and 14, overlapping them at both ends and forming an axial slot 18 at the top. Clamps 15 overlying the outermost rings 13 and 4 secure this plate 12 in place. The rings 13 and 14, like rings 8, are applied as polyurethane-foam strips fastened with contact cement. At this time more foaming polyurethane material is poured in between the rings 8, 13, and 14 to define a chamber at the end of the tube 3 which is only open at 11 and 18. This forms a seal 16 between the rings 13, a seal 17 between the rings 14, and a seal 10 between the seals 8.

The regions of the tubes 1–3 exposed between these seals is now thoroughly cleaned, and as shown in FIG. 9 a collar 19 is fitted to the top of the structure, in line with slot 18. A mass of liquid polyurethane mixed with a foaming agent is poured in through the slot 18 and allowed to harden and cure to form a massive seal 20. Since the slot 10 is open and the spider 7 forms longitudinal passages all of the air will be driven out and even a nominal amount of the resin will flow out at this point, however due to the resins' viscosity the chamber will fill.

There is formed in this manner an extremely tight seal at the end of the tube 3. Since first a very good seal is formed by the use of the double rings to ensure that a closed chamber exists at the end of the tube 3, the tubes 1–3 may be cleaned without endangering the installation, and thereafter the massive seal 20 may be poured into place. This seal 20 extends back over the tube 3 inside and outside, and even extends over the tube 1 for a good distance so that the chances of leakage are minute.

I claim:

1. A jacketed-pipe structure comprising:
a casing having an end;
a tube in said casing extending from said end;
a pair of longitudinally spaced first walls between said tube and said casing at said end;
a synthetic-resin ring completely filling the region between said first walls;
a pair of longitudinally spaced second walls around said tube outside said casing;
a synthetic-resin ring completely filling the space between said second walls;
a first sheet wrapped around said second walls;
a pair of longitudinally spaced third walls around said casing;
a synthetic-resin ring completely filling the space between said third walls;
a pair of longitudinally spaced fourth walls around said sheet and outside said casing;
a synthetic-resin ring completely filling the space between said fourth walls;
a second sheet wrapped around said third and fourth walls, said first and third walls on one side and said second and fourth walls on the other side defining a chamber; and
a synthetic-resin mass completely filling said chamber.

2. The structure defined in claim 1 wherein said sheets form upwardly open slots.

3. The structure defined in claim 1, further comprising a spacer body surrounding said tube between said first walls and second walls, said first sheet being wrapped around said second walls and said spacer body.

4. The structure defined in claim 3 wherein said spacer body is formed with longitudinal passages.

5. The structure defined in claim 1, wherein said second sheet forms an upwardly open slot, said structure further comprising a collar at said slot for introduction of said mass in a liquid state into said chamber.

6. The structure defined in claim 1 wherein each of said walls is a ring of foamed polyurethane.

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