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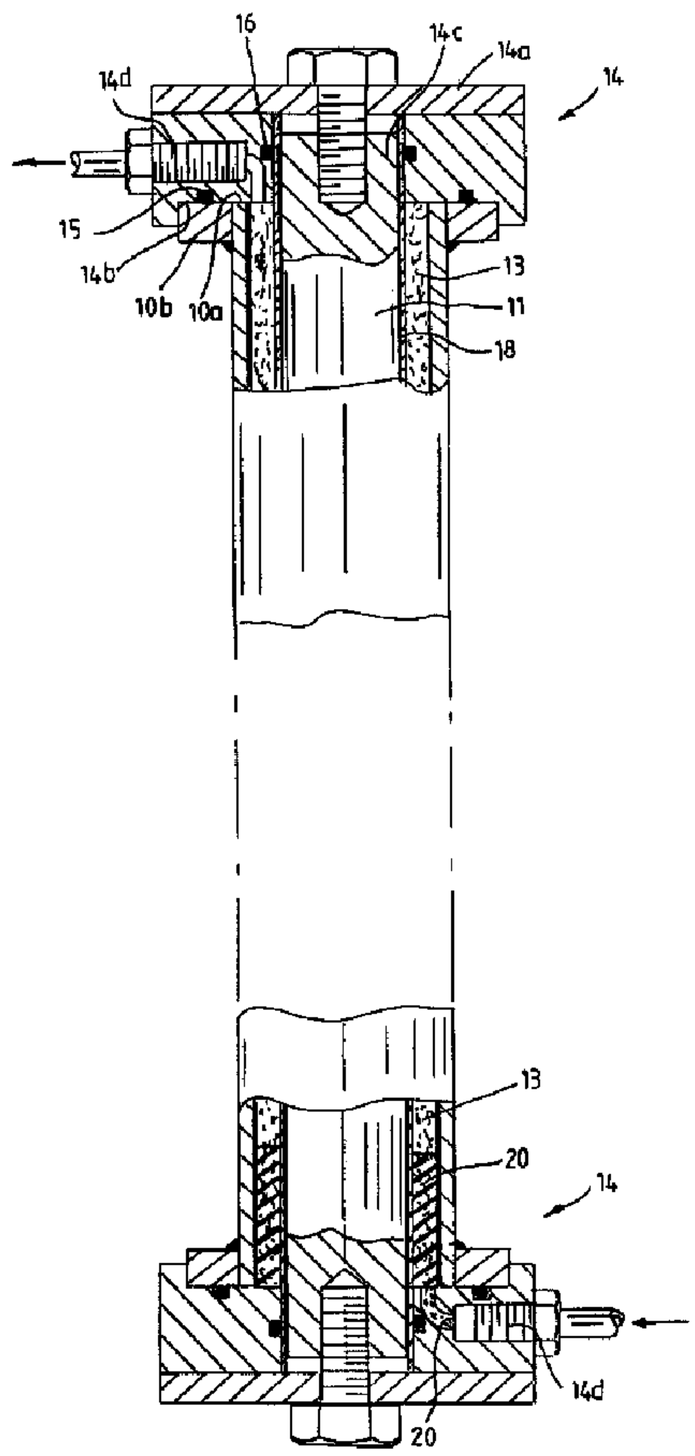
(54) Titre : METHODE DE REVETEMENT DE LA PAROI INTERIEURE D'UNE CONDUITE
(54) Title: PIPE LINING METHOD



(57) Abrégé/Abstract:
THE INVENTION provides a method of lining a pipe comprising the steps of positioning a mandrel in co-axial relationship within the tube to extend from end to end, charging the space between the mandrel and the inner wall of the pipe with a lining material

CA 2055284 C 2002/05/28

(11)(21) 2 055 284

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(57) Abrégé(suite)/Abstract(continued):
having the required physical properties, introducing a settable binder into the aforesaid space to bind the lining material into a continuous coherent lining, and removing the mandrel once the binder has substantially set.

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PIPE LINING METHOD

A B S T R A C T

THE INVENTION provides a method of lining a pipe comprising the steps of positioning a mandrel in co-axial relationship within the tube to extend from end to end, charging the space between the mandrel and the inner wall of the pipe with a lining material having the required physical properties, introducing a settable binder into the aforesaid space to bind the lining material into a continuous coherent lining, and removing the mandrel once the binder has substantially set.

PIPE LINING METHOD

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FIELD OF INVENTION

THIS invention relates to a method of lining the interior of a pipe or the like.

DESCRIPTION OF PRIOR ART

Various wear resistant linings for steel pipes have been proposed in the past, but these all suffer from one disadvantage or another. For example it is known to load tubular ceramic sections into a pipe as a lining. The disadvantage of such an arrangement is that corrosion and deterioration of the steel pipe occurs at the junction between adjacent ceramic sections. The ceramic sections are moreover a costly commodity.

SUMMARY OF INVENTION

According to the invention a method of lining a pipe comprises the steps of positioning a mandrel in co-axial relationship within the tube to extend from end to end, charging the space between the mandrel and the inner wall of the pipe with a

lining material having the required physical properties, and introducing a settable binder into the aforesaid space to bind the lining material into a continuous coherent lining, and removing the mandrel.

In a preferred arrangement the binder will be introduced at low level, and allowed to filter upwardly through the lining material substantially to fill the aforesaid space. With such an arrangement the pipe will preferably be positioned generally vertically, and the binder introduced at the bottom end of the pipe. Preferably also the method will include the step of sealing the space between the mandril and the inner surface of the pipe, and evacuating air from such space during or prior to introducing the binder into the space.

Further according to the invention the binding material is or includes a particulate material and the binder preferably comprises a synthetic resinous binder.

Still further according to the invention the method

includes the step of providing a release agent or layer between the outer surface of the lining and the inner surface of the pipe to permit relative longitudinal movement between these surfaces.

Further features of the invention provide for the mandrel to be lined or coated with a non-adherent release layer prior to the introduction of the binder. Thus for example the mandrel could be sheathed in a tube of suitable non-adherent material such as polyethylene. The invention further envisages that the mandrel could be of tubular structure and adapted to be shrunk or collapsed after the binder has set. Where the mandrel is to be shrunk, it could for example be of metallic material and shrunk by means of the introduction of a coolant such as liquid nitrogen thereinto. Alternatively, the mandrel could be of flexible material and be inflated and subsequently deflated upon removal from the pipe.

Also included within the scope of the invention, is apparatus adapted for use in the method disclosed herein, such apparatus including an end cap

construction which comprises a crown formation adapted to close the end of a pipe or the like, first locating means adapted to locate the end of the pipe relative to the crown formation, and second locating means adapted to locate a mandrel disposed within the pipe relative to the crown formation. In one embodiment of the invention the construction will also include seal means adapted to seal the space between the outer surface of the mandrel and the inner surface of the pipe, relative to the crown formation. With such an arrangement the invention of the crown formation defines a passageway through which a binder may be introduced, and/or air evacuated, into or from the space between the mandrel and the inner pipe surface.

Preferably the first locating means will be in the nature of a circumferential recess adapted to receive the end of the pipe and any flange which may be defined at the end of the pipe. The second locating means could be in the nature of an aperture through which a fastener may pass to engage the mandrel. Doubtless many variations are possible in this regard.

The invention also includes within its scope the provision of a second end cap construction which comprises a crown formation adapted to close the end of a pipe or the like, a first locating means adapted to locate the end of the pipe relative to the crown formation, second locating means adapted to locate a mandrel disposed within the pipe relative to the crown formation, and apertures in the crown formation through which particulate material may be charged into the space between the outer surface of the mandrel and the inner surface of the pipe.

~~BRIEF~~ DESCRIPTION OF A PREFERRED EMBODIMENT

Further features of the invention will appear from the embodiment described below purely by way of example with reference to the accompanying drawings wherein:

Figure 1 is a partially sectioned perspective view of a pipe which is in the process of being lined in accordance with method of the invention; and

Figure 2 is a sectioned elevation of the pipe in Figure 1 shown during a resin filling operation.

In one example of the invention a method of lining a pipe 10 with a wear resistant lining comprises the steps of locating a mandrel 11 co-axially within the bore of the pipe 10 and charging the space 12 between the outer surface of the mandrel and the inner surface of the pipe with a particulate wear resistant material 13 such as alumina. The particulate lining material is thereafter bound into a continuous coherent lining as described in more detail below.

The mandrel 10 is held in a central position within the pipe by means of end cap constructions 14 or 15. The construction 14 defines a crown formation including an outer closure 14a which encloses the end of the pipe, a first locating formation in the form of a groove 14b which is adapted to receive the end 10a of the pipe 10, a flange 14b therefore, and a second locating formation 14c also in the form of a recess adapted to receive the mandrel 11.

The end cap construction 14 further includes a pair of seal rings 15 and 16, the seal rings 15 and 16 being adapted to seal the pipe flange 10b and the mandrel 11 respectively relative to the crown formation 14 thus in effect sealing the space 13 between the outer surface of the mandrel and the inner surface of the pipe.

A different end cap 17 for facilitating the charging of particulate material 13 into the space 12 between the mandrel 11 and the inner wall of the pipe 10 is shown in Figure 1. This end cap 17 dispenses with the seals 15, 16, and defines elongated slots 17b in its outer closure 17a to align with the space 12 between the mandrel 11 and the inner pipe surface. Once the pipe 10 has been charged with the particulate lining material 13, the end cap 15 shown in Figure 1 can be removed and the end cap 14 shown in Figure 2 is employed to seal the space 12 between the mandrel 11 and the inner surface of the pipe 10.

The method of the invention further provides that a layer 18, preferably a tube of release material

will be located on the outer surface of the mandrel 11. By release material is meant material which will not adhere to the binder which is described in more detail below. Preferably a sleeve 18 of polyethylene or the like material will be drawn over the mandrel 11 and additionally a coating of release agent, not shown, will be applied to the outer surface of the polyethylene material.

The method of the invention further provides that a coating or layer 19 of release material will also be provided on the inner surface of the pipe 10 to prevent the lining which is formed by the method from binding to the wall and thus being subjected to stress as a result of the expansion or contraction of the pipe. Such a lining could likewise be in the form of a tubular sleeve of polyethylene or the like material or could simply comprise a coating of release agent.

Once the particulate lining material 13 has been charged into the space 12 between the outer surface of the mandrel and the inner surface of the pipe, this space is sealed as described above, and a

binder 20 is then introduced into the space 12 to bind the particulate material 13 into a continuous coherent lining. The method of the invention provides that the pipe 10 will be generally vertically orientated and the binder 20 introduced into the space 12 at low level through a port 14d in the end cap construction 14 and allowed to filter upwardly through the particulate material 13, Figure 2. For most applications a liquid settable synthetic resinous material such as a polyester or epoxy resin having the required properties will be used. In order to facilitate the resin filling process, the method of the invention provides for air to be evacuated from the space 12 between the mandrel and the inner surface of the pipe, at high level through the port 14d at the upper end cap construction 14, Figure 2. It has been found that the evacuation of air has a further beneficial effect of largely eliminating formation of foam or bubbles which could result in void areas in the lining. Means for injecting the resin 20 into the lining zone 12 will preferably be in the form of conventional high pressure resin pumping equipment which will preferably include means for mixing the resin with the required polymerization catalyst.

Once the resin has set the end caps and the mandrel will be removed from the pipe leaving a continuous coherent lining within the pipe 10. In order to facilitate removal of the mandrel, the mandrel could be of tubular construction of a suitable metal, and a coolant could be introduced into the bore of the tube to shrink the tube and thus to permit ready extraction of the mandrel.

Alternatively, the mandrel could be in the nature of a collapsible tube of rubber or synthetic resinous material which is adapted to be inflated until the resin has set and thereafter to be deflated and extracted from the pipe. Clearly other variations are also possible and it is envisaged that these will all fall within the scope of the consistory clauses. For example, in one arrangement the end cap construction 14 could define a formation which projects a short distance into the tube so that the lining is moulded into a particular form at the ends of the pipe, for example an outwardly diverging form.

CLAIMS

1. A method of lining a pipe characterized in the steps of positioning a mandrel in co-axial relationship within the tube to extend from end to end, charging the space between the mandrel and the inner wall of the pipe with a particulate lining material having the required physical properties, introducing a settable binder into the aforesaid space to bind the particulate lining material into a continuous coherent lining, and removing the mandrel once the binder has set.

2. The method according to claim 1 characterized in that the pipe is positioned generally vertically and the binder introduced at low level and allowed to filter upwardly through the lining material substantially to fill the space between the mandrel and the inner surface of the pipe.

3. The method according to claim 1 characterized in the step of sealing the space between the mandrel and the inner surface of the pipe and evacuating air from such space during or prior to introducing the binder into the space.

4. The method according to claim 1 characterized in that the lining material is or includes a particulate material.

5. The method according to claim 1 characterized in that the binder comprises a synthetic resinous binder.

6. The method according to claim 1 characterized in that the step of providing a release agent or layer at the interface between the lining and the pipe to permit relative longitudinal movement between the surfaces in use.

7. The method according to claim 1 characterized in the step of lining or coating the mandrel with a release agent or lining to prevent binding between the mandrel and lining.

8. The method according to claim 7 characterized in that the mandrel is sheathed in a tube of non-adherent material such as polyethylene.

9. The method according to claim 1 characterized in that the mandrel is of a tubular structure and adapted to be shrunk or collapsed after the binder has set.

10. The method according to claim 1 characterized in that the mandrel is adapted to be shrunk to permit removal thereof once the binder has set and is of a tubular structure and the method includes the step of introducing a coolant such as liquid nitrogen into the mandrel to effect shrinkage thereof.

11. The method according to claim 1 characterized in that the mandrel is adapted to be collapsed for removal purposes after the binder has set, and the method includes the step of inflating the mandrel prior to introducing the lining material and/or binder and subsequently deflating the mandrel to permit removal thereof from the pipe.

12. Apparatus adapted for use in the method claimed in any one of claims 1 to 11 characterized in an end cap construction which comprises a crown formation adapted to close the end of a pipe or the like, first locating means adapted to locate the end of the pipe relative to the crown formation, and second locating means adapted to locate a mandrel disposed within the pipe relative to the crown formation.

13. Apparatus according to claim 12 characterized in that the construction includes seal means adapted to seal the space between the outer surface of the mandrel and the inner surface of the pipe, relative to the crown formation.

14. Apparatus according to claim 12 characterized in that the crown formation defines one or more passageways through which a binder and/or particulate lining material may be introduced and/or air evacuated into or from the space between the mandrel and the inner pipe surface.

15. Apparatus according to claim 14 characterized in that the crown formation provides a first passageway through which a binder may be introduced or air evacuated, and a end cap removably mounted on the crown formation and which optionally defines a second passageway through which particulate material may be introduced into the space between the mandrel and inner pipe surface.

16. Apparatus according to claim 12 characterized in that the first locating means is in the nature of a circumferential recess adapted to receive the end of a pipe together with a flange which may be defined at the end of the pipe.

17. Apparatus according to claim 12 characterized in that the second locating means is in the nature of an aperture through which a fastener may pass to engage the mandrel.

18. A pipe lined in accordance with the method claimed in any one of claims 1 to 11.

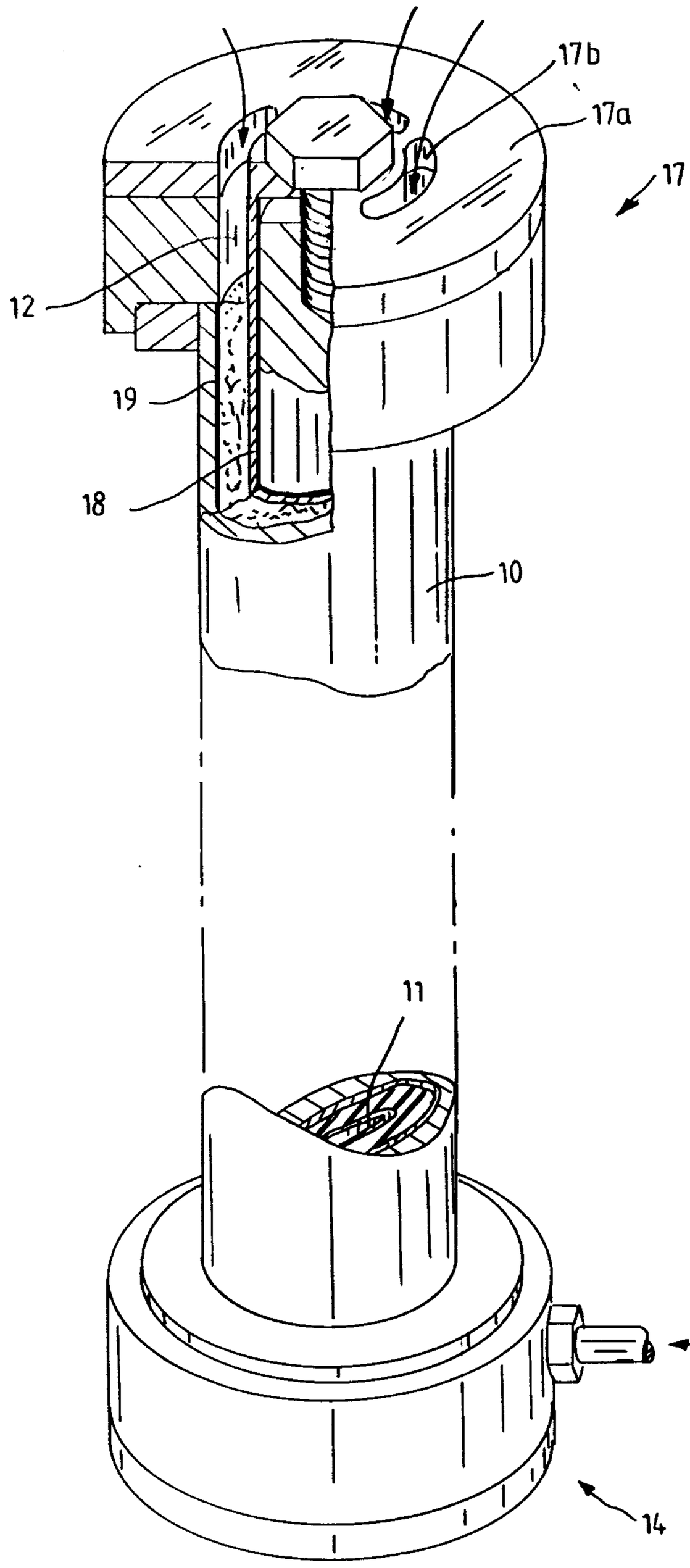


FIGURE 1

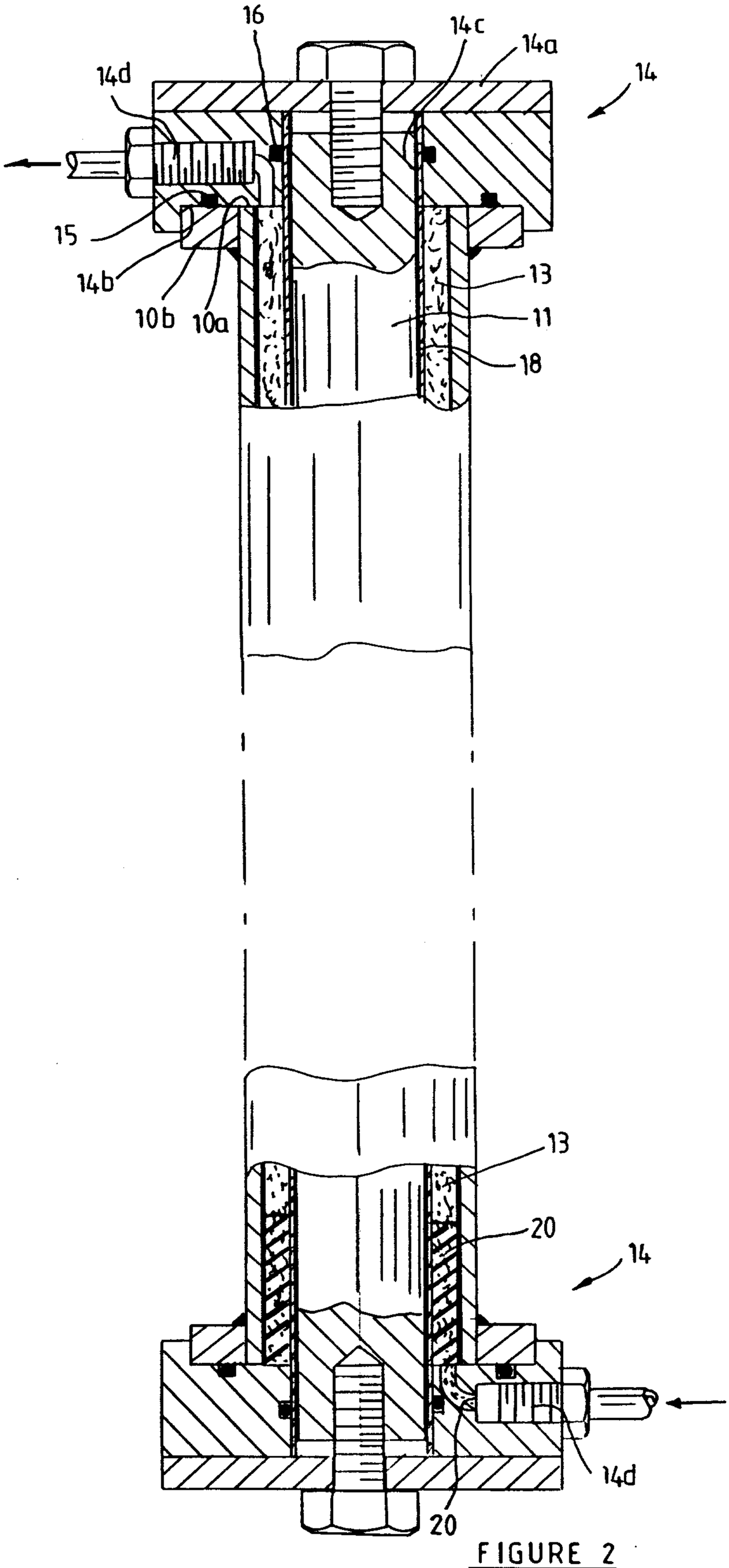
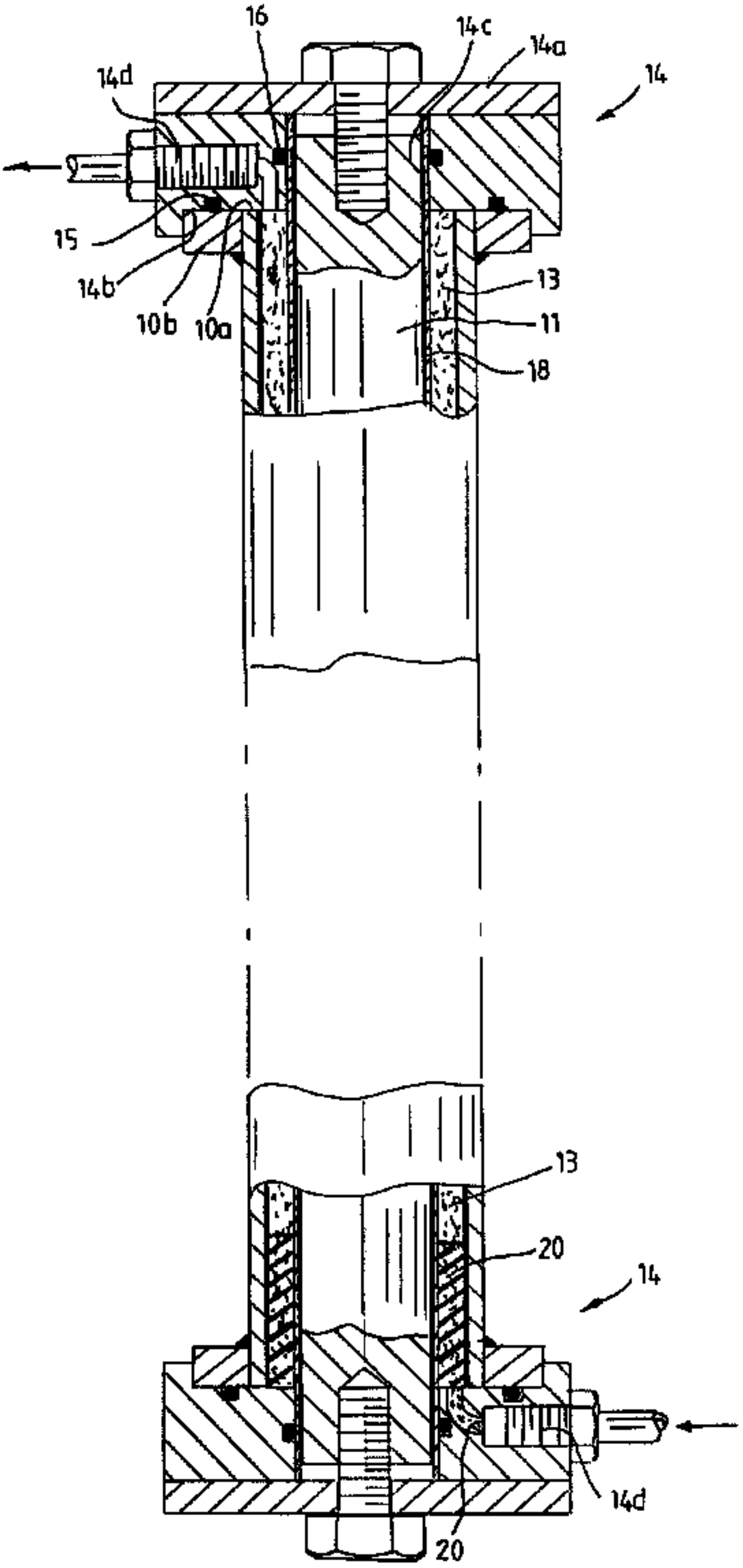


FIGURE 2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