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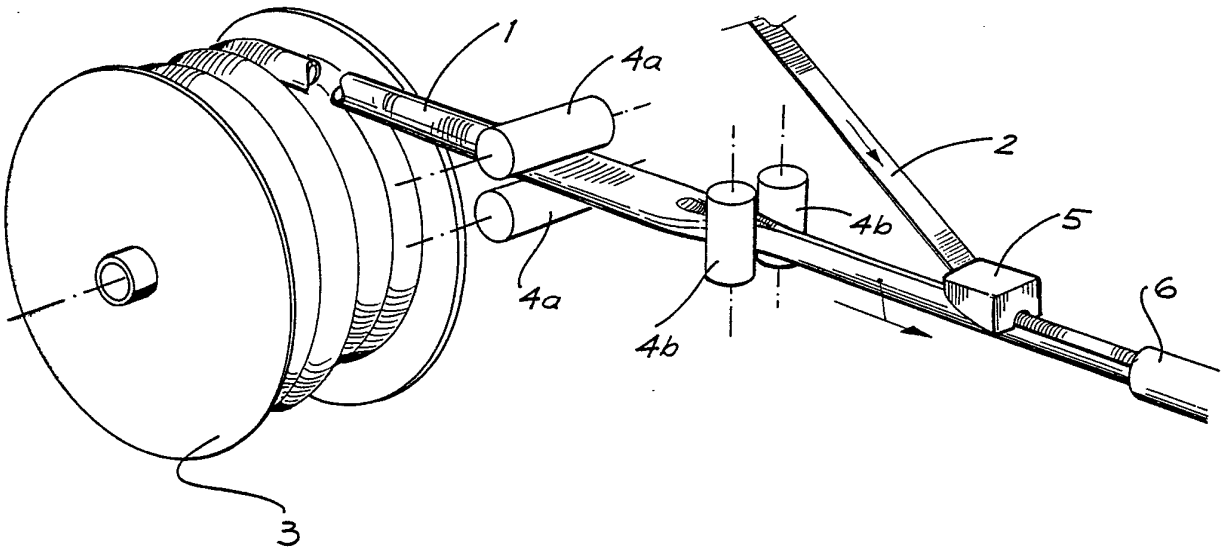
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(54) Title: METHOD AND MEANS FOR APPLYING FLEXIBLE LINERS TO PIPES



(57) Abstract

To line the internal surface of a pipe (6) such as a water, gas or drain pipe an inner plastics semi-rigid lining (1) is collapsed and retained in collapsed condition by a tearable strap (2). The collapsed state of the lining (1) being of a lesser maximum diameter than the underformed lining (1) so that it can readily fit within and along pipe (6). Severing of the strap (2) allows the lining (1) to resiliently expand to its original shape and closely fit the internal wall of the pipe (6).

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"METHOD AND MEANS FOR APPLYING FLEXIBLE LINERS TO PIPES

The present invention relates to the lining of pipes and more particularly to the lining of pipes with a plastics material. The invention provides an improved in-situ method for pipe lining which has special utility for underground pipe systems.

Various methods have been proposed for lining pipes, however, the present invention overcomes certain impracticalities inherent in the prior art.

Common in the field has been a proposal to provide adhesive means to bond a plastics material liner to the inner surface of the pipe. In one particular method an adhesive is applied to the inner surface of the liner and the liner progressively axially everted within the pipe by means of compressed air. In another method, the inner surface of the pipe is coated with a radiation curable adhesive and an extruded thermoplastic liner is introduced into the pipe, bonding being effected by means of a travelling radiation source.

The present invention provides means whereby a plastics material liner can be frictionally affixed to the inner surface of a pipe thereby overcoming the necessity of adhesive means. Additionally, frictional location of the liner overcomes the problems associated with thermally activated methods allowing, in particular, non-metallic pipes to be lined.

The present invention provides a method of lining a pipe comprising the steps of providing a semi-rigid plastics tube having an external diameter corresponding to the internal diameter of the pipe to be lined, forcibly collapsing the tube so as to form at least one longitudinally extending depression of the tube thereby decreasing the diameter of the tube, fixing a longitudinally extending tearable strap to or about the pipe so as to maintain the collapsed configuration,

introducing the collapsed tube in its maintained collapsed configuration into the pipe for a desired distance along and within the pipe and releasing the strap in order to restore the tube to its original shape and bring it into frictional contact with the internal wall of the pipe.

In another form the present invention provides a semi-rigid plastics tube maintained in a collapsed shape comprising at least one longitudinally extending depression of the tube and a tearable strap fixed to or extending around the tube to maintain the maximum diameter of the collapsed tube at a lesser dimension than when the tube is uncollapsed.

In a preferred embodiment the strap may be composed of a laminated plastic film which is heat welded to the tube. In another embodiment the strap is in the form of a plastics film wrapped all the way round the deformed or collapsed plastics tube so that the film is welded to itself to maintain the tube in its collapsed configuration. This arrangement is particularly appropriate where the film cannot be readily adhered to the material of the tube. In such embodiments, release of the strap could be effected by cutting the strap or by pressurizing the tube.

In order that the invention may be better understood preferred forms thereof are hereinafter described by way of example with reference to the accompanying drawings in which:

Figs. 1 and 2 are cross-sectional views of an undefined length of extruded plastics tubing;

Fig. 3 is a cross-sectional view of the same piece of tubing together with a welded on plastics strap;

Figs. 4 and 5 are cross-sections of a second form of the invention;

Fig. 6 is a cross-sectional view similar to Fig. 3 with a plastics strap welded to itself; and

Fig. 7 is a schematic representation of a system according to the invention for the in situ collapsing of tubing and lining of pipes.

Fig. 1 shows a cross-section of a tube 1 which can be of an extruded plastics material such as low density polythene. As shown, the tube 1 has an outside diameter, D, so chosen as to correspond to the inside diameter of the pipe (not shown) to be lined. In Fig. 2 the same tube 1 is shown after it has been forcibly collapsed into a typical configuration having a major cross-sectional axis, d, such that $d < D$. This configuration is maintained by a tearable film 2 which is heat welded onto the tube as shown in Fig. 3. In this maintained collapsed configuration the tube 1 is introduced for a desired distance within and along the pipe to be lined. The film 2 is then cut or otherwise broken to enable the tube to return to its original shape. As the liner 1 returns to its original diameter, D, it frictionally engages the interior wall of the pipe.

Referring to Fig. 6, the only variation from the arrangement of Fig. 3 is that the film 2 wraps around tube 1 and is welded or adhered to itself rather than being affixed to tube 1. This arrangement is appropriate where the materials of the film 2 and tube 1 are not compatible for welding or the like. Where a tube 1 is to be employed in a high temperature or corrosive environment it may be necessary to use cross-linked polyethylene or polybutylene as the tube material such that welding of a film 2 may not be suitable.

The collapsed tubing can be conveniently spool fixed for delivery. Alternatively, on site apparatus can be provided to perform the collapsing and securing of the collapsed tube, such apparatus comprising roller means and heat welding means. In Fig. 7 a spool of uncollapsed tubing 1 is shown generally at 3. Roller means 4a, 4b

first substantially flatten and then arcuate the tubing, respectively, so as to produce a cross-sectional configuration as shown in Fig. 2. In close proximity to the roller means 4b is provided a welding station 5 which receives and fixes a tearable film 2 to the tube thereby maintaining the tube in a collapsed configuration as shown in Fig. 3. The tubing is then introduced within and along a pipe 6.

The embodiments described having regard to Figs. 1-3 and 6 is especially suited to the lining of small diameter pipes. A further embodiment is hereafter described having reference to Figs. 4 and 5 in which the invention has improved application to the lining of larger diameter pipes.

A tube of extruded plastics material such as low density polythene is provided as previously indicated in Fig. 1 and having a larger diameter to correspond to the inside diameter of larger pipes desired to be lined. The tube is substantially flattened as shown in Fig. 4 and subsequently arcuated as shown in Fig. 5. Description of this embodiment is in other respects as discussed above. This second embodiment has improved practical value since the flattened liner shown in Fig. 4 can be spool fixed for delivery thereby obviating the necessity of roller means 4a. Clearly, further steps can be taken to reduce the on-site apparatus shown in Fig. 7 and thereby increase the versatility of applications of the invention.

CLAIMS:-

1. A method of lining a pipe comprising the steps of providing a semi-rigid plastics tube having an external diameter corresponding to the internal diameter of the pipe to be lined, forcibly collapsing the tube so as to form at least one longitudinally extending depression of the tube thereby decreasing the diameter of the tube, fixing a longitudinally extending tearable strap to or about the pipe so as to maintain the collapsed configuration, introducing the collapsed tube in its maintained collapsed configuration into the pipe for a desired distance along and within the pipe and releasing the strap in order to restore the tube to its original shape and bring it into frictional contact with the internal wall of the pipe.

2. A method as claimed in claim 1, wherein the tearable strap is welded to the tube.

3. A method as claimed in claim 1, wherein the tearable strap surrounds the collapsed tube and is affixed to itself.

4. A method as claimed in any one of the preceding claims, wherein the tube is collapsed and maintained in its collapsed configuration at a location remote from the pipe then transported to be introduced into the pipe.

5. A method as claimed in any one of claims 1 to 3, wherein the tube is collapsed and maintained in its collapsed configuration at a location adjacent the pipe to be lined.

6. A method as claimed in any one of the preceding claims, wherein the tube is produced from any one of polyethylene and its copolymers, cross-linked polythene and polybutylene.

7. A semi-rigid plastics tube maintained in a collapsed shape comprising at least one longitudinally extending depression of the tube and a tearable strap fixed to or

extending around the tube to maintain the maximum diameter of the collapsed tube at a lesser dimension than when the tube is uncollapsed.

8. A plastics tube as claimed in claim 7, wherein the tube is produced from any one of polyethylene and its copolymers, cross-linked polythene and polybutylene.

9. A method of lining a pipe substantially as hereinbefore described with reference to the accompanying drawings.

10. A semi-rigid plastics tube maintained in a collapsed state substantially as hereinbefore described with reference to Figs. 1-3, 4 and 5 or Fig. 6 of the accompanying drawings.

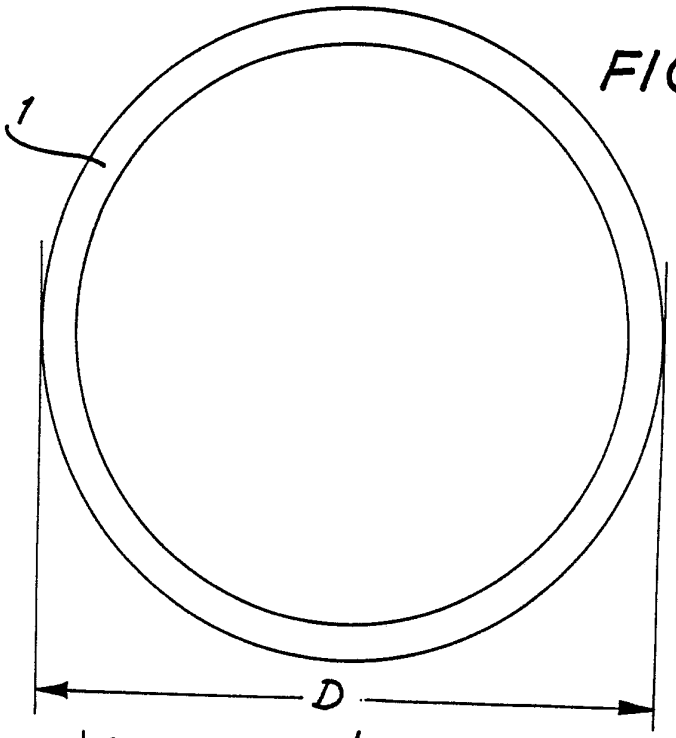


FIG. 1

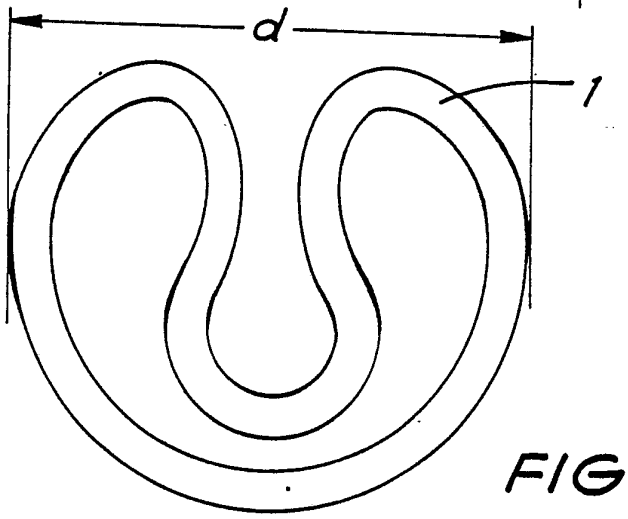


FIG. 2

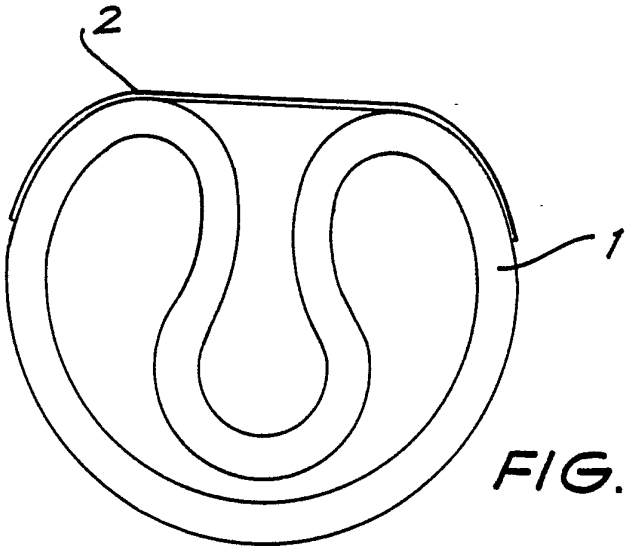


FIG. 3

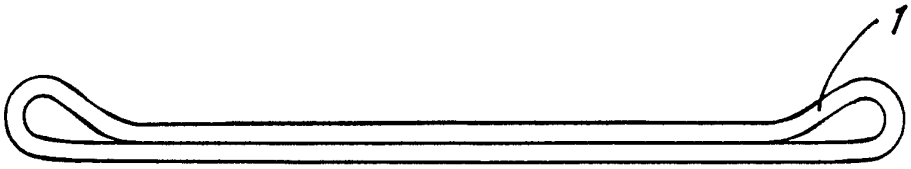


FIG. 3

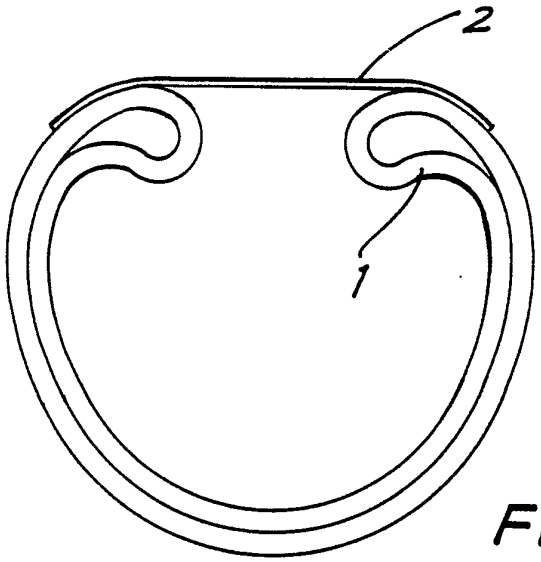


FIG. 4

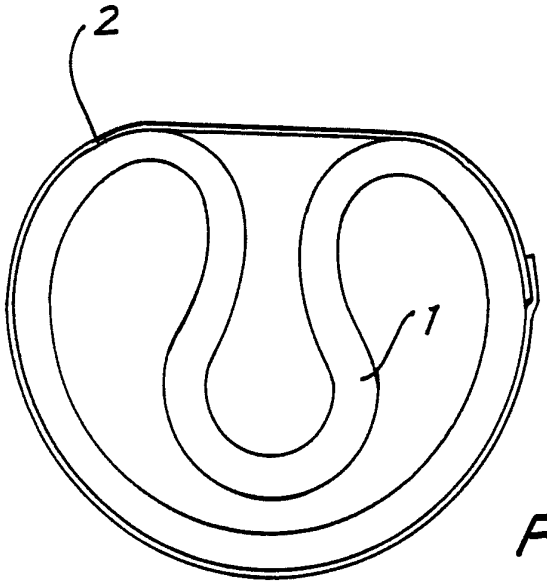


FIG. 6

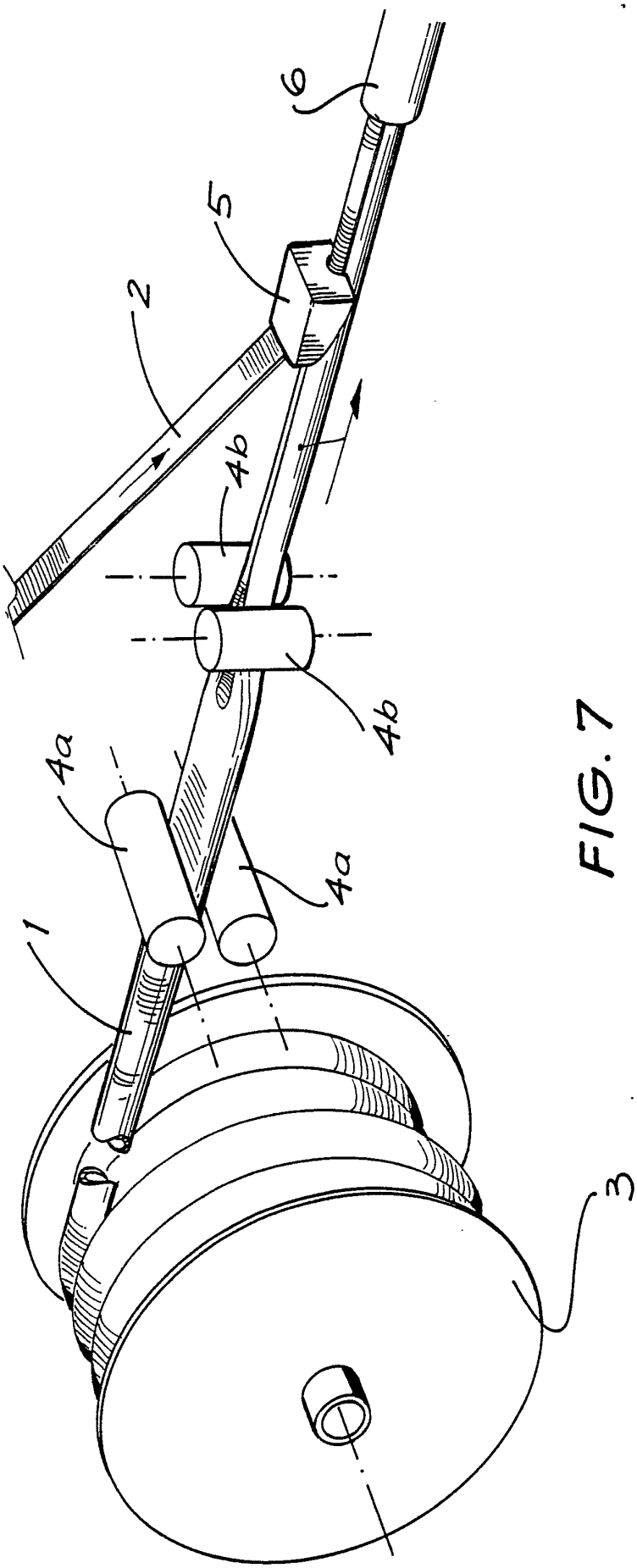


FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 86/00362

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] B29C 27/16, 63/34, B29D 23/10, F16L 58/10, 57/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B29C 27/16 F16L 58/10, 57/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	AU,A, 16542/83 (TRIO ENGINEERING LIMITED) 5 January 1983 (05.01.83)	1-10
X	AU,B, 38373/78 (TRIO ENGINEERING LIMITED) 31 January 1980 (31.01.80)	1-10
X	FR, 2199090 (STABILATOR AB) 26 September 1974 (26.09.74)	1-10
A	AU,A, 36219/84 (KAWASAKI STEEL CORPORATION) 13 June 1985 (13.06.85)	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
16 February 1987 (16.02.87)	3-3-81 - 3 MARCH 1987
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	J.L. WERNER

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/AU 86/00362

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
AU 16542/83	DK 3051/83	EP 98547	ES 523780
	JP 59140989	NO 832378	
AU 38373/78	CA 1115917	DK 3324/78	EP 576
	ES 472 063	GB 2003576	JP 55133923
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