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A U S T R A L I A

PATENT

NOTICE OF ENTITLEMENT

We, UPONOR N.V., of Emmaplein Fouress Building, P.O. Box 259, Philipsburg, Sint Maarten, Dutch Antilles, being the applicant and the person nominated for grant of patent in respect of the Application for an invention entitled "TUBE FOR LINING OF PRESSURE WATER PIPES" state the following:-

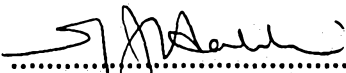
The actual inventors of the invention are:

JOHANSSON Thomas, of Amiralsvägen 14, S-438 00 Landvetter, Sweden and
JÄRVENKYLÄ Jyri, of Tapiontie 4, SF-15870 Hollola, Finland.

The basic application from which priority is claimed is 8704210-7 filed in SWEDEN on 29 October, 1987.

The basic application listed above is the first application made in a Convention country in respect of the invention.

The person nominated for the grant of the patent has entitlement from the actual inventors who by virtue of an assignment of the invention and of the priority right from the actual inventors.


.....
Michael J. Houlihan
Registered Patent Attorney

9 April 1992
.....
Date

To: The Commissioner of Patents

Declaration in Support of an Application for a Patent

*Strike out for
non-convention

In support of the *Convention** application made for a ^{patent}
~~patent of addition~~ for an invention entitled

Insert full
name and address
of declarant

I, Esko Hippeläinen
of Annikintie 5 B 14, SF-15200 Lahti, Finland

do solemnly and sincerely declare as follows:

1. I am^{patent}
We are the applicant(s) for the ^{patent}
~~patent of addition~~
(or in the case of an application by a body corporate)
1. I am authorised by
the applicant for the ^{patent}
~~patent of addition~~ to make this declaration on its behalf.
2. The basic application(s) as defined by section 141 of the Act ^{is} —
~~are~~

Strike out Para. 2
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Filing Date	Country	Applicant(s)

Insert details
for the/or EACH
basic application

3. The basic application(s) referred to in this Declaration ^{was}
~~were~~ the first application(s) made in a
Convention country in respect of the invention the subject of the application.

4. I am
We are the actual inventor(s) of the invention.
(or, where a person other than the inventor is the applicant:)

Insert full
name(s) and
address(es) of
inventor(s)

4. JOHANSSON Thomas JÄRVENKYLÄ Jyri
of Amiralssvägen 14 Tapiontie 4
S-438 00 LANDVETTER SF-15870 HOLLOLA
Sweden Finland

is
are the actual inventor(s) of the invention and the facts upon which the applicant is entitled to make the
application are as follows:

Applicant is the assignee of the invention from the said actual inventors.

See over for
instructions

DECLARED AT

No Legalization
No Corporate Seal

this 5th day of April 19 90



Signature of Declarant
Esko Hippeläinen

To: The Commissioner of Patents.

(12) PATENT ABRIDGMENT (11) Document No. AU-5-26087/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 625657

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TUBE FOR LINING OF PRESSURE WATER PIPES
- International Patent Classification(s)
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- (71) Applicant(s)
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- (74) Attorney or Agent
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- (56) Prior Art Documents
AU 70813/87 F16L 55/16
- (57) Claim

1. Pipe of thermoplastic material for pressure water pipelines, having radially projecting fins (2, 10, 11) on the outside surface of the pipe wall (1, 12), characterized in that the pipe wall including said fins is formed integrally as a tubular element with the tensile strength of the pipe wall (1, 12) being greater than the shear strength of the fins (2, 10, 11).

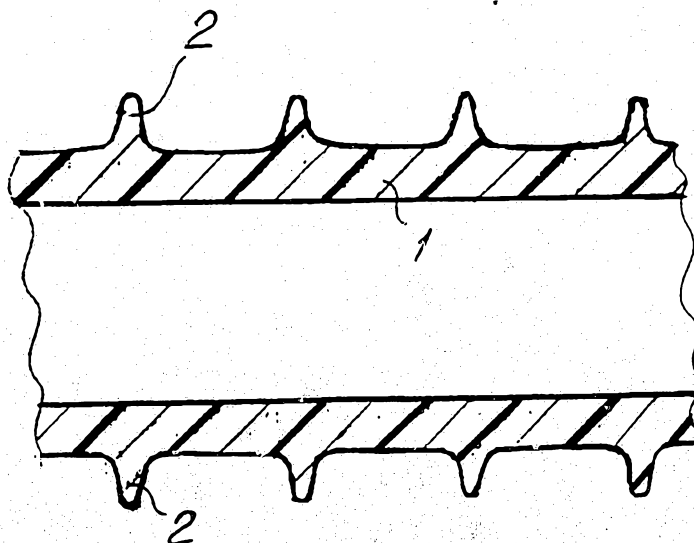
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INTERNATIONAL APPLICATION

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(21) International Application Number: PCT/SE88/00579 (22) International Filing Date: 28 October 1988 (28.10.88) (31) Priority Application Number: 8704210-7 (32) Priority Date: 29 October 1987 (29.10.87) (33) Priority Country: SE (71) Applicant (for all designated States except US): UPON-OR N.V. [NL/NL]; Emmaplein - Fouress Building, P.O. Box 259, Philipsburg, Sint Maarten (AN). (72) Inventors; and (75) Inventors/Applicants (for US only): JOHANSSON, Thomas [SE/SE]; Amiralsvägen 14, S-438 00 Landvetter (SE). JÄRVENKYLÄ, Jyri [FI/FI]; Tapiontie 4, SF-15870 Hollola (FI).		(74) Agents: STRÖM, Tore et al.; Ström & Gulliksson AB, P.O. Box 4188, S-203 13 Malmö (SE). (81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), SU, US. Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>	
(54) Title: TUBE FOR LINING OF PRESSURE WATER PIPES			



(57) Abstract

A pipe of thermoplastic material for relining of pressure water pipelines is made as a finned pipe wherein the tensile strength of the pipe wall (1) is greater than the shear strength of the fins (2).

TUBE FOR LINING OF PRESSURE WATER PIPES

The invention relates to a pipe for relining pressure water pipelines and more particularly to a relining pipe which shall be drawn into the pipeline to be restored. This type of relining is termed slip-lining.

In pressure water pipelines which often comprise cast-iron or nodular-iron pipes or steel pipes deposits eventually build up on the inner side of the pipe wall, which necessitate repeated cleaning of the pressure water pipeline. However, by such cleaning the material of the iron pipes will be uncovered, which in turn causes increased corrosion so that the pipe wall after repeated cleaning will be thinner and thinner and finally will not satisfy the established requirements as to the strength. The reduction of the strength of the pipe caused by corrosion can give rise to damages such as perforation of the pipe wall. Damages can also arise due to shocks. In those cases wherein a reduction of the dimension of the pressure water pipeline can be accepted, the pipeline can be restored by drawing a relining pipe thereinto. The pipes which are used today in restoring pipelines in this manner consist of smooth polyethylene or polypropylene pipes which are drawn into the pressure water pipeline either as a major continuous length of pipe which is wound up to form a coil, or as lengths of about 12 m which are interconnected by butt welding in the field. When the pipe is introduced into the pressure water pipeline from the ground level the pipe often will be tightly bent, e.g. at the transition from a vertical well to a horizontal pipeline and in bends in the pipeline. In order that the relining pipe can be drawn into the pipeline from the

ground level through a shaft the pipe accordingly must have some flexibility in the longitudinal direction thereof, which is of course also required in order that the relining pipe can follow existing
5 bends or irregularities in the pipeline. At the same time it is required that the pipe has a strength which is so great that the pipe resists the positive and negative pressures which can appear in the pipelines. These two requirements are in conflict with
10 each other and therefore it is not unusual that a pipe which is sufficiently flexible will be deformed during the relining or at great negative pressures. Moreover, the relining pipe must have an outside diameter which is sufficiently smaller than the in-
15 side diameter of the pipeline in order that the pipe can slide unobstructedly through the pipeline when it is drawn thereinto. Due to the gap between the relining pipe and the pipeline there will be obtained, however, a movement of the relining pipe at existing
20 pressure shocks in the relined pressure water pipeline, which can result in damages on the relining pipe at existing irregularities or sharp edges in the pipeline so that the relining pipe eventually will break due to such mechanical damages. The movement of
25 the relining pipe as such can be eliminated by injecting between the relining pipe and the pipeline a setting filler, but this measure makes the relining substantially more expensive and, therefore, it is desired to avoid such measure. The joints between the
30 pipe lengths provided by mirror welding or induction welding moreover provide risk zones because they can be of poor quality, which cannot be detected by external visual inspection, and because there is obtained at the joints a bead on the outside of the relining pipe, which can engage with the pipes of the
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pipeline when the relining pipe is drawn thereinto.

The purpose of the invention is to provide a pipe which is more suitable for sliplining than the smooth polyethylene or polypropylene pipe and eliminates the drawbacks accounted for above, and which at the same time is flexible in the longitudinal direction thereof and is stiff in the radial direction and can easily be secured in position in the pipeline. The pipe according to the invention is a pipe of thermoplastic material for ~~sliplining~~ pressure water pipelines, having radially projecting fins on the outside surface of the pipe wall disclosed in US-A-4,690,174 and has obtained the characterizing features of claim 1.

Due to the fact that the relining pipe comprises a finned pipe having the properties mentioned above it is possible to successfully use the pipe as a relining pipe. Owing to the fins the pipe wall can be made thinner than in smooth pipes, which improves the flexibility of the pipe, and at the same time the fins reduce the risk of deformation in the direction of the pipe radius. The relationships between the strengths of the pipe wall and the fins make possible that the finned pipe is used as a relining pipe because said relationships guarantee that the fins and not the pipe wall yield when the fins encounter a resistance in the pressure water pipeline.

The lower shear strength of the fins can be obtained in a simple manner by making the fins of a softer material than the pipe wall. As an alternative the total volume of the fins is at the most half the volume of the pipe wall, and the height of the fins is at least double the size of the average width of the fins.

In order to facilitate the introduction of a finned pipe into the pipeline it may be advantageous that the fin or fins extend helically around the



pipe, the rotation of the pipe as a consequence thereof can facilitate the insertion of the pipe into the pipeline.

5 An advantageous embodiment of the pipe of the invention is characterized in that the pipe is provided with alternating higher thinner fins and lower thicker fins.

10 In a pipe thus finned the fins stiffen the pipe wall so that this wall between the fins can have a smaller wall thickness than the smooth pipe, which in turn means that the pipe will be more flexible in the longitudinal direction thereof. The higher fins stabilize and center the relining pipe in the pipeline, the pipe as a consequence thereof will be prevented from movement under the influence of pressure shocks. 15 At the same time a better and safer joint can be provided between the pipe lengths at the low fins where the joint moreover is protected between adjacent higher fins and is prevented from engaging the pipeline pipes when the relining pipe is drawn into the pressure water pipeline. 20

The invention also relates to the use of a finned pipe, wherein the tensile strength of the pipe wall is greater than the shear strength of the fins, as a relining pipe in pressure water pipelines. 25

The pipe of the invention will be described in more detail below reference being made to the accompanying drawings wherein

30 Figure 1 discloses a first embodiment of the pipe of the invention in a longitudinal cross-sectional view,

Figure 2 discloses a second embodiment in longitudinal cross-sectional view,

35 Figure 3 is a longitudinal cross-sectional view of a mirror welded joint between two pipe

lengths,

Figure 4 is a longitudinal cross-sectional view of a joint obtained by induction welding,

Figure 5 discloses a joint obtained by resistance welding and

Figure 6 discloses a mechanical joint between pipe lengths.

Figure 1 discloses a pipe of the present invention. The pipe is made of thermoplastics, e.g. polyethylene or polypropylene. The pipe wall is indicated at 1 and the fins at 2. The pipe wall and the fins are dimensioned in relation to each other such that the tensile strength or compression strength of the pipe wall is greater than the shear strength of the fins 2. Preferably, the fins 2 are made of a softer material than the pipe wall. From the figure it can also be seen that the total volume of the fins 2 per unit length of the pipe is at the most half the volume of the pipe wall, and that the height of the fins is at least double the size of the average width of the fins. The fins shown in Figure 1 encircle the pipe wall in the peripheral direction but the fins can also extend helically around the pipe.

According to Figure 2 the relining pipe of the invention is constructed as a finned pipe having alternating higher thinner fins 10 and lower thicker fins 11, the higher and lower fins alternating with each other in such manner that there is provided between each two adjacent fins of one kind a fin of the other kind. The pipe should be made of thermoplastics, and a suitable material is polyethylene, but also polypropylene can be used. The higher thinner fins preferably are dimensioned such that they are elastically flexible to some extent. The fins stiffen the pipe wall 12 so that this can be

given a smaller thickness than in a corresponding smooth pipe for the same external pressure. Due to the fact that the wall thickness is smaller the pipe will also be more easily flexed, the introduction of the pipe in the pipeline to be relined being facilitated as a consequence thereof. Owing to the flexibility of the higher thinner fins these fins can yield at the introduction. These fins guide the pipe when it slides through the pipeline and serve to stabilize the inserted pipe and to keep it centered in the pipeline.

At the lower thicker fins 11 lengths of the pipe of the invention can be joined in different manners, and the most important ones thereof are disclosed in Figures 3 to 6. In Figure 3 there is shown a butt joint 13 obtained by mirror welding after the two joint pipe ends having been cut substantially centrally through a terminating lower thicker fin 11. It will be seen that the joint is well protected between the adjacent higher thinner fins 10, which is an advantage particularly when the pipe is drawn into the pipeline to be relined, because the joint which may have a bead or other irregularity on the outside of the pipe will be prevented from engaging existing irregularities in the pipeline at this bead or irregularity.

A similar joint as that in Figure 3 can be obtained by induction welding in the manner disclosed in Figure 4 wherein a metal ring 15 is provided between the end surfaces of the pipes to be interconnected and this ring is heated by generating eddy currents therein by means of a magnetic field generator 16 the two pipe ends being fused to opposite sides of the ring.

The joint in Figure 5 has been obtained by

resistance welding. A ring 17 of the same material as that of the pipe is welded to the lower thicker fins 11 abutting each other, by fusing the plastic material by means of electric heating wires 18 located
5 between the ring and the fins.

Finally, a purely mechanical connection is disclosed in Figure 6, wherein the two pipe ends are kept together by means of an external metal ring 19 which engages at hook-shaped edge portions the two
10 adjacent lower thicker fins 11 between which there is provided a sealing ring 20.

In order that the relining pipe will not move at the position thereof in the pipeline, e.g. at existing pressure shocks, it should be anchored so that it cannot move axially. At smooth relining pipes this is
15 achieved by means of a clamp shackle consisting of two halves which are clamped around the relining pipe by means of screw connections and are fixedly anchored in a suitable way. The clamp shackle is kept in
20 position on the relining pipe solely by friction, which means that it may be necessary to clamp the shackle so tightly around the relining pipe that this pipe will be deformed, and that the relining pipe may be exposed to wear at existing movement between the
25 relining pipe and the shackle.

The invention allows this force engagement between the relining pipe and the shackle to be replaced by a positive engagement. In Figure 2 there is shown a shackle 21 which in a conventional manner
30 comprises two halves which are clamped by means of screw connections around the relining pipe and which on the inside thereof are profiled to receive the fins 10 and 11 in corresponding annular grooves. It is not necessary to clamp this shackle so tightly
35 around the relining pipe that this will be deformed

because the engagement between the relining pipe and the shackle is a positive engagement and is not depending on the abutting pressure against the relining pipe. The shackle can keep the relining pipe in position by engaging the end edge of a pipeline 22 wherein the relining pipe has been inserted, as is shown in Figure 2, or can be anchored in an existing valve or pipe bend or in stationary anchoring means in the ground.

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The claims defining the invention are as follows:

1. Pipe of thermoplastic material for pressure water pipelines, having radially projecting fins (2, 10, 11) on the outside surface of the pipe wall (1, 12), characterized in that the pipe wall including said fins is formed integrally as a tubular element with the tensile strength of the pipe wall (1, 12) being greater than the shear strength of the fins (2, 10, 11).
2. Pipe as in claim 1, wherein the fins (2, 10, 11) are made of a softer material than the pipe wall (1, 12).
3. Pipe as in claim 1 or claim 2, wherein the total volume of the fins (2) is at the most half the volume of the pipe wall (1) and wherein the height of the fins is at least double the size of the average width of the fins.
4. Pipe as in any one of claims 1 to 3, wherein the fin or fins extend helically around the pipe.
5. Pipe as in any one of claims 1 to 4, wherein the pipe is provided with alternating higher thinner fins (10) and lower thicker fins (11).
6. Pipe as in claim 5, wherein each fin of one type is located between two fins of the other type.
7. Pipe as in claim 5 or claim 6, wherein the higher thinner fins (10) are made elastically flexible.
8. Pipe as in claim 5, wherein an encircling anchoring shackle (21) is provided on the pipe in positive engagement with the fins (10, 11).
9. Pipe of thermoplastic material for pressure water pipes substantially as herein described with reference to any one of the accompanying drawings.

DATED this 21st day of April 1992.

UPONOR N.V.

By their Patent Attorneys:

CALLINAN LAWRIE

Michael J. Houlihan.



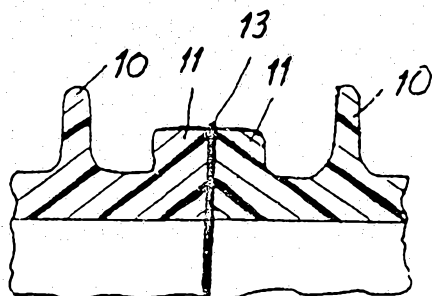


Fig. 3

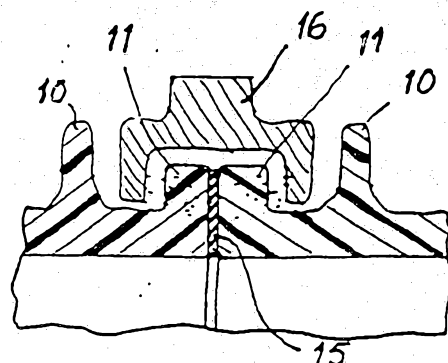


Fig. 4

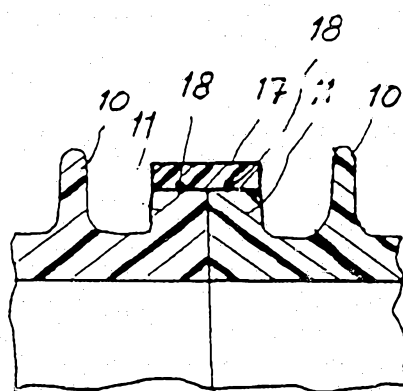


Fig. 5

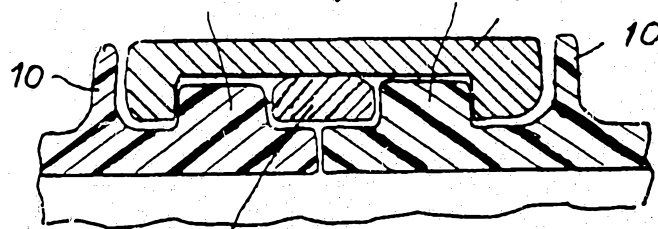


Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE88/00579

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC 4 F 16 L 55/16		
II. FIELDS SEARCHED		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
IPC 4	F 16 L 55/16-/18, 11/11-/12, 9/12, /18; E 03 F 3/06	
US C1	137: 97-98, 121-122, 173	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
Y	WO, A1, 87/05376 (UPONOR N.V.) 11 September 1987 see page 2, lines 22-35, and page 3, lines 1-10 & AU, 70813/87 SE, 8600964	1-9
Y	EP, A1, 0 213 674 (WAVIN B.V.) 11 March 1987 see column 3, lines 3-5 and 27-33 & NL, 8502327 JP, 62093585 US, 4754781	1-9
Y	FI, C, 71 402 (ERRKI JYLLILÄ, KALEVI SÄNTTY) 9 September 1986 see page 1, lines 12-22, and claims 1, 2 and 6	1-3,5-7,9
Y	SE, B, 448 772 (OY UPONOR AB) 16 March 1987 see page 2, lines 22-26 and page 3, lines 1-4 .../...	1-2,5,8-9
* Special categories of cited documents: ** "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "A" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1988-12-20	1988-12-29	
International Searching Authority	Signature of Authorized Officer	
Swedish Patent Office	Tommy Blomberg	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
Y	US, A, 2 622 623 (A. MICHAUDET) 23 December 1952 see fig. 2-4 and column 4, lines 40-51	1-2, 4-9
Y	US, A, 4 690 174 (JÄRVENKYLÄ) 1 September 1987 & WO, 87/00904 DE, 3622543 NL, 8601915 AU, 61352/86 JP, 63500466 EP, 0267907	1-3, 5, 7, 9
Y	CA, A, 1 034 882 (BOWEN, LOYD) 18 July 1978	1-2