PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
F16L 9/12	A1	WO 92/21908
		(43) International Publication Date: 10 December 1992 (10.12.92)

(21) International Application Number: PCT/NO92/00097

(22) International Filing Date: 27 May 1992 (27.05.92)

(30) Priority data:
912103 31 May 1991 (31.05.91) NO

(71) Applicant *(for all designated States except US):* ADVANCED MATERIALS A/S [NO/NO]; Hindervn. 5, N-3200 Sandefjord (NO).

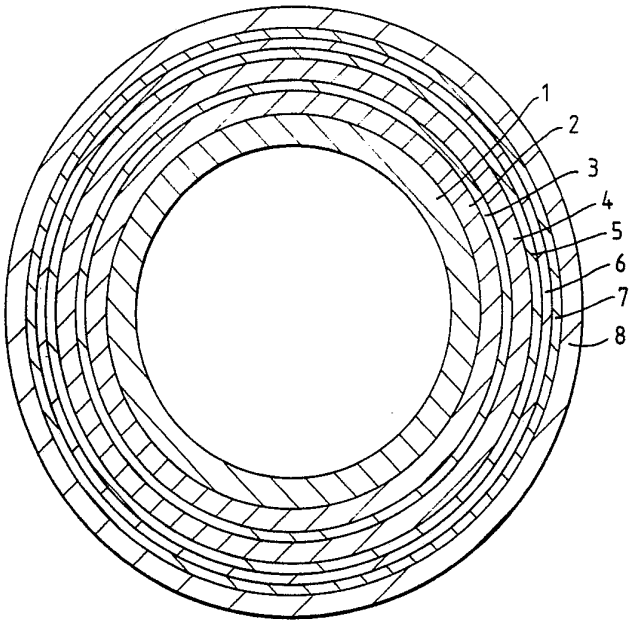
(72) Inventors; and
(75) Inventors/Applicants *(for US only) :* AANONSEN, Torbjørn [NO/NO]; Bjerregårdsgt. 31, N-0172 Oslo (NO). ESPEDALEN, Jørgen [NO/NO]; Håbakk 21, N-4120 Tou (NO).

(74) Agent: COWARD, Bjarne, G.; Bryns Patentkontor A/S, Postboks 9566, Egertorget, N-0128 Olso (NO).

(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, RU, SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
With amended claims.

(54) Title: LAMINATED PIPE AND A PROCESS FOR MAKING THE SAME



(57) Abstract

A laminated pipe for oil production offshore comprising a thermoplastic inner pipe coated with a laminate of matrix material comprising one or more layers of reinforcing fibres is disclosed. A method for production of the laminated pipe and a connection device for joining the pipes are also disclosed.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CS	Czechoslovakia
DE	Germany
DK	Denmark
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IT	Italy
JP	Japan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
NL	Netherlands
NO	Norway
PL	Poland
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SN	Senegal
SU	Soviet Union
TD	Chad
TG	Togo
US	United States of America

LAMINATED PIPE AND A PROCESS FOR MAKING THE SAME.

The present invention is related to a method for making a laminated pipe and a laminated pipe produced by this method and more specifically a laminated pipe for injection of chemicals into an underwater drilled well connected between a host oil platform and an underwater satellite station. The laminated pipe can also be used for hydraulic regulation of valves in satellite stations. The laminated pipe can be operated with high pressures, it is resistant against chemicals and can be spooled onto a drum.

A production platform surrounded by several oilwells at a distance from the production platform is often used during oilproduction offshore. During the past few years a special method for oilproduction from deepsea oilwells has been developed, where each well has an underwater satellite station with the required production facilities as valves etc. These satellites are connected by piping to the host platform where the controlling and production of the oilwells are conducted.

By well drilling and oil production offshore, it is necessary to inject chemicals to underwater installations and hydraulic fluids to valves etc., especially with hydraulic regulation of the wellhead Christmas tree. When a valve in the underwater installation is to be opened or closed, these actions must be performed during the shortest possible time for instance by blow outs.

If a blow out occurs at the wellhead, it will often take several minutes for the hydraulic signals to reach the wellhead because of long reponse time. This response time is a result of the fibres in the signal pipe being woven without matrics material outside the thermoplastic pipe. A result of this is that the stretch volume increases and thereby the

response time will increase. The environmental consequence of the fact that it can take up to several minutes to close down a blow out under water can be very severe.

Known pipes as described supra is mainly steelpipes of different types and thermoplastic pipes with an outer loadbearing wound sheet of polymer fibres.

These prior art pipes have several disadvantages. The steel pipes will corrode and the reinforced thermoplastic pipes have a too long response time when hydraulic signals are transmitted over long distances. The transported chemicals will also have a tendency to diffuse through the plastic material. Another disadvantage with the prior art pipes is that they are unspoolable, i.e. they must be installed in sections and consequently be joined. This will result in increased costs due to the required arrangements with pipe joining at large seadepths. Another disadvantage with prior art laminated pipes with an inner pipe of thermoplastic and an outer composite sheet of a reinforced thermoset resin is that the mechanical strength between the thermoplastic and the thermoset resin is too little. The reason for this is the difficult grafting of a thermoplastic to a thermoset resin.

One object according to the present invention is to provide a laminated pipe with significant lower response time than prior pipes, which pipes can be produced in infinite lengths. A result of this is that it is not required to join the pipes at other positions than at the connections between the pipe and the connection sites. In addition these laminated pipes will be more resistent towards chemicals than corresponding steel pipes.

Another object is to provide a laminated pipe that can be spooled onto a drum and installed by a conventional cable laying vessel.

Another object is to provide a method for production of a laminated pipe described supra which method results in grafting between the thermoplastic and the thermoset resin.

Another object is to provide a connection device for the laminated pipes.

These objects are achieved according to the invention with a laminated pipe that is characterized in that it comprises a thermoplastic inner pipe coated with a fiber reinforced thermoset resin and one or more layers of reinforcing fibres, which reinforcing fibres are chosen from glassfibre, carbonfibre and polymer fibres or combinations thereof. The laminated pipe according to the invention can comprise an inner thermoplastic liner coated with a layer of longitudinal reinforcing fibres, a layer of radial reinforcing fibres, a multidirectional reinforcing mat, longitudinal reinforcing fibres and radial reinforcing fibres, where all the layers are joined with thermoset resin, preferably epoxy. The laminated pipes are also characterized in that they are spoolable on a drum with a diameter dependent on the pipes' outer diameter and the thickness of the laminate.

The present invention also relates to a method for producing a laminated pipe characterized in that a thermoplastic liner acts as a carrier for the subsequent layers. The thermoplastic liner is produced in an extruder and is subjected to a longitudinal stretch that extends the pipe in longitudinal direction corresponding to the pipes thermal expansion at cure temperature prior to application of the laminates. Prior to application of the laminates, the thermoplastic liner is subjected to a suitable degreasing composition such as acetone, rubbing with a suitable abrasive such as abrasive paper and washing with a suitable degreasing composition to ensure that during the lamination process there will be obtained chemical and mechanical bonds between the thermoplastic liner and the thermoset resin. The laminate pipe is

produced in infinte lengths with continuous winding of the reinforcing fibres without winding these. Alternatively this pretreatment can comprise application of a ter-polymer by means of a cross-head extruder to obtain a chemical bond between the thermoplastic and the thermoset resin. The laminate pipe is produced in infinite lengths with continuous application of reinforcing fibres without winding these.

The present invention also concerns a connection device for a laminated pipe, characterized in that it comprises a steel pipe with an inner cone, with a slotted section at the cone's largest diameter, a pipe adapter with a cone, which smallest diameter corresponds to the thermoplastic liner's inner diameter.

Fig. 1 is a sectional view of a laminated pipe according to the invention.

Fig. 2 is a flow sheet of a process for producing a laminated pipe according to the invention.

Fig. 3 is a sectional view of a connection device according to the invention.

Fig. 4 is an example of application of a laminated pipe according to the invention.

Figur 1 is a sectional view of a laminated pipe according to the invention. In the drawing the layers are shown with equal thickness, but this is because of illustrative purposes only. The laminated pipe according to fig. 1 comprises an inner thermoplastic liner 1, with a layer of longitudinal glass-fibres 2, a multidirectional mat 3, a radial layer of glassfibres 4, a multidirectional mat 5, a longitudinal layer of glassfibres 6, a multidirectional mat 7 and a radial layer of glassfibres 8. All these layers are bonded together with a thermoset resin.

Figur 2 shows a method for producing a laminated pipe according to the invention. The thermoplastic liner is extruded 9 and applied a longitudinal stretch. This longitudinal stretch that extends the pipe corresponds to the thermoplastic pipes thermal expansion in longitudinal direction at curing temperature. The thermoplastic liner achieves frozen-in tensions in longitudinal direction. These thermal tensions will later be released during curing with a positive effect on the binding conditions between the thermoset resin and the thermoplastic. Subsequent to extrusion the thermoplastic liner will be stored or fed through a bufferstation (not shown) to the production process.

Immediately prior to the laminating process, the thermoplastic liner is subjected to a pre-treatment 10 consisting of washing the liner with a suitable degreasing composition such as acetone and subsequent rubbing 11 of the outer part of the liner with a rotating abrasive paper, such as a grade 40 abrasive paper. The liner is washed/rinsed at 12, e.g. with acetone, and fed to the production process. The thermoplastic liner does not come in contact with fat or contaminating materials during the abrasion/washing-process. This pre-treatment of the thermoplastic liner is shown at 10-12 in figur 2. An alternative to this pretreatment is application of a ter-polymer on the outer surface of the liner. The ter-polymer is applied with a crosshead extruder (not shown) and results in chemical bonding between thermoplastic thermoset resin.

The thermoplastic liner is now ready for laminate application, which laminates are applied at room temperature. The laminates are directly applied to the thermoplastic liner support and this eliminates the need for an interior mandrel that are used by conventional production of laminated pipes. Laminated pipes are usually produced by laminating/wrapping fibres onto a rotating mandrel. By the process according to

the invention neither the thermoplastic liner nor the laminate rotates.

At first, one layer of fibres is applied directly onto the thermoplastic liner in longitudinal direction at 13. The glassfibres are fed from a magazine 14 with socalled callipers and subsequently through a bath 15 containing thermoset resin, where the fibrewires are impregnated. The glassfibre wires are placed in a side-by-side relation and cover the thermoplastic liner completely. Next a layer of multidirectional mat 16 is applied. Outside this mat 16 another layer of radial glassfibre is applied by means of a carrousel 17. Outside this layer another multidirectional mat 18, impregnated with thermoset resin, is applied. This mat 18 is a thin-felt-like glassfibre mat.

A layer of longitudinal glassfibres 19, impregnated with thermoset resin in a bath 20, is applied onto the mat 18.

Outside this axial layer 19, a multidirectional mat 21 is applied. Subsequently a final layer of radial glassfibres is applied by means of a rotating carrousel 22.

Finally two layers of cellofane tape 23 are wrapped over the laminate in order to prevent loss of thermoset resin and prevent oozing of laminate during the subsequent curing process.

The laminate pipe is fed into a curing oven where the epoxy is cured. The curing oven is a pipe that is externally insulated with mineral wool. Inside the oven there is mounted a V-shaped rail on which the laminated pipe is pulled by means of a belt-conveyer 25. The curing oven 24 has a fan and an heating element with a controller.

The length of the curing oven is determined according to

curing time and production velocity. The laminated pipe is to be cured when it leaves the oven 24.

When the pipe has left the oven 24, the cellofane tapes are washed away. The pipe is cooled and when it has reached ambient temperature, spooled onto a drum 26. Due to the fact that the pipe has flexibility, the drum 26 is motor driven.

A pulling wire is placed between the belts in the belt-conveyer and pulls the longitudinal fibres and the thermoplastic liner through the production process and into the curing oven 24. When the forward end of the pipe leaves the curing oven 24, the distance between the rubber belts is increased and the conveyer 25 pulls the pipe itself.

The production of the laminated pipe is based on a continuous process. In principle the laminated pipe can be produced in infinite lengths, and it is possible to connect the pipes by known techniques if necessary. If a rupture should occur, the pipe can be connected with a steel connection after it is cured.

The thermoplastic pipe and the external loadbearing laminate achieve a mechanical and chemical binding through the production process. This binding will prevent separation of the thermoplastic liner and the laminate when the pipe is in operation. The mechanical binding between the thermoplastic liner and the laminate is achieved by the mechanical rubbing and surface rinsing with a degreasing composition prior to lamination and a chemical binding (grafting) between the thermoplastic liner and the curing substance in the thermoset resin. The heat produced in the curing oven will after some time be transferred from the laminate to the thermoplastic liner. Due to the curing temperature, the thermal tensions in the liner will be released and the liner will contract in longitudinal direction in a ratio corresponding to the extension of the pipe if it had not been subjected to tension

during extrusion. The real extension of the thermoplastic liner in longitudinal direction is approximately zero. When the curable material starts to cure, the thermoplastic liner is stabilized and the thermoset resin will form mechanical and chemical bonds to the surface of the thermoplastic liner. When the laminated pipe leaves the curing oven, the temperature will decrease and the thermoset resin and the liner will contract. The thermal treatment reduces the frozen-in tensions in the thermoplastic liner. The result of the applied axial tension to the thermoplastic liner is that the liner will have a minor plastic deformation when the curing process is complete and the temperature has decreased to ambient temperature. This will give a better binding between the thermoplastic and the thermoset resin and the permanent shear stress will be minimized. Thereby the shear stress between thermoset resin and thermoplastic will decrease.

The laminated pipe is subjected to a number of different stress and load during production, transport, installation and operation. The composition of the composite laminate is based on the physical and environmental conditions that occur during production and the pipes lifetime.

Based on the presumed loads the laminated pipes are subjected to, the composition of the pipes can of course differ from the embodiments depicted in figs. 1 and 2. The number of layers and their directions can be varied.

Fig. 3 shows a connection device comprising a steel pipe 27 with an inner cone 28 that is attached to a corresponding external cone 28 on the composite pipe. The steel pipe 27 has a slotted section 29 at the cone's 28 largest diameter, which section reduces the tensions at the intermediate section between the composite pipe 30 and the steel pipe 27 during operation. In the other end of the steel pipe, a pipe adapter 31 with a cone 32, which least diameter corresponds to the inner diameter of the thermoplastic liner, is pushed into

the thermoplastic liner 33. This cone will force the thermoplastic liner outwards and it will be attached to the inner surface 34 of the steel pipe simultaneously like the laminated pipe. The pipe adapter 31 will replace the function of the thermoplastic pipe and in addition the adhesive and the laminate will not be exposed to the transported fluid. The pipe adapter 31 is connected to the inner surface of the steel pipe, which is threaded, where two conical surfaces abut and form a primary contact surface. The connection device can connect the laminated pipe to any other piping by suitable design of the other end of the pipe adapter. The adhesive can be a sand-containing thermoset resin.

Fig. 4 illustrates an example of operation of a laminated pipe according to the invention between a host platform 37 and underwater installations, such as satellites 38, 39.

After production, the laminated pipe is spooled onto a drum and transported by a conventional laying vessel (cable laying vessel) to the installation site, connected to a oilproducing platform and laid in a predetermined route. If necessary the pipe can be dug into the seabed during laying. The other end of the laminated pipe is connected to a predetermined underwater installation (sub-sea template).

Sections of laminated pipes can be joined with metallic connections wherever necessary during installation. The metallic connections are adhered to the laminated pipe.

The laminated pipe can transport chemicals and/or water for injections into a transportline for oil through a Christmas tree. The chemicals will follow the oilflow in the flowline back to the host platform while water is injected into the well to enhance the oil recovery. The laminated pipe can also transport oil/fuel as a flowline.

The laminated pipe also has many applications on-shore. The pipe can be installed without digging in areas where there are low risks for physical damage or environmental influence. The pipe can if necessary be insulated with a fire-proof coating in areas with fire hazard.

In on-shore oil producing wells, the laminated pipe can be used for injection of water and transport of crude oil from the well to a storage site.

PATENT CLAIMS:

1.
Laminated pipe for oilproduction offshore,
c h a r a c t e r i z e d i n that the pipe comprises an inner thermoplastic pipe coated with a laminate of matrix material comprising one or more layer of reinforcing fibres.

2.
Laminated pipe according to claim 1,
c h a r a c t e r i z e d i n that the reinforcing fibres are chosen from the group consisting of glassfibres, carbonfibres and polymeric fibres of combinations thereof.

3.
Laminated pipe according to claims 1 - 2,
c h a r a c t e r i z e d i n that the matrix material is a thermoset resin.

4.
Laminated pipe according to any of the claims 1 - 3,
c h a r a c t e r i z e d i n that the pipe comprises an inner thermoplastic pipe (1) coated with a layer of longitudinal reinforcing fibres (2), a multidirectional mat (3), a layer of radial reinforcing fibres (4), a multidirectional mat (5), longitudinal reinforcing fibres (6), a multidirectional mat (7) and radial reinforcing fibres (8), where all the layers are bound together by thermoset resin.

5.
Laminated pipe according to any of the claims 1 - 4,
c h a r a c t e r i z e d i n that the pipe is spoolable on a drum with a diameter that is dependant on the outer diameter of the pipe and the thickness of the laminate.

6.
Method of producing a laminated pipe,
c h a r a c t e r i z e d i n that a thermoplastic pipe (7) acts as carrier for the subsequent formation of the laminate.

7.
Method according to claim 6,
c h a r a c t e r i z e d i n that the thermoplastic pipe (7) prior to lamination is subjected to a tension in longitudinal direction that extends the pipe corresponding to a tensionfree thermoplastic pipe's thermal extension in longitudinal direction at curing temperature, with the result that the extension of the thermoplastic pipe during curing is approximately zero.

8.
Method according to any of the claims 6 - 7,
c h a r a c t e r i z e d i n that the thermoplastic pipe prior to lamination is subjected to washing with a suitable degreasing composition such as acetone, rubbing with an abrasive such as sand abrasive and washing with a suitable degreasing composition, which under lamination will result in formation of chemical and mechanical bonds between the thermoplastic pipe and the thermoset resin.

9.
Method according to any of the claims 6 - 7,
c h a r a c t e r i z e d i n that the thermoplastic pipe prior to lamination is subjected to application of a terpolymer by means of a cross-head extruder, which results in formation of chemical bonds between the thermoplastic and the thermoset resin.

10.
Method according to any of the claims 6 - 9, c h a r a c t e r i z e d i n that the laminated pipe is produced in continuous lengths with continuous application of reinforcing fibres without winding these.

11.
Connecting device for a laminated pipe, c h a r a c t e r i z e d i n that the device comprises a steel pipe (27) with an inner cone (28), with a slotted section (29) at the cone's largest diameter, a pipe adapter (31) with a cone (32) with smallest diameter corresponding to the inner diameter to the thermoplastic pipe (33).

AMENDED CLAIMS

[received by the International Bureau
on 30 October 1992 (30.10.92);
original claims 1 - 11 replaced by amended claims 1 - 5
(2 pages)]

1.
A laminated tube for offshore oil production comprising a thermoplastic inner tube coated with a laminate of matrix material comprising one or more layers of reinforcing fibres chosen from the group consisting of glass fibres, carbon fibres and polymeric fibres or combinations thereof, said matrix material being a curable plastic, characterized in that the laminated tube comprises an inner thermoplastic tube (1) coated with a layer of longitudinal reinforcing fibres (2), a multidirectional mat (3), a layer of radial reinforcing fibres (4), a multidirectional reinforcing mat (5), longitudinal reinforcing fibres (6), a multidirectional mat (7) and radial reinforcing fibres (8), where all the layers are bound together by a curable plastic.

2.
A laminated tube according to claim 1, characterized in that the laminated tube is produced in continuous lengths with continuous application of reinforcing fibres, where the tube after production is coiled up on a spool.

3.
A method of producing a laminated tube, characterized in that the thermoplastic tube (7) prior to lamination is subjected to tension in its axial direction that extends the tube corresponding to the thermal extension in an axial direction of a tension-free thermoplastic tube at the curing temperature, in such a way that the thermal extension of the thermoplastic tube during the curing process will be approximately nil.

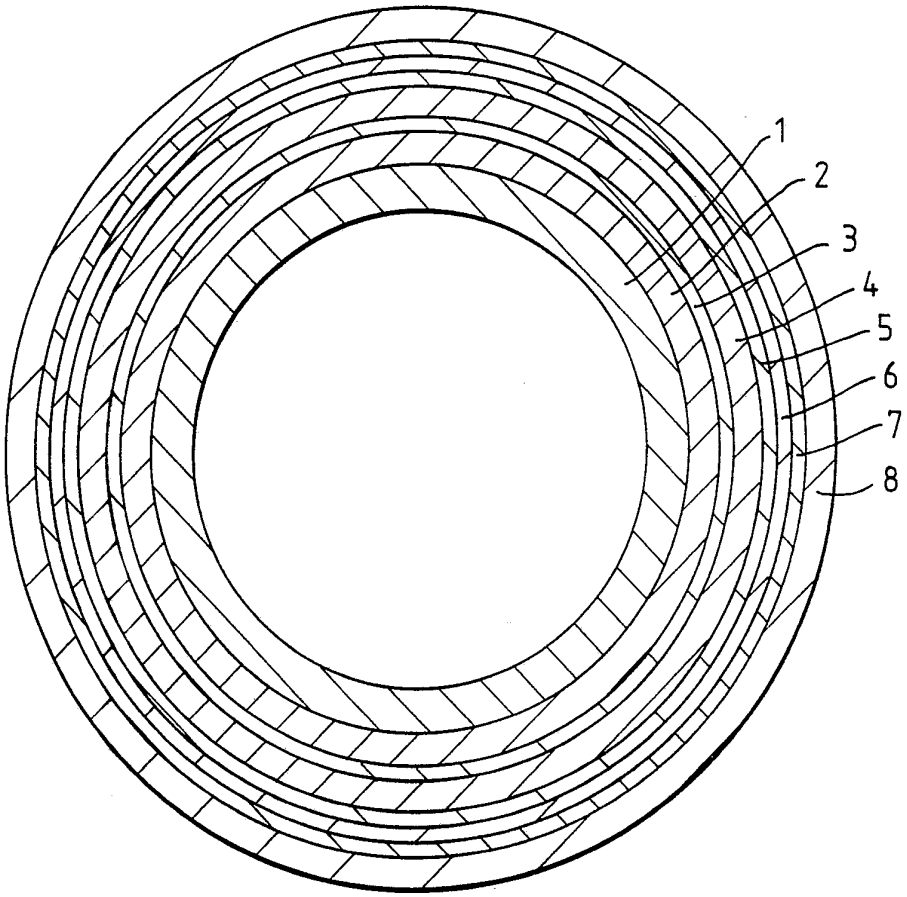
4.

The method according according to claim 3, characterized in that the thermoplastic tube prior to lamination is subjected to the application of a polymer by means of a cross-head extruder which forms a chemical bonding between the curable plastic and the thermoplastic.

5.

The utilization of a laminated tube according to claims 1 - 2, wherein said laminated tube is used for the transport of chemicals or the transfer of hydraulic signals under water.

Fig.1.



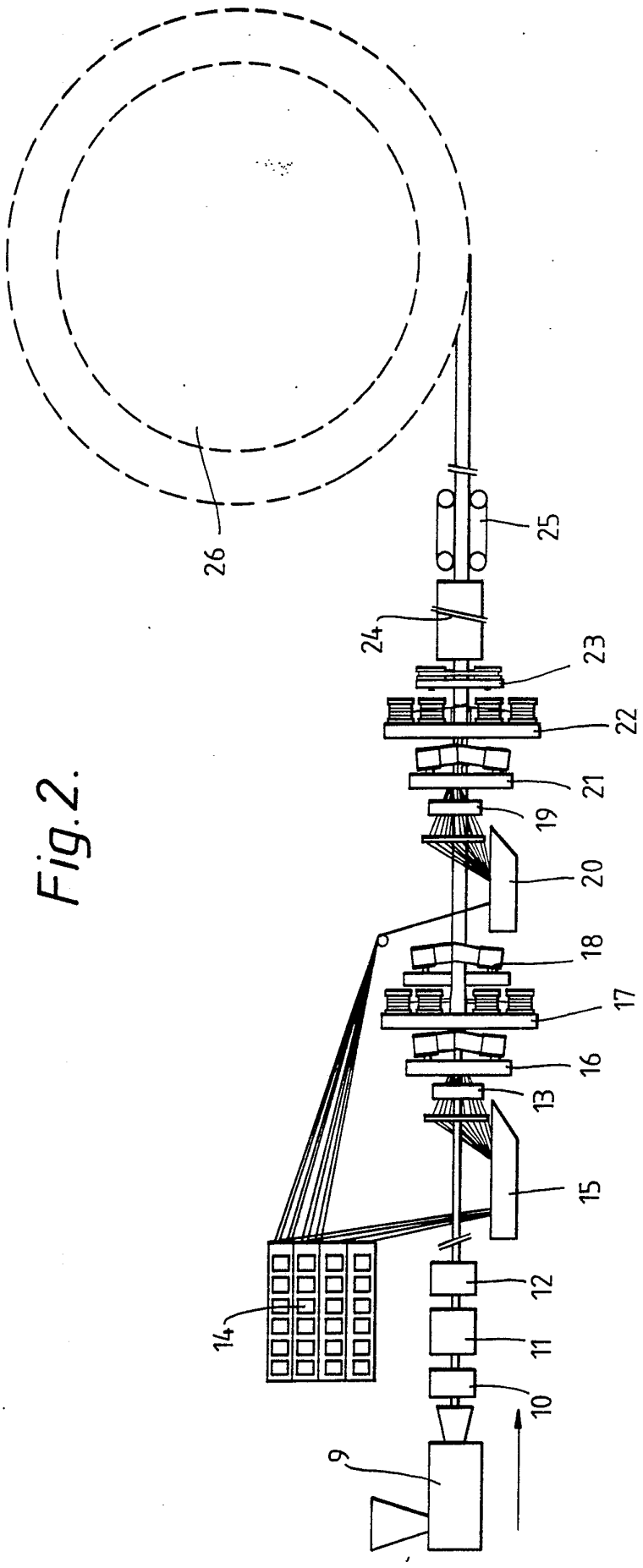


Fig.2.

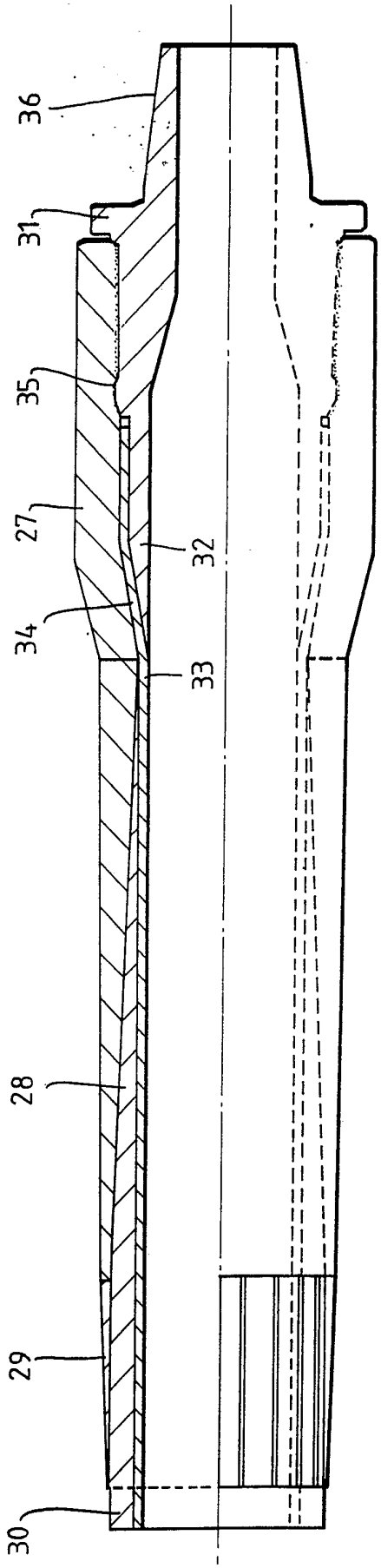
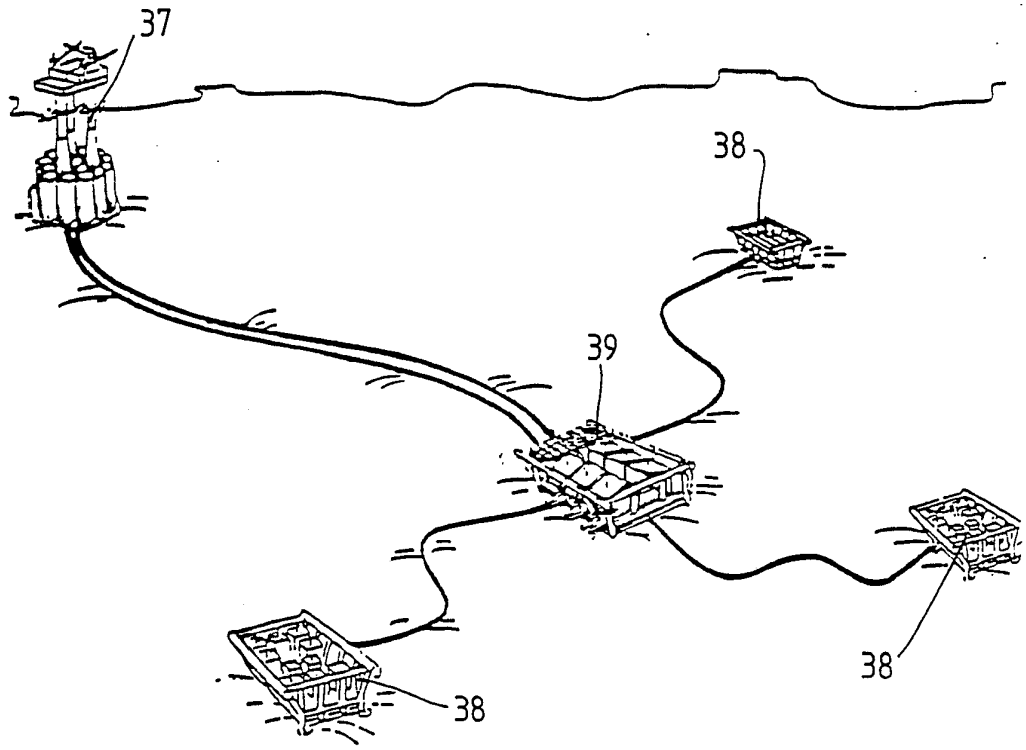


Fig. 3.

Fig.4.



INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 92/00097

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

IPC5: F 16 L 9/12

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	F 16 L

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

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	GB, A, 1229938 (WAVIN N.V.) 28 April 1971, see page 1, line 86 - line 93; figure 1 --	1,3,6
X	GB, A, 1485688 (KUREHA KAGAKU KOGYO KABUSHIKI KAISHA) 14 September 1977, see figure 2 see page 2. "Example" --	1-3,6
X	GB, A, 2077880 (DAINIPPON INK AND CHEMICALS, INC.) 23 December 1981, see abstract; figure 1 --	1-3,6
X	US, A, 1358633 (FREDERICK HACHMANN) 9 November 1920, see figures 1-5 --	11

* Special categories of cited documents:[10]

"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.

"&" 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
7th September 1992	1992 -09- 09
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Axel Lindhult

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

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
A	GB, A, 2178820 (M.A.N. TECHNOLOGIE GMBH) 18 February 1987, see abstract --	7

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers....., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers....., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☒ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

Claims 1-10: A laminated pipe and a method of producing this pipe.
Claim 11: A connecting device for a laminated pipe.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the the claims. It is covered by claim numbers:

4. ☒ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additonal fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional seach fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/NO 92/00097

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 31/07/92
The Swedish 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	Publication date	Patent family member(s)		Publication date
GB-A- 1229938	71-04-28	BE-A-	721530	69-03-27
		DE-A-	1779801	71-09-16
		FR-A-	1582487	69-09-26
		NL-A-	6713324	69-04-01
GB-A- 1485688	77-09-14	DE-A-	2547547	76-05-20
		FR-A-B-	2290291	76-06-04
		JP-C-	985018	80-01-29
		JP-A-	51053571	76-05-12
		JP-B-	54018708	79-07-10
GB-A- 2077880	81-12-23	DE-A-C-	3121241	82-05-27
		JP-C-	1419159	88-01-14
		JP-A-	56167981	81-12-23
		JP-B-	62022038	87-05-15
		US-A-	4515737	85-05-07
		JP-C-	1397025	87-08-24
		JP-A-	56166030	81-12-19
		JP-B-	62000773	87-01-09
US-A- 1358633	20-11-09	NONE		
GB-A- 2178820	87-02-18	DE-A-	3528629	87-02-12
		JP-A-	62046633	87-02-28
		NL-A-	8601871	87-03-02