P/00/008b 12/11/91
Section 29 (1)
Regulation 3.1 (2)

AUSTRALIA

Patents Act 1990

633708

NOTICE OF ENTITLEMENT

(To be filed before acceptance)

We,

PIERRE UNGEMACH of 2 rue Rameau, F-60300 Senlis, France,

ROLAND TURON of 6 allée Richard-Wagner, F-93420 Villepinte, France,

and

RAYMOND LUCET of 41 rue de Marolles, F-94370, Sucy en Brie, France,

being the applicant in respect of Application No. **73437/91** state the following:-

Part 1 - Must be completed for all applications

The Persons nominated for the grant of the patent are the actual inventors.

Part 4 - Must be completed for PCT applications.

The persons nominated for the grant of the patent are the applicants of the application listed in the declaration under Article 8 of the PCT

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

PIERRE UNGEMACH, ROLAND TURON and RAYMOND LUCET

By our Patent Attorneys,
WATERMARK PATENT & TRADEMARK ATTORNEYS

.....

Lynn P. Stafford
Registered Patent Attorney

DATED this 24th day of November, 1992

AU9173437

(12) PATENT ABRIDGMENT (11) Document No. AU-B-73437/91
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 633708

(54) Title
DEVICE FOR DELIVERING CORROSION OR DEPOSITION INHIBITING AGENTS INTO A WELL BY MEANS OF AN AUXILIARY DELIVERY TUBE

International Patent Classification(s)
(51)[5] E21B 041/02 F16L 011/08 F16L 011/12

(21) Application No. : 73437/91 (22) Application Date : 22.02.91

(87) PCT Publication Number : WO91/13235

(30) Priority Data

(31) Number	(32) Date	(33) Country
90 02207	22.02.90	FR FRANCE

(43) Publication Date : 18.09.91

(44) Publication Date of Accepted Application : 04.02.93

(71) Applicant(s)
PIERRE UNGEMACH; ROLAND TURON; RAYMOND LUCET

(72) Inventor(s)
PIERRE UNGEMACH; ROLAND TURON; RAYMOND LUCET

(74) Attorney or Agent
WATERMARK PATENT & TRADEMARK ATTORNEYS , Locked Bag 5, HAWTHORN VIC 3122

(57) Claim

1. Device for injecting corrosion and deposit inhibiting agents in a well collecting a fluid, from the surface, without stopping working, comprising an auxiliary injection tube conveying the injected agents, wherein said auxiliary injection tube comprises a metal tubular web coated with a coating made of a material which is inert with respect to said fluid collected by the well and support cables disposed about the tubular web, which are also coated with said material and adapted for giving to the device the mechanical strength required for lowering/raising operations and further providing mechanical protection of said web with respect to the aggressiveness of said fluid collected by the well.

9. Device according to any one of claims 1 to 8, characterized in that the auxiliary injection tube comprises:

- a central metal tubular web,
- a first cylindrical encapsulation formed by said material coating said central metal tubular web,
- four support cables disposed in the first encapsulation, symmetrically with respect to the longitudinal axis of symmetry of the central web, the support cables being placed facing each other in twos in orthogonal planes.

OPI DATE 18/09/91 APPLN. ID 73437 / 91
AOJP DATE 24/10/91 PCT NUMBER PCT/FR91/00149

DEMANDE INTI ...E BREVETS (PCT)

(51) Classification internationale des brevets 5 :
E21B 41/02, 17/20, F16L 11/08
F16L 11/12

A1

(11) Numéro de publication internationale: WO 91/13235

(43) Date de publication internationale: 5 septembre 1991 (05.09.91)

(21) Numéro de la demande internationale: PCT/FR91/00149

(22) Date de dépôt international: 22 février 1991 (22.02.91)

(30) Données relatives à la priorité:
90/02207 22 février 1990 (22.02.90) FR

(71)(72) Déposants et inventeurs: UNGEMACH, Pierre [FR/FR]; 2, rue Rameau, F-60300 Senlis (FR). TURON, Roland [FR/FR]; 6, allée Richard-Wagner, F-93420 Villepinte (FR). LUCET, Raymond [FR/FR]; 41, rue de Marolles, F-94370 Sucy-en-Brie (FR).

(74) Mandataires: FRECHEDE, Michel etc. ; Cabinet Plasseraud, 84, rue d'Amsterdam, F-75009 Paris (FR).

(81) Etats désignés: AT (brevet européen), AU, BE (brevet européen), CA, CH (brevet européen), DE (brevet européen), DK (brevet européen), ES (brevet européen), FR (brevet européen), GB (brevet européen), GR (brevet européen), IT (brevet européen), LU (brevet européen), NL (brevet européen), SE (brevet européen), SU, US.

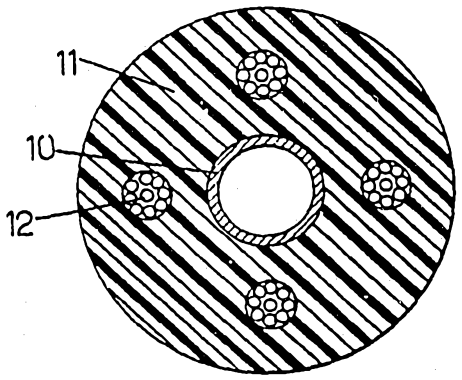
Publiée
Avec rapport de recherche internationale.
Avant l'expiration du délai prévu pour la modification des revendications, sera republiée si de telles modifications sont reçues.

(54) Title: DEVICE FOR DELIVERING CORROSION OR DEPOSITION INHIBITING AGENTS INTO A WELL BY MEANS OF AN AUXILIARY DELIVERY TUBE

(54) Titre: DISPOSITIF D'INJECTION DANS UN PUITS D'AGENTS INHIBITEURS DE CORROSION OU DE DEPOT A L'AIDE D'UN TUBE AUXILIAIRE D'INJECTION

(57) Abstract

A novel auxiliary delivery tube designed to deliver a fluid containing corrosion or deposition inhibiting agents into a well from the surface without interrupting operations. A tube (10) conveying the agents to be delivered is wrapped in a material (11) which is inert in relation to the fluid collected by the well and is surrounded by support cables (12) which are also wrapped in said material (11), thereby providing both a secondary protection for the tube (10) should the wrapping material (11) deteriorate, and the mechanical properties required by the well, especially when extracting from the well.



(57) Abrégé

Concept nouveau de tubage auxiliaire d'injection destiné à injecter dans un puits depuis la surface, sans arrêter l'exploitation, un fluide contenant des agents inhibiteurs de corrosion ou de dépôt. L'invention comprend un tube (10) véhiculant les agents injectés, enrobé dans un matériau (11) inerte vis-à-vis du fluide capté par le puits et des câbles de soutien (12), disposés autour du tube (10) et enrobés eux aussi dans le matériau (11), assurant à la fois une protection secondaire du tube (10) en cas de détérioration de l'enrobage (11) et les caractéristiques mécaniques nécessaires du tube d'injection, notamment lors des opérations de retrait du puits.

The present invention relates to a new concept of "auxiliary injection tube", called hereafter AIT for injecting a fluid containing corrosion and/or deposit inhibiting agents into a well, continuously from the surface without stopping working.

The invention is more particularly applicable to geothermal wells for combatting the effects of the corrosive and scale-forming thermochemistry of the geothermal fluid and preserving the long-life of the structures. These problems are well known in the Paris basin where numerous geothermal "doublets" (assembly formed of a production well for collecting the hot water of the reservoir and an injection well used for re-injecting the fluid into the reservoir after heat has been extracted) have been realized from the 1970s.

In these installations, the geothermal fluid - hot water whose temperature is between 50°C and 85°C and with high salinity (15 to 25 g/l) - comprises a dissolved gas phase enriched with CO2 and H2O which confer thereon a slight acidity (pH of 6 to 6.4). This aggressiveness results, in certain zones of the harnessed reservoir, in repeated and accelerated damage to the structures because of the corrosion and deposits affecting the casings and clogging affecting the collection zone of the reservoir.

The damage mechanism may be summed up as follows :

- corrosion of the casing of the production well and, to a lesser extent, of the injection structure;
- dissolution of the iron of the casing with formation of a solution and formation of iron sulphides;
- deposits of the sulphides on the walls of the steel of the production casing without protection thereof (continuation of the corrosion kinetics under the deposits);
- entrainment in a particular form (solid suspensions) in the water produced and clogging of the heat exchangers, deposits/scaling of the injection casing and accumulation

on the bottom and on the walls of the reservoir collection zone;

- increase of the pressure losses, reduction of the the flowrate of the geothermal loop and clogging of the structures and surface equipment.

To reduce, in the absence of eradicating, such damage different curative and preventive means may be used. Chemical preventive means are among the most widely employed. Based on the injection at the well bottom of corrosion/deposit inhibiting agents with respectively film-forming (corrosion) and dispersant (deposit) functions, these methods have not demonstrated all the required reliability in their geothermal applications, because in particular of the AIT resistance. The French patents 2 463 197 and 2 502 239 describe respectively an inhibiting method by injecting aliphatic amines and a well bottom injection device connected to the end of an auxiliary injection tube.

The very object of a well is to extract the highest possible flow; the space occupied by the AIT in the production string must then be minimum so as to limit the pressure losses. The usual 1" or 1"1/4 carbon steel tubings are rapidly corroded in contact with the geothermal fluid. Recourse to 1" glass fibre "macaronis" regularly gives rise to operating troubles because of the mechanical characteristics of the material which is too weak.

The choice of noble alloys (Cr, Mo, Ni, etc...), of a high cost, have the further drawback of making the solid structure fragile in the presence of dissolved H2S in a low concentration.

The invention, forming the subject matter of the present application, palliates the drawbacks of present-day systems by using a metal web offering the mechanical characteristics required for this application, coated with a material which is inert with respect to the geothermal

fluid, while remaining of a limited diameter.

Understanding of the invention and its advantages will be facilitated by the description of one embodiment illustrated by the accompanying figures, in which :

Figure 1 is one example of auxiliary injection tube application in a production well equipped with an immersed pump;

Figure 2 is a section of an auxiliary injection tube formed in accordance with the present invention;

Figure 3 shows at its points a), b), c) and d) a sectional view of different particular embodiments of an auxiliary injection tube in accordance with the object of the present invention.

The geothermal fluid, in figure 1, is driven by pump 1 through the production casing 2 and, after passing through the master valve 3 of the well head 4, is fed into the surface network 5 towards the exchangers. The auxiliary injection tube 6 is introduced into the well head 4 via a stuffing box 7 providing sealing of the AIT on the well head 4 even when the latter is moving, particularly when it is positioned. On the surface, the AIT is wound on a drum 8 for positioning the lower end of the AIT at the desired depth. Between drum 8 and the stuffing box 7, a sheave 9 supports the AIT with a winding radius compatible with its characteristics and holds it in position.

One example of the present invention is shown in figure 2. It comprises a mechanical tubular web 10 serving both for conveying the inhibiting agents and giving the mechanical characteristics required for injection of the inhibiting agents. The outside of the mechanical web is coated with a material 11 which is electrochemically inert with respect to the fluid collected; this coating may be formed with a continuous manufacturing machine, for embedding the tubular web 10 and the support cables 12 in the material 11. This construction may for example use

extrusion or pultrusion techniques. In current techniques, the coating material 11 will be polymer material withstanding the mechanical stresses of use and thermal or chemical stresses. Some applications may for example justify the use of an elastomer, a polyamide or PTFE (Teflon) type materials, particularly in the case of temperature problems. The precise choice of the material forming the coating 11 will have to take into account the specific environment of the application : geothermics, oil, temperature,...Embedded in coating 11 and outside tube 10, steel reinforced support cables 12 protect the tube 10 in the case of damage or spot wear of coating 11, for example, following repeated lowering of measurement instruments into the well and confers on the AIT thus formed mechanical characteristics making positioning/ removal operations possible in all safety, even if tube 10 breaks. The isolation of the metal masses in presence by the coating material 11 prevents the formation of galvanic couples.

In a preferred embodiment of the invention, the outer diameter of the finished AIT is 1" (25.4 mm), so as to remain within oil standards; web 10 uses a material having to withstand the inhibiting formulations and may be a 316L stainless steel tube having an outer diameter of 10 mm and an inner diameter of 8 mm. Other applications may use, without being limited thereto, materials of the Incoloy 825, Inconel 624, Hastaloy type. The number of support cables 12, preferably four, may vary as a function of the applications. In figure 2, the outer diameter of cables 12 is 5 mm; this may vary as a function of the available standards and the dimensions of the other components. For example, in one embodiment, the AIT may have an outer diameter of 1"1/4 (31.75 mm) and the web 10 an outer diameter of 12 mm and an inner diameter of 10 mm. For obvious reasons, the elongation coefficient of the material forming cables 12 is less than that of tube 10.

This concept may be used not only in "resident" mode (permanently positioned) but also in temporary mode, mounted on a so-called "coiled tubing" unit for injections "on request".

A more detailed description of different variants of construction of an auxiliary injection tube forming the subject matter of the present invention will be given with reference to figure 3.

At point a) of this figure, the auxiliary injection tube 6 comprises the central metal tubular web 10 and a first cylindrical encapsulation 110, formed by material 11, coating the central metal tubular web 10. Furthermore, four support cables referenced 120, 121, 122, 123 are disposed in the first encapsulation, symmetrically with respect to the longitudinal axis of symmetry of the central web 10. Preferably, the support cables 120, 121, 122, 123 are placed facing each other in twos in orthogonal planes.

At point b) of this same figure 3, a second encapsulation 111 is provided, between the central metal tubular web 10 and the first encapsulation 110. This second encapsulation may advantageously be formed by a material chosen for providing a particular protection of the central metal tubular web 10, as a function of the chosen application.

At point c) of said figure 3, a third encapsulation 112 is provided so as to coat the first encapsulation 110. This third encapsulation forming an external sleeve may be formed by a material chosen for reinforcing the tightness of the assembly to external agents. When the auxiliary injection tube is used in user mode service, as shown at point d) of figure (2) it may be advantageous, in order to reinforce the mechanical strength of the AIT tube, while keeping its qualities of flexibility on winding, to provide eight support cables referenced 120 to 127. These cables are advantageously disposed symmetrically with

respect to the longitudinal axis of symmetry of the central web.

By way of non limitative example, the first 110, second 111 and third 112 encapsulations may be chosen from the following materials :

figure b)

2nd encapsulation 111	1st encapsulation 110
fluorine-containing polyamide (PVDF)	PA 11
Polyamide 11 (PA11)	Polypropylene copolymer (PP)
PVDF	PP
Chlorotrifluoroethylene (Halar)	PA 11
Halar	PVDF

Figure 3c)

1st encapsulation 110	2nd encapsulation 111	3rd encapsulation 112
PP	PA 11	EPDM/polypropylene
PP	PVDF	EPDM/polypropylene

Furthermore, and advantageously, it will be noted that the support cables may be used in pairs for the transmission of electric control signals, which may be conveyed to the well bottom at the level of the injection head.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Device for injecting corrosion and deposit inhibiting agents in a well collecting a fluid, from the surface, without stopping working, comprising an auxiliary injection tube conveying the injected agents, wherein said auxiliary injection tube comprises a metal tubular web coated with a coating made of a material which is inert with respect to said fluid collected by the well and support cables disposed about the tubular web, which are also coated with said material and adapted for giving to the device the mechanical strength required for lowering/raising operations and further providing mechanical protection of said web with respect to the aggressiveness of said fluid collected by the well.

2. Device according to claim 1, wherein said auxiliary injection tube is made continuously and wound on a drum permitting ready positioning and storage on the surface.

3. Device according to claim 1, wherein said auxiliary injection tube is mounted on a mobile unit of the "coiled tubing" type for operations on request.

4. Device according to claim 1 wherein said auxiliary injection tube may be mounted permanently, in a fixed manner, on a well.

5. Device according to claim 1, wherein said inert material is a polymer which is continuously extrudable.

6. Device according to claim 1, wherein said support cables are metal cables.

7. Device according to claim 1, wherein the material of the web is chosen so as to withstand the inhibiting formulations used.

8. Device according to claim 1, wherein said auxiliary injection is held in position on the surface by a sheave on which said auxiliary injection tube is engaged.

9. Device according to any one of claims 1 to 8, characterized in that the auxiliary injection tube comprises:

- a central metal tubular web,
- a first cylindrical encapsulation formed by said material coating said central metal tubular web,
- four support cables disposed in the first encapsulation, symmetrically with respect to the longitudinal axis of symmetry of the central web, the support cables being placed facing each other in twos in orthogonal planes.

10. Device according to claim 9, wherein a ~~said~~ second encapsulation is provided between said central metal tubular web and said first encapsulation.

11. Device according to claim 10, wherein a third encapsulation is provided so as to coat said first encapsulation.

12. Device according to any one of claims 9 to 11, wherein in user mode service said auxiliary injection tube comprises eight support cables disposed symmetrically with respect to the longitudinal axis of symmetry of said central web.

DATED this 24th day of November, 1992.

PIERRE UNGEMACH, ROLAND TURON & RAYMOND LUCET

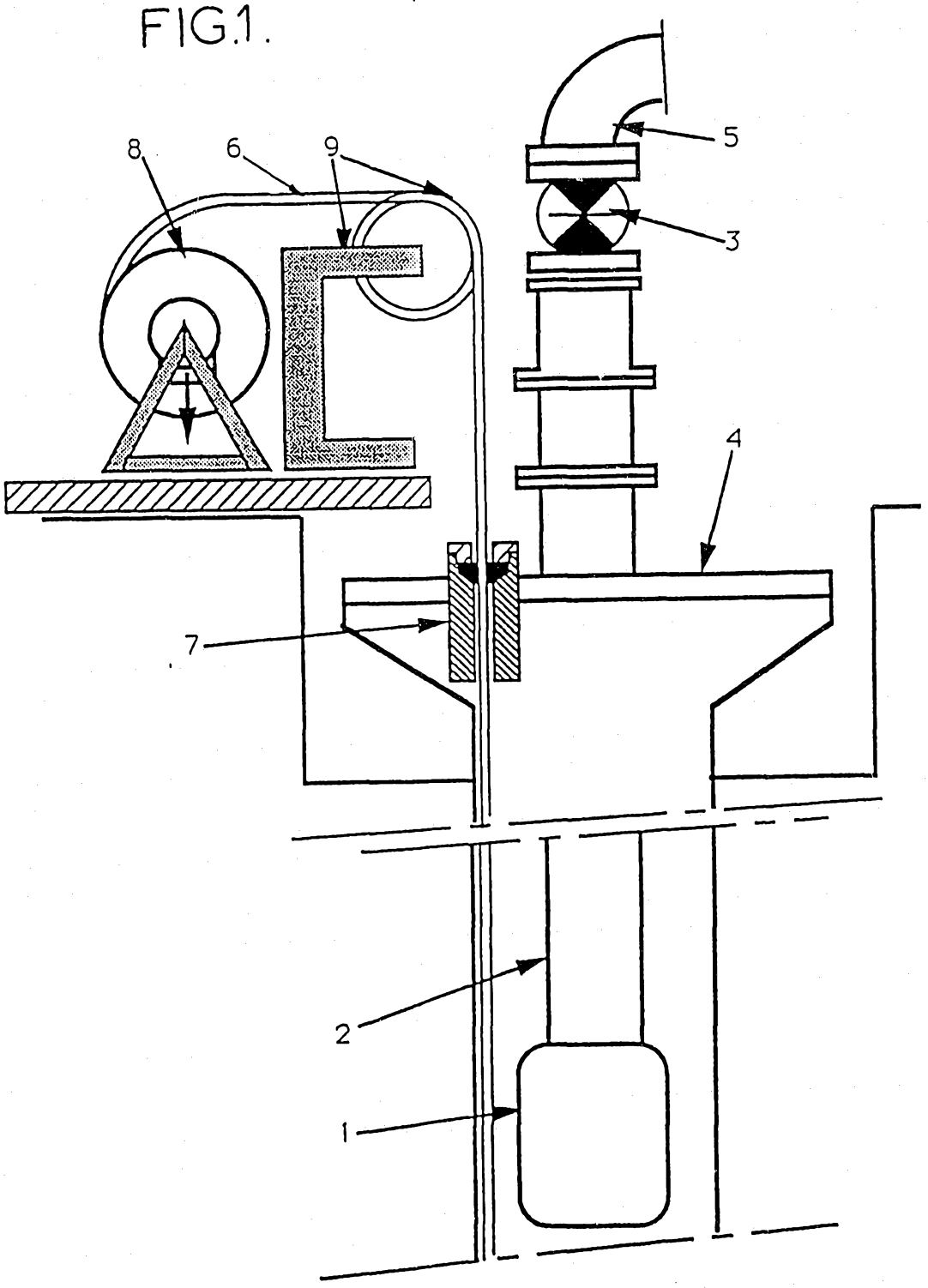
WATERMARK PATENT & TRADEMARK ATTORNEYS
THE ATRIUM
290 BURWOOD ROAD
HAWTHORN VICTORIA 3122
AUSTRALIA

ABSTRACT OF THE DISCLOSURE

A new auxiliary injection tube concept is disclosed for injecting a fluid containing corrosion and/or deposit inhibiting agents into a well from the surface, without stopping working.

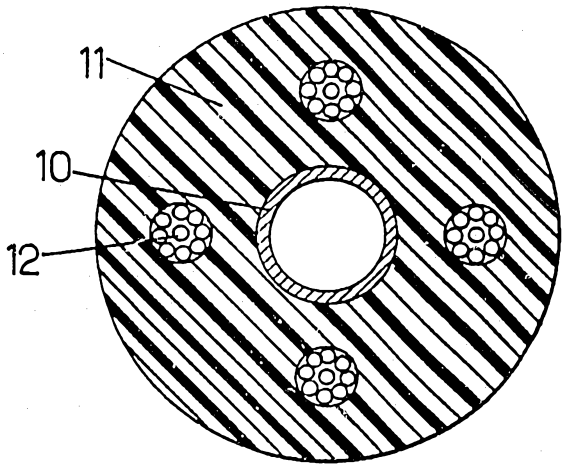
The invention comprises a tube 10 conveying the injected agents, coated with a material 11 which is inert with respect to to the fluid collected by the well and support cables 12, disposed about the tube 10 and also coated with material 11 providing both secondary protection of the tube 10 in the case of damage to coating 11 and the mechanical characteristics required for the injection tube, particularly during withdrawal from the well.

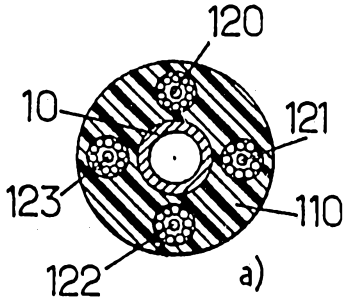
FIG.1.



734 37/91.

FIG.2.





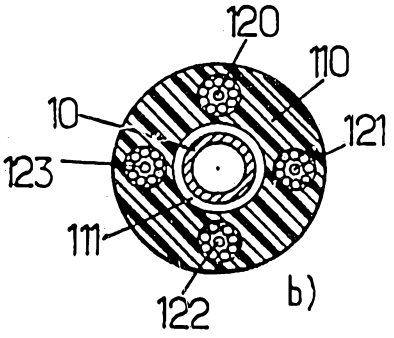
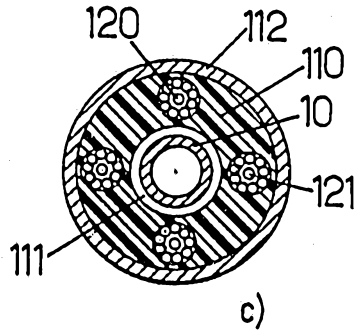
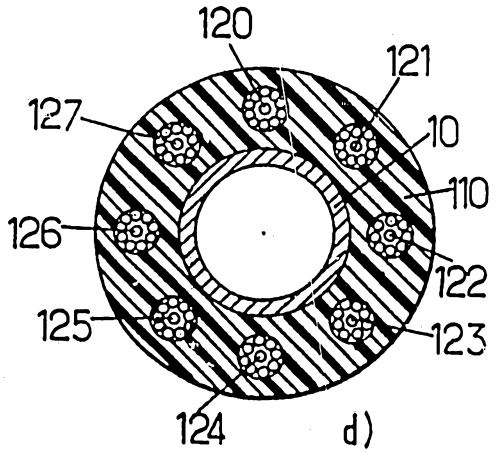


FIG.3.





INTERNATIONAL SEARCH REPORT

International Application No PCT/FR 91/00149

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.[5] E21B 41/02; E21B 17/20; F16L 11/08; F16L 11/12

II. FIELDS SEARCHED

Minimum Documentation Searchod [7]

Classification System	Classification Symbols
Int. Cl.[5]	E21B; F16L

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

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]
A	US, A, 4091843 (S. MIKES ET AL.) 30 May 1978 see column 2, lines 14-32; figure 1 --	1
A	US, A, 4470621 (J.H. IRVINE) 11 September 1984 see column 3, lines 4-15, see lines 40-53 ----------	1

* 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

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"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 on 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
17 June 1991 (17.06.91)	10 July 1991 (10.07.91)
International Searching Authority	**Signature of Authorized Officer**
European Patent Office	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

FR 9100149
SA 45489

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 European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4091843	30-05-78	DE-A-	2613934	14-10-76
		FR-A,B	2306079	29-10-76
		GB-A-	1483997	24-08-77
US-A-4470621	11-09-84	None		