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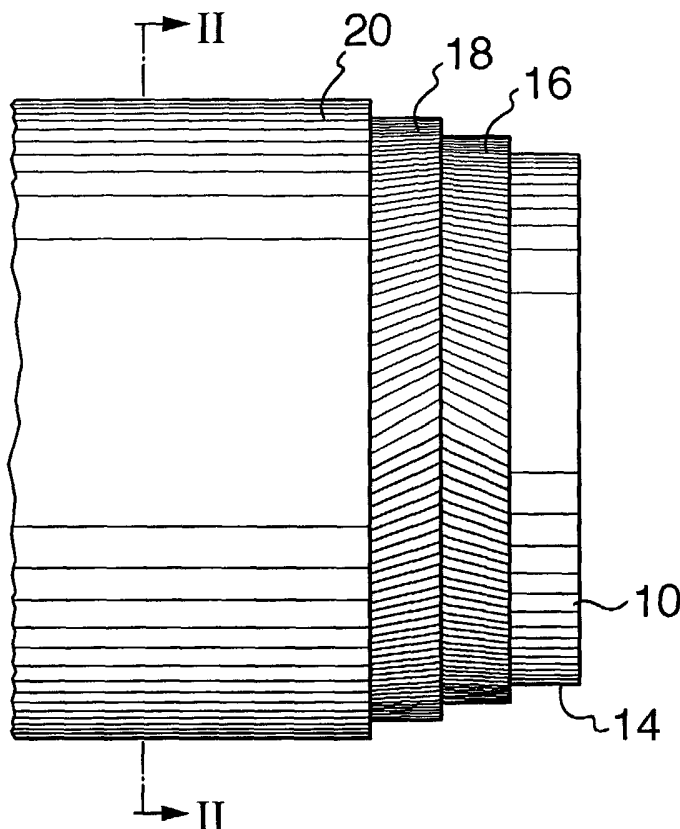
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[Continued on next page]

(54) **Title**: FIBER REINFORCED PIPE



(57) **Abstract**: A flexible, fiber reinforced pipe has been invented for conveying fluids. The pipe is flexible enough to be spoolable, even under winter temperature conditions. The pipe can contain pressure, when buried, unrestrained and bent. The pipe exhibits impact resistance under normal handling and can be formed using a continuous process, such that it can be manufactured as it is being laid. A flexible, fiber reinforced pipe includes an inner tubular liner having an inner surface and an outer surface; a first layer of reinforcing fibers helically wrapped about the inner liner and in direct contact therewith; an outer layer of reinforcing fibers helically wrapped about an underlying layer of reinforcing fibers and in direct contact therewith; and an outer tubular sheath applied over the outer layer in direct contact therewith.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L11/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 604 461 A (MATTHEWS RICHARD A) 14 September 1971 (1971-09-14) column 6, lines 32-62; figure 3	1-6,8 9-16
X	EP 0 969 236 A (PARKER HANNIFIN GMBH) 5 January 2000 (2000-01-05) column 13, lines 49-51; figure 1 column 3, line 35	1-6, 8-13, 15-21, 23,24 14,22
X	US 3 481 369 A (GANAHL CARL BRICE DE) 2 December 1969 (1969-12-02) column 6, lines 37-40; figures 1,2	1-3,5-8
X	US 2 815 043 A (CARMICHAEL GEORGE N ET AL) 3 December 1957 (1957-12-03) figures 3,4	1-3,5-8
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* 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 when the document is taken alone

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

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 117 597 A (GALLAGHER RAYMOND A ET AL) 14 January 1964 (1964-01-14) figure 1	1,2,5-8
X	US 4 273 160 A (LOWLES DAVID C) 16 June 1981 (1981-06-16) figure 2	9-13, 15-21, 23,24
Y	column 3, lines 42-15	14,22
X	US 4 343 333 A (KEISTER BERNARD) 10 August 1982 (1982-08-10) figure 8	9-13, 15-21, 23,24
Y	column 1, lines 35-40	14,22
X	US 4 384 595 A (WASHKEWICZ DONALD E ET AL) 24 May 1983 (1983-05-24) figure 1	9-13, 15-21, 23,24
Y	column 2, line 17	14,22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2004/000105

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
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. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

1-24
4. ☐ 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 claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8

A flexible, fiber reinforced pipe comprising:
an inner tubular polymeric liner having an inner surface and an outer surface;
a first layer of reinforcing fibers helically wrapped in a first helical direction about the inner tubular liner and
in direct contact therewith;
an outer layer of reinforcing fibers helically wrapped about an underlying layer of reinforcing fibers and
in direct contact therewith,
at least one layer of reinforcing fibers helically wrapped in a second helical direction opposite to the first helical direction;
and an outer tubular sheath applied over
and in direct contact with the outer layer of reinforcing fibers

2. claims: 9-16

A flexible, fiber reinforced pipe comprising:
an inner tubular polymeric liner,
a first layer of reinforcing fibers helically wound about the inner tubular liner,
an outer layer of reinforcing fibers helically wrapped and positioned outwardly of the first layer of reinforcing fibers and
an outer coating applied over the outer layer of reinforcing fibers,
the first layer of reinforcing fibers and the outer layer of reinforcing fibers each being substantially free floating between the inner tubular liner and the outer coating and
the pipe including at least one layer of reinforcing fibers wrapped in a first helical direction and at least one layer of reinforcing fibers wrapped in a second helical direction.

3. claims: 17-24

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

A flexible, fiber reinforced pipe comprising:
an inner tubular polymeric liner,
a first layer of reinforcing fibers helically wound about
and covering the inner tubular liner,
the first layer of reinforcing fibers including
substantially continuous and dry fibers,
an outer layer of reinforcing fibers helically wrapped and
positioned outwardly of the first layer of reinforcing
fibers,
the outer layer of reinforcing fibers including
substantially continuous and dry fibers, and
an outer coating applied over the outer layer of reinforcing
fibers
the pipe including at least one layer of reinforcing fibers
wrapped in a first helical direction and at least one layer
of reinforcing fibers wrapped in a second helical direction

4. claims: 25-32

A flexible, fiber reinforced pipe comprising:
an inner tubular polymeric liner,
a first layer of reinforcing fibers helically wound about
the inner tubular liner,
an outer layer of reinforcing fibers helically wrapped and
positioned radially outwardly of the first layer of
reinforcing fibers, and
an outer coating applied over the outer layer of reinforcing
fibers
the pipe including at least one layer of reinforcing fibers
wrapped in a positive helical direction and
at least one layer of reinforcing fibers wrapped in a
negative helical direction, wherein the first layer and the
outer layer provide the pipe with controlled radial growth
under load and controlled axial growth under load

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA2004/000105

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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