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(54) Title: A FABRIC HAVING RECYCLED RING SPUN YARN(S) AND RING SPINNING METHOD FOR MANUFACTURING THE YARN

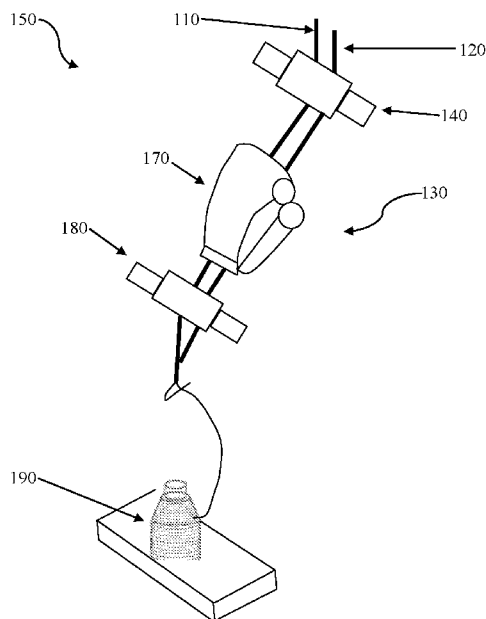


Figure 1

(57) Abstract: The present disclosure envisages a fabric comprising recycled fibers between 25% to 70% w/w of the fabric. The fabric comprises at least one recycled ring spun yarn having recycled fibers at least 25 % w/w of the recycled yarn. The present disclosure further envisages a ring spinning process for manufacturing a yarn having recycled fibers. The process includes a step of simultaneously drafting at least two rovings in a spinning frame machine and condensing the drafted fibers to obtain a recycled yarn. At least one of the rovings or each roving comprises recycled fibers so as to provide the recycled yarn having recycled fibers at least 25% w/w of the yarn and tenacity more than 13 cN/Tex. The length of each recycled fiber is at least 15 mm.



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A FABRIC HAVING RECYCLED RING SPUN YARN(S) AND RING SPINNING METHOD FOR MANUFACTURING THE YARN

TECHNICAL FIELD OF THE INVENTION

The present invention relates to the field of fabrics having recycled yarns and spinning processes for manufacturing the recycled yarns.

5 BACKGROUND OF THE INVENTION

Demand for Sustainable products in textile industry including denim industry is growing because of limited availability of natural fibers, shortage of natural resources and concerns related to environmental pollution. Cellulosic fibers have achieved a pivotal position in the Textile industry as they are strong and
10 recyclable. The demand of the cellulosic fibers, such as cotton is increasing day by day as a fabric made from these fibers is more comfortable as compared to fabrics made of any other fibers. On the other hand, disposal of used cloth has become a cumbersome task and may pose an environmental hazard if not disposed properly. To fulfill the demand and to address problem of disposal of
15 used cloths, a fabric is woven using yarns having recycled fibers and virgin fibers. In order to make a fabric, the recycled fibers and virgin fibers are blended together during yarn manufacturing process to get yarns known as recycled yarns for manufacturing sustainable products.

20 The recycled natural fibers are obtained from the used clothes having cellulosic fiber content. The process of obtaining recycled fibers includes collecting used cloths from various places for recycling. During recycling process, the collected clothes are cut into small pieces and shredded into fibers. It is observed that the recycled fibers are always uneven in length, and also, the length of these recycled
25 fibers is comparatively smaller.

Presently, an open-end spinning process is used for making yarns from recycled fibers. In order to make recycled yarns by open end spinning process, generally virgin fibers are mixed with the recycled fibers in such a way that there is
30 homogeneous blend of the virgin fibers and the recycled fibers. However, there are many documents and patents are available that are disclosing use of recycled

fibers up to 100% in the open end spinning to manufacture the recycled yarn by the open-end spinning. However, it is observed that the aesthetic of a fabric made from the recycled yams obtained from the open-end spinning are compromised and it is observed that the fabric has poor tensile properties.

5

Another yarn spinning process is known as a ring spinning process. It is very well known that ring spinning process provides higher tensile strength as well as it gives clean aesthetic look to a fabric. Thus, it is advisable to use ring spun yams during fabric manufacturing process. However, the existing ring-spinning process has limitation on increasing recycle fiber content. It is observed that if the amount of the recycled fibers is increased beyond 25%, the strength of yarn produced deteriorates which results in poor quality of the fabric. Frequent yam breakage is observed during the yam/fabric manufacturing process which lowers the efficiency of the process.

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15

Hence, there is a need of a ring-spinning process which facilitates use of recycled fibers in a yam, and therefore, in a fabric, and alleviates the aforementioned drawbacks of existing manufacturing processes or provides at least an alternative.

20 SUMMARY OF THE INVENTION

The present disclosure envisages a fabric comprising recycled fibers between 25% to 70% w/w of the fabric. The fabric comprises at least one recycled ring spun yarn having recycled fibers at least 25% w/w of the recycled yarn.

25

The present disclosure further envisages a ring spun recycled yam comprising recycled fibers at least 25% w/w of the recycled yarn with a tenacity more than 13 cN/Tex.

30

The present disclosure further envisages a ring spinning process of manufacturing a yarn having recycled fibers. The process comprises the step of drafting at least two roving simultaneously in a spinning frame machine and condensing the drafted fibers to obtain a recycled yarn. At least one of the rovings or each roving

comprises recycled fibers so as to provide the recycled yarn having recycled fibers at least 25% w/w of the recycled yarn and tenacity more than 13 cN/Tex.

BRIEF DESCRIPTION OF ACCOMPANYING DRAWING

5 Figure 1 illustrates a schematic diagram of a ring spinning machine illustrating simultaneous drafting of two rovings in a drafting unit.

DETAILED DESCRIPTION OF THE INVENTION

10 Although specific terms are used in the following description for sake of clarity, these terms are intended to refer only to particular structure of the invention, and are not intended to define or limit the scope of the invention.

15 References in the specification to “an embodiment” mean that a particular feature, structure, characteristic, or function described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase “in an embodiment” in various places in the specification are not necessarily all referring to the same embodiment.

20 The present invention relates to a ring spinning process of manufacturing a yarn having recycled fibers and a fabric made of recycled yarn.

25 The ring spinning process, of the present invention, facilitates use of recycled fibers with virgin/natural fibers to make a ring spun yarn containing recycled fibers at least 25% w/w of the ring spun yarn. The steps of the process are elaborated in subsequent paragraphs.

30 Recycled fibers to be used in a yarn manufacturing process can be obtained from either pre-consumer or post-consumer fabric, garment or yarn waste. The garment/fabric so obtained is cut into small pieces. The pieces are then shredded into fibers. In an embodiment, the recycled fibers include natural fibers, i.e., cotton fibers and/or bast fibers.

These recycled fibers are then blended with virgin fibers in a blow room process. In an embodiment, the virgin fibers include natural fibers, man-made fibers or combination thereof.

5 The blow room process is carried out to obtain a homogeneous blend of recycled and virgin fibers.

In blow room process, fibers are homogenously blended and cleaned. These fibers are fed to a card unit through a chute feed system.

10

In the carding process, the fibers are cleaned, disentangled and intermixed to obtain slivers containing recycled and virgin fibers. The setting and speed of carding element of the machine is adjusted such a way that recycled fibers, which are shorter in lengths, can be processed smoothly.

15

The slivers so obtained are subjected to draw frame process. In the draw frame process, the fibers are drafted by passing the slivers through a series of rollers. Each roller rotates faster than the previous roller. The obtained sliver has fibers which are well blended and leveled.

20

After draw frame process, the slivers are subjected to roving frame process. In the roving frame process, the slivers are converted into roving.

25

Each roving has a hank value ranging from 0.6-1. In an embodiment, the hank value of the rovings is 0.75.

30

The ring spinning process includes the step of drafting at least two roving simultaneously in a spinning frame machine and condensing the drafted fibers to obtain a recycled ring spun yarn more specifically, in the drafting zone, two roving are simultaneously fed in a single drafting unit to obtain a yarn. In an embodiment, two rovings are drafted simultaneously. Figure 1 illustrates a

schematic view of a ring spinning machine (150) illustrating the aforementioned process step in a drafting unit (130). Two rovings (110, 120) are initially passed through a back drafting roller (140). Further, they are passed through a middle drafting roller (170). The middle drafting roller (170) is provided with an apron. Further, the rovings (110, 120) are passed through a front drafting roller (180). After front drafting roller, the fibers are converted into yarn and wound on a bobbin (190). The roving stop motion is used, which prevent faulty yam generation. In an embodiment, the drafting system used is a spring loaded drafting system. The yarn has a twist multiplier value ranges from 2.5 - 5.0.

During drafting, the ring frame machine speed is reduced by 10%. More specifically, the rovings are drafted at reduced speed as compared to the regular speed. In an embodiment, the rovings are drafted at speed 10% lower than the regular speed. For example, for manufacturing a 10s Ne yarn in an existing machine, the speed of machine is approximately 10000 rpm, whereas, in the present invention, speed of machine is 9000 rpm, i.e., 10% lower than the regular speed.

At least one of the rovings or each roving comprises recycled fibers so as to provide the recycled yarn having recycled fibers at least 25% w/w of the recycled yarn. In an embodiment, each roving has recycled fibers and virgin fibers or one of the rovings comprises virgin fibers only. The weight of the recycled fibers in the rovings is adjusted so as to get a yarn having recycled fibers at least 25% w/w of that yarn. In another embodiment, one roving has recycled fibers and virgin fibers, whereas other roving has only virgin fibers. The weight of the recycled fibers in the roving is adjusted so as to get a yarn having recycled fibers at least 25% w/w of that yarn.

In an embodiment, the recycled fibers in the recycled yam ranges from 25% to 70% w/w of the yam.

The recycled fibers in the roving(s) varies from 25% to 70% w/w of the yarn to be manufactured and the virgin fibers in the rovings varies from 30% to 75% w/w of the yarn to be manufactured.

5 In an embodiment, the rovings have recycled fibers 40% w/w of the yarn to be manufactured and virgin fibers 60% w/w of the yarn to be manufactured.

In another embodiment, the rovings can have recycled fibers up to 70% w/w of the yarn to be manufactured. This scenario is typically observed in cotton yam manufacturing process.

10

The virgin fibers in the rovings can be natural fibers and/or manmade fibers.

Subsequent to drafting two rovings simultaneously in the ring spinning machine (150), the fibers obtained are condensed to obtain a ring spun yam.

15 Simultaneous drafting of two rovings increases the strength of the yarn, and reduces frequent yarn breakage by reducing the amount of fiber protruding from the yarn. Further, simultaneous feeding of two rovings increases the homogeneity of the yarn.

20 The recycled fibers in the roving include cotton fibers and/or bast fibers having length at least 15 mm.

The rovings are twisted individually as well as twisted together. More specifically, the two rovings are drafted together in the drafting zone and twisted
25 individually as well as together after the drafting zone and then the resultant yam is wound on to the bobbin (190). This results in improved yarn tenacity and reduced variation in yarn strength. Thus, yarn can perform well with comparatively lower yam tenacity. Further a fabric made of the yarn manufactured by the process of the present disclosure has better hand feel and
30 improved strength.

The ring spun yarn obtained from the process of the present invention has tenacity more than 13 cN/Tex.

5 The yarn, thus obtained has good strength as compared to yarn obtained using conventional processes. Following table depicts a comparison between strength of a yarn of the present disclosure obtained by the aforementioned process and a yarn obtained by a conventional process.

Table - 1

COUNT (7.2s Ne)	C.S.P.	Tenacity (cN/Tex)	% Elongation
Yarn having 25% recycled fiber content obtained using a conventional process	1930	13.25	6
Yarn having 25% recycled fiber content obtained using process of the present disclosure	2080	14	5.8

10 In the aforementioned table, C.S.P. (Count Strength Product) refers to a product of English count and strength of yarn in pound. High C.S.P. corresponds to high strength of the yarn.

15 From the Table-1, it is evident that the yarn obtained by the process of the present disclosure has better C.S.P. and tenacity as compared to yarn having same recycled fiber content obtained from conventional processes. High C.S.P. and high tenacity results in higher strength of the yarn. Thus, the yarn has better strength than the yarn obtained in conventional processes.

20 The present disclosure further envisages a yarn obtained by a ring spinning process. The yarn is a ring spun yarn, and has recycled fibers at least 25% w/w of the yarn. In an embodiment, the yarn comprises recycled fibers more than 25% w/w of the recycled yarn.

The recycled fibers in the ring spun yarn ranges from 25% to 70% w/w of the yarn, whereas the virgin fibers in the yarn ranges from 30% to 75% w/w of the yarn. The virgin fibers in the yarn can be natural fibers and/or manmade fibers.

5 In an embodiment, the recycled fibers in the ring spun yarn include recycled cotton fibers and/or bast fibers, and the length of the recycled fibers is at least 15 mm.

10 In another embodiment, the single yarn count of the ring spun yarn ranges from 4s Ne to 60s Ne. In yet another embodiment, the single yarn count of the ring spun yarn ranges from 6s Ne to 20s Ne.

The ring spun yarn shows good tensile properties.

15 The yarn is used for fabric manufacturing process such as dyeing, weaving and finishing. In an embodiment, the yarn is undyed. In another embodiment, the ring spun yarn is dyed with oxidative class of dyes, reactive dyes, vat dye, pigment and/or any other textile class of dyes etc. The dyed or un-dyed yarns are subjected to weaving process to obtain a woven fabric. In an embodiment, the yarn is dyed
20 with Indigo dye. The yarn can be used as warp yarn or weft yarn or both.

The present disclosure further envisages a fabric. The fabric comprises recycled fibers between 25% - 70% w/w of fabric and virgin fibers between 30% to 75% w/w of the fabric. The fabric comprises at least one recycled ring spun yarn
25 having recycled fibers at least 25% w/w of the recycled yarn. In an embodiment, the yarn comprises recycled fibers more than 25% w/w of the recycled yarn.

The fabric, which is woven using the yarn of the present disclosure, undergoes finishing process to achieve aesthetic look as well as required parameters. The required parameters include stretch, growth, shrinkage, weight, tensile properties
30 etc. The fabric has a weight range from 4 - 20 Ounce/square yard. In an embodiment of the present invention, the weight of the fabric ranges from 8-15

5 Ounce/square yard. The fabric can be a woven or knitted fabric. The woven/knitted fabric can contain elastane. The fabric has recycled fibers at least 25% w/w of the fabric and virgin fibers at least 30% w/w of the fabric. The content of the recycled fibers in the fabric varies from 25% to 70% w/w of the fabric and content of the virgin fibers in the fabric varies from 30% to 75% w/w of the fabric.

10 In an embodiment, the recycled fibers in the fabric include natural fibers including recycled cotton fibers and/or bast fibers having length at least 15 mm. Further, the virgin fibers in the fabric include natural or manmade fibers. The virgin fibers comprise cotton, tencel, viscose, and/or elastane fibers.

The fabric comprises recycled yarn used as warp or weft or both.

15 The fabric can be woven in various types such as plain weave, twill weave, dobby weave, satin/sateen weave, jacquard etc. Further, the fabric can be knitted in various types such as circular knitted, plated, seamless, warp knit etc.

20 The yarn count of the fabric ranges from 4s Ne to 60s Ne.

The fabric can be dyed or un-dyed. In an embodiment, the fabric is dyed with an Indigo dye, a vat dye, a reactive dye, a pigment dye or oxidative class of dyes. The present disclosure further envisages a garment manufactured by the aforementioned fabric having recycled fibers having at least 25% w/w of the fabric and remaining virgin fibers. The fabric of the garment has weight ranging from 8-15 Ounce/square yard.

25

Following are few examples of fabric made by yarns manufactured by the process of the present disclosure.

1. Non-stretch fabric having yarns manufactured by the process of the present disclosure. The fabric has following particulars.

Composition	40% recycled fiber + 60% cotton fibers
Warp	7.2s Ne
Weft	8s Ne
Weave	3/1 twill
Shade	Indigo
Weight	11.75 Ounce/square yard

5

2. Stretchable fabric having yarns manufactured by the process of the present disclosure. The fabric has following particulars.

Composition	35% recycled fiber + 63% cotton fibers + 2% Elastane
Warp	7.2s Ne
Weft	10 + 70D elastic yarn
Weave	3/1 Twill
Shade	Indigo
Weight	12 Ounce/square yard
Stretch	18%

3. Non-stretch fabric having yarns manufactured by the process of the present disclosure. The fabric has following particulars.

Composition	70% recycled fiber + 20% regenerated fiber+ 10% cotton fibers
Warp	6.4s Ne
Weft	6.4s Ne
Weave	3/1 twill
Shade	Indigo
Weight	13 Ounce/square yard

10

5 The embodiments were chosen and described in order to best explain the principles of the present invention and its practical application, to thereby enable others, skilled in the art to best utilize the present invention and various embodiments with various modifications as are suited to the particular use contemplated. It is understood that various omission and substitutions of equivalents are contemplated as circumstance may suggest or render expedient, but such are intended to cover the application or implementation without departing from the spirit or scope of the present invention.

Claims :

1. A fabric having recycled fibers content between 25% to 70% w/w of the fabric, said fabric comprising at least one recycled ring spun yarn having recycled fibers at least 25 % w/w of the recycled yarn.
- 5 2. The fabric as claimed in claim 1, wherein the recycled fibers include natural fibers.
3. The fabric as claimed in claim 2, wherein the natural fibers include cotton fiber and/or bast fiber.
- 10 4. The fabric as claimed in claim 1, wherein the virgin fibers include natural fibers and/or manmade fibers.
5. The fabric as claimed in any one of the preceding claims 1 - 4, wherein the virgin fibers comprise cotton, tencel, viscose, and/or elastane fibers.
6. The fabric as claimed in claim 1, wherein the weight of the fabric ranges from 4 - 20 ounce/square yard.
- 15 7. The fabric as claimed in claim 1, wherein said fabric has recycled ring spun yarn used as warp or weft or both.
8. The fabric as claimed in claim 7, wherein the recycled ring spun yarn has a yarn count ranging from 4 Ne - 60 Ne.
- 20 9. The fabric as claimed in claim 1, wherein the fabric is dyed with an indigo dye, sulphur dye, vat dye, reactive dye, a pigment dye or oxidative class of dyes.
10. The fabric as claimed in claim 1, wherein fabric is woven or knitted.
11. A garment made of the fabric as claimed in claims 1 -10.

12. A ring spun recycled yam comprising recycled fibers at least 25% w/w of the recycled yarn with a tenacity at least 13 cN/Tex.
13. The ring spun recycled yarn as claimed in claim 12, wherein the content of said recycled fibers in said ring spun recycled yarn ranges from 25% to 70% w/w of the ring spun yarn, and the content of virgin fibers in said yarn varies from 30% to 75% w/w of the ring spun yarn.
14. The ring spun recycled yarn as claimed in any of the claim 12 or 13, wherein the recycled fibers in said yarn include recycled cotton fibers and/or bast fibers having length at least 15 mm, and said virgin fibers include natural or manmade fibers.
15. The ring spun recycled yarn as claimed in any one of the preceding claims 12-14, wherein the yarn count of said ring spun yam ranges from 4s Ne to 60s Ne.
16. The yam as claimed in any one of the preceding claims 12-15, wherein said ring spun yarn is dyed with an Indigo dye, a vat dye, a reactive dye, a pigment dye or oxidative class of dyes.
17. A ring spinning process of manufacturing a ring spun yarn having recycled fibers, said process comprising the step of:
- drafting at least two roving simultaneously in a spinning frame machine; and
- condensing the drafted fibers to obtain a recycled ring spun yam;
- wherein at least one of said rovings or each roving comprises recycled fibers so as to provide the recycled ring spun yam having at least 25% w/w recycled fibers and tenacity more than 13 cN/Tex.
18. The process as claimed in claim 17, wherein the recycled fibers in the recycled ring spun yarn ranges from 25% to 70% w/w of the yarn.

19. The process as claimed in claim 17, wherein each of said roving has recycled fibers and virgin fibers or one of the roving comprises virgin fibers only.
- 5 20. The process as claimed in claim 17, wherein the recycled fibers in said roving include cotton fibers and/or bast fibers having length at least 15 mm.
21. The process as claimed in claim 17, wherein the roving are drafted at reduced speed about 10% lower than the regular speed.

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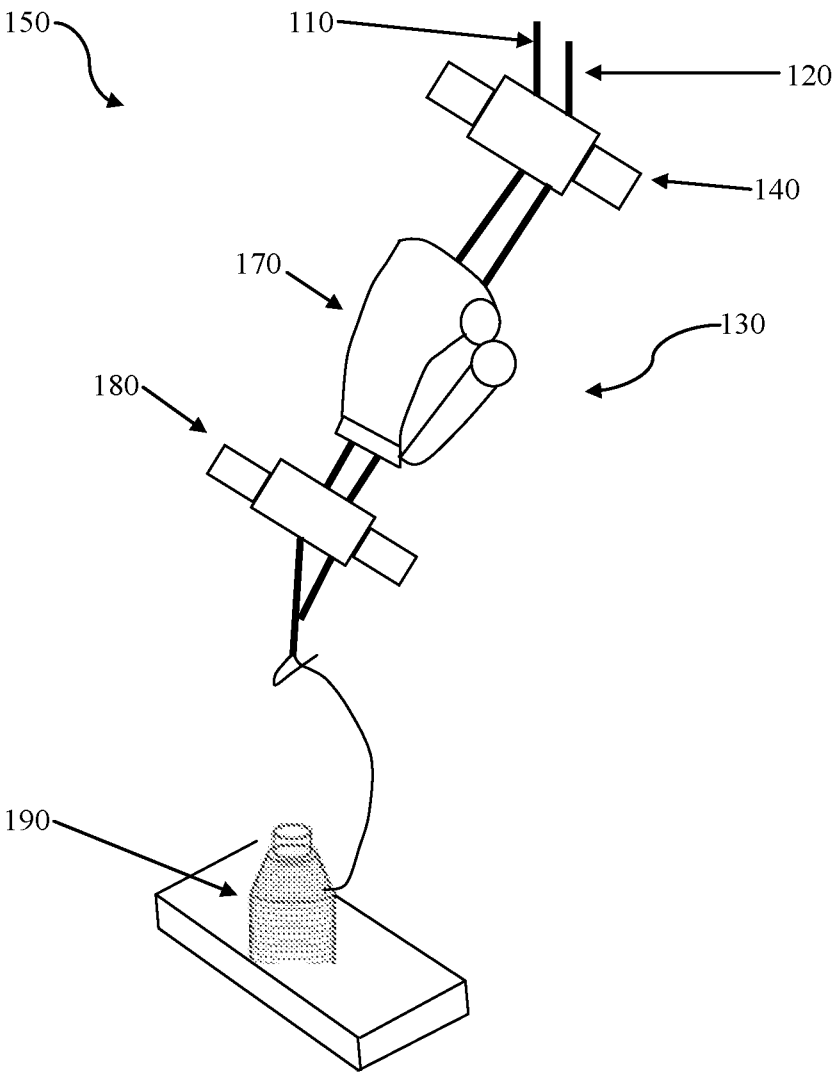


Figure 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2019/050768

A. CLASSIFICATION OF SUBJECT MATTER

D03D15/00, D01G11/00, D01H4/00, D01G13/00, D02G3/04 Version=2020.01

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)

CPC: D01G11/10, D01G21/00, Y02W30/667, Y02W30/663, Y02W30/66.

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 practicable, search terms used)

TotalPatent One, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US20160002829A1 (PARADIGM ONE LLC) January 07, 2016 (07/01/2016). Paragraphs [0032-0034], [0059-0064], [0089-0095], [0100], [0114-0121]; Claims 1-24.	1-21
A	US20180305847A1 (LONG JOHN TSUNG RIGHT INDUSTRIAL CO LTD) October 25, 2018 (25/10/2018). Abstract; Figures 2, 6A; Paragraphs [0007-0027], [0040].	1-21
A	US5331801A (ECO FIBRE CANADA INC) July 26, 1994 (26/07/1994). Figure 1; Claims 1-14.	1-21

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT / IN2 019/ 050768

Citation	Pub. Date	Family	Pub .Date
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