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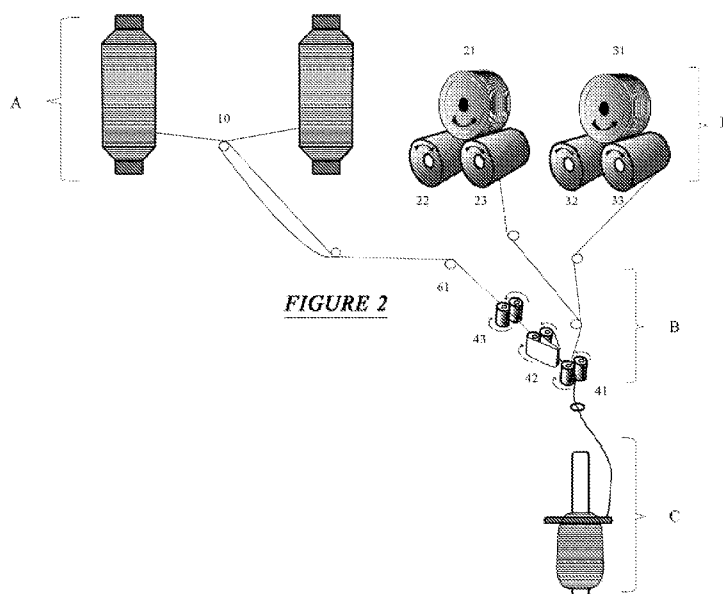
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(54) Title: METHOD OF INDUSTRIAL PRODUCING ELASTOMERIC YARN AND FABRIC THEREOF



(57) Abstract: The present invention relates to make stretch yarn by using at least two roving and two elastomeric filaments with variable draft to allow the yarn made in the fabric to get good stretch, good recovery and good shrinkage. The invention is applicable for all types of fibers material and is not limited in the yarn count. The said invention yarn is woven into fabrics exhibiting the excellent stretch characteristics and functional performance for commercial application.

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

Published:

— *with international search report (Art. 21(3))*

Method of Industrial Producing Elastomeric Yarn and Fabric thereof

CROSS REFERENCE TO RELATED APPLICATIONS

5 This application claims priority to Hong Kong Short-Term Patent Application No. 19131094.5 filed on October 16, 2019, the disclosure of which is incorporated by reference herein in its entirety.

BACKGROUND

10 Field of the invention

 The present invention relates to elastomeric yarns and fabrics, and a method of producing the same.

Terminology

15 For the technical terms elaborated as follows and used herein, reference is made to *Textile Terms and Definitions* (Ninth Edition) and ASTM.

- *Elastomer*: any polymer having high extensibility together with rapid and substantially complete elastic recovery.
- 20 • *Elastomeric Filament*: a filament formed from elastomer, for example elastane or elastodiene.
- *Filament*: a fiber of indefinite length.
- Roving: a name given, individually or collectively, to the relatively fine fibrous strands used in the later of final processes of preparation of spinning.
- 25 • *Stretch*: yarn capable of a pronounced degree of stretch and recovery from stretch.
- *Draft*: to reduce the linear density of a fibrous assembly by drawing.
- *Shrinkage*: reduction in length(or width) of a fiber, yarn, fabric or other textile, induced by conditioning, wetting, steaming, chemical treatment, wet processing as in laundering, dry heat or mechanical action.

- *Fabric Growth*: is calculated from the length difference between the bench marks prior to application of the tension and after relaxation.
- *Twist Multiplier*: means in a yarn, the product of twist level and is the same as Twist per inch divided by square root of Ne.

5

Description of related art

Conventional yarn is a product of substantial length and relatively small cross-section consisting of fibers and/or filament(s) with or without twist. The choice of fibers and the specification on the yarn determines the qualities and the characteristics of the fabric.

10 Nowadays, more and more consumers are concentrating to find some products with functional properties like thermal resistance, easy-care, easy dry, UV protection, etc. The last but not the least is body-fit products which have good stretch and recovery.

Throughout the years, spinners tried to produce the yarn with high stretch by different material, different denier of the spandex and combination in order to get those
15 characteristics so a wide range of products have been developed. Of course, they have a lot of restriction amongst these and need additional finishing process which is not cost effective.

As years before, many spinners commonly use that pre-stretched elastomeric fibers (that called spandex or elastane) and guided in the center of the drafted fiber sheath to produce those core stretch yarn. By controlling the denier and the draft, different stretch
20 result will come out. Woven fabric made of such yarn will have the problem of poor recovery/shrinkage, the higher the stretch, the poorer the result. In some cases, additional heat-setting is a necessary to improve the dimensional stability of the fabric which is cost consuming.

US Patents No. 3,671,379, 6,782,923 and 7,143,790 disclose the way of making
25 woven stretch fabric by comprising those bare polyester filaments said bi-component polyester filament. The invention is limited on the stretch, in general, in the range from 15-25% but not limited and have synthetic feel although the recovery is acceptable. Only limited use in weft of the denim without over dyed and cannot use in piece dyed unless do the two parts dyed. In this case, the cost is higher and the stretch properties are also affected.

30 US Patents No. 7,299,828 and 7,637,091 disclose that core spun yarn with bi-component polyester comprising poly(ethylene terephthalate) and poly(trimethylene terephthalate) or poly(trimethylene terephthalate) and poly(tetramethylene terephthalate) or poly(trimethylene terephthalate) and poly(trimethylene terephthalate) can improve the

synthetic feel with a natural fiber look. However, its stretch is affected and much worse than bare bi-component polyester.

Others like US Patents No. 8,093,160 and 9,303,336 disclose that core spun yarn with polyester filament (with/without elastic) and elastomeric fibers (spandex) which can improve the stretch to the range 20% - 60% and can achieve a good recovery. However, it faces the problem of the white portion at the piecing part and some un-coverage of those filaments and is limited to certain extent for using in warp of denim and piece dyed stretch fabric.

SUMMARY OF THE INVENTION

The objective of the present invention is to make ring spun yarn by using different drafts on the core elastomeric filaments in the ring spun yarn and by which, not limited, to improve the mechanical to get the good shrinkage, good recovery and stretch.

The present invention is a ring spun yarn with at least two elastomeric filament with at least two different main drafts. The main draft in individual filament is the average of variable draft used. In one embodiment, said filament ranges from 20 deniers to 500 deniers.

The present invention comprises two fibrous sheath and said, are those short staple fibers can be natural or synthetic fibers like cotton, rayon, polyester, wool, acrylic and a combination thereof. And have no restriction same as the normal ring spun yarn.

In another embodiment said, the yarn count of present invention has no limitation, preferably ranging from English Cotton yarn count from about Ne 4 to Ne 60.

The present invention also has an objective to use this composite yarn is in denim and piece dyed fabric and not limited to knit fabric as well as sweater.

Other aspects of the present invention are disclosed as illustrated by the embodiments hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts the side view of the apparatus for the present invention of normal ring spinning machine.

Figure 2 depicts the side view of the apparatus for the present invention of using two elastomeric filaments with different drafts with two roving.

Figure 3 depicts the view of position of the elastomeric filaments in the yarn with variable draft in the same yarn.

Figure 4 depicts the view of position of the elastomeric filament in the yarn if the draft is the same.

Figure 5 depicts the side view of the apparatus for the present invention of using three elastomeric filaments with different drafts with three roving.

5 Figure 6 depicts the view of position of three elastomeric filaments in the yarn with variable draft.

DETAILED DESCRIPTION

The objective of the present invention is to find a way to produce a ring spun yarn by using elastomeric filament (not limited to spandex and other elastomers also applicable) to
10 achieve good elongation, good recovery and less shrinkage without affecting other physical properties both in yarn and in fabric. The present yarn is suitable for denim, piece dyed, circular knit and sweater as well. The present invention is a ring spun yarn comprising at least two elastomeric filaments (not limited to spandex and other elastomers also applicable) with at least two different mean drafts. And said the filament ranges from 20 deniers to 500
15 deniers wherein the draft of the filaments ranges from 1.05 to 5. In another embodiment, the yarn count of the ring spun yarn has no limitation and said ranges from Ne 4 to 60 preferable.

It is well known that the ways of making staple spun yarns are ring spinning, Open-End Spinning and that of Jet Spinning, amongst those, Ring Spinning is one of the most common way. The present invention is using this Ring Spinning Technology.

20 The embodiments and the examples disclosed herein are made to show the present invention and are not intended to be limiting.

In the ring spinning production, spinning is the final stage of processing that produces a continuous twisted strand of fibers which has received its final attenuation. In Figure 1, it shows the skills in the art.

25 During the normal spinning process, the main sections include material [A], drafting [B] and twisting [C] as in Figure 1. In the present invention, the material used in [A] is those natural or synthetics staple fibers, not limited to cotton, rayon, polyester, wool, acrylic, etc. or a combination thereof. It consists of two roving with the same material or two different materials.

30 In the drafting system [B] consists of three pair of rolls 41, 42, 43 and for most system, aprons are mounted with the middle rolls 42. The speed ratio of each pair of roll is so adjusted that the fibers 10 are delivered through a trumpet 61 from a slowly moving pair of rolls 43 towards a rapidly moving pair of rolls 41. The final yarn count depends on the yarn

count of the material 10 and the ratio of the linear speed between these pair of rolls 41, 43 for those normal yarns. The strength of the yarn depends on the material and the twist added in the twisting section [C].

The present invention of this stretch yarn is produced by inserting at least two elastomeric filaments into the core of the fibers sheath of the described ring spun yarn. The apparatus [D] is shown in Figure 2. The material of these two types of elastomeric filaments 21, 31 can be the same or with different material, like those spandex or elastomer or a combination thereof. The draft is one of the most important related factors in the present invention. During the spinning process, the elastomeric filaments 21 are unwound from the rollers 22, 23 whereas elastomeric filaments 31 are unwound from the rollers 32, 33. The draft on the elastomeric filament 21 is controlled by the ratio of the surface speed of front roller 41 and roller 23 whereas the draft on the elastomeric filament 31 is controlled by the ratio of the surface speed of front roller 41 and the roller 33. In one embodiment of the present invention, the mean drafts of these filaments are ranging from 1.05 to 5. And that the elastomeric filament is positioned in the left to center of the fibrous sheath but not limited.

In the present invention, the ratio of the surface speed of the front roller 41 and roller 23, and the surface speed of roller 41 and roller 33 are controlled by program throughout the spinning process. The variables are denoted as:

Surface speed of roller 41/surface speed of roller 23: $D_{231}, D_{232}, D_{233} \dots D_{23X}$
 Surface speed of roller 41/surface speed of roller 33: $D_{331}, D_{332}, D_{333} \dots D_{33X}$

The draft of $D_{231}, D_{232}, D_{233} \dots D_{23X}$ is running at different time as in

$T_{231}, T_{232}, T_{233} \dots T_{23X}$

The draft of $D_{331}, D_{332}, D_{333} \dots$ & D_{33X} is running at different time as in

$T_{331}, T_{332}, T_{333} \dots T_{33X}$

Therefore, the mean draft $[D_{21}]$ of that filament 21 is calculated as

$$D_{21} = \frac{D_{231} \times T_{231} + D_{232} \times T_{232} + D_{233} \times T_{233} + \dots + D_{23X} \times T_{23X}}{T_{231} + T_{232} + T_{233} + \dots + T_{23X}}$$

The mean draft $[D_{31}]$ of that filament 31 is calculated as

$$D_{31} = \frac{D_{331} \times T_{331} + D_{332} \times T_{332} + D_{333} \times T_{333} + \dots + D_{33X} \times T_{33X}}{T_{331} + T_{332} + T_{333} + \dots + T_{33X}}$$

In practical, the difference of those variable drafts is $\pm 50\%$ amongst individual mean draft, but not limited.

It is calculated as:

$$\begin{aligned} 0.50 &\leq (D_{231}-1)/(D_{21}-1) \leq 1.50 \\ 0.50 &\leq (D_{232}-1)/(D_{21}-1) \leq 1.50 \\ 0.50 &\leq (D_{23X}-1)/(D_{21}-1) \leq 1.50 \dots \text{etc.} \end{aligned}$$

$$D_{21}, D_{231}, D_{232} \dots D_{23X} \geq 1 \text{ and}$$

$$\begin{aligned} 0.50 &\leq (D_{331}-1)/(D_{31}-1) \leq 1.50 \\ 0.50 &\leq (D_{332}-1)/(D_{31}-1) \leq 1.50 \\ 0.50 &\leq (D_{33X}-1)/(D_{31}-1) \leq 1.50 \dots \text{etc.} \end{aligned}$$

$$D_{31}, D_{331}, D_{332} \dots D_{33X} \geq 1$$

In Figure 3, it is the view of the position of that elastomeric filament on the yarn with different draft ratio and time whereas, in Figure 4, the draft ratio on single elastomeric filament is the same and not limited that both draft of the elastomeric filament is the same.

Another embodiment of the invention, have inserted 3 elastomeric filaments into the core of the fibers sheath as in Figure 5. The material of these three types of elastomeric filaments 21, 31, 51 can be the same or with different material but at least two of them are elastomeric filaments (spandex) and the other one can be those polyester, nylon, PE synthetic filaments, not limited to elastic or inelastic or a combination thereof. During the spinning process, the filament 21 is unwound from the rollers 22, 23 whereas filament 31 is unwound from the rollers 32, 33 and filament 51 is unwound from the rollers 52, 53. The draft on the

filament 21 is controlled by the ratio of the surface speed of front rollers 41 and roller 23 whereas the draft on the filament 31 is controlled by the ratio of the surface speed of front roller 41 and the roller 33 and the same. The draft on the filament 51 is controlled by the surface speed of front roller 41 and roller 53. In one embodiment of the present invention, the mean drafts of these filaments are ranging from 1.05 to 5. And that the elastomeric filament is positioned in the left to center of the fibrous sheath but not limited.

In the present invention, the ratio of the surface speed of the front roller 41 and roller 23, the surface speed of roller 41 and roller 33, and the surface speed of roller 41 and roller 53 are controlled by program. The variables are denoted as:

Surface speed of roller 41/surface speed of roller 23: $D_{231}, D_{232}, D_{233} \dots D_{23X}$

Surface speed of roller 41/surface speed of roller 33: $D_{331}, D_{332}, D_{333} \dots D_{33X}$

Surface speed of roller 41/surface speed of roller 53: $D_{531}, D_{532}, D_{533} \dots D_{53X}$

The draft of $D_{231}, D_{232}, D_{233} \dots D_{23X}$ is running at different time as in

$T_{231}, T_{232}, T_{233} \dots T_{23X}$

The draft of $D_{331}, D_{332}, D_{333} \dots D_{33X}$ is running at different time as in

$T_{331}, T_{332}, T_{333} \dots T_{33X}$

The draft of $D_{531}, D_{532}, D_{533} \dots D_{53X}$ is running at different time as in

$T_{531}, T_{532}, T_{533} \dots T_{53X}$

Therefore, the mean draft $[D_{21}]$ of that filament 21 is calculated as

$$D_{21} = \frac{D_{231} \times T_{231} + D_{232} \times T_{232} + D_{233} \times T_{233} \dots + D_{23X} \times T_{23X}}{T_{231} + T_{232} + T_{233} \dots + T_{23X}}$$

The mean draft $[D_{31}]$ of that filament 31 is calculated as

$$D_{31} = \frac{D_{331} \times T_{331} + D_{332} \times T_{332} + D_{333} \times T_{333} \dots + D_{33X} \times T_{33X}}{T_{331} + T_{332} + T_{333} \dots + T_{33X}}$$

$$T_{331}+T_{332}+T_{333}+\dots\dots\dots+T_{33X}$$

The mean draft $[D_{51}]$ of that filament 51 is calculated as

$$D_{51} = \frac{D_{531} \times T_{531} + D_{532} \times T_{532} + D_{533} \times T_{533} + \dots\dots\dots + D_{53X} \times T_{53X}}{T_{531} + T_{532} + T_{533} + \dots\dots\dots + T_{53X}}$$

In practice, the difference of those variable drafts is $\pm 50\%$ amongst individual mean draft, but not limited.

10

Same as previous, the variable draft should be as

$$0.50 \leq (D_{531}-1)/(D_{51}-1) \leq 1.50$$

$$0.50 \leq (D_{532}-1)/(D_{51}-1) \leq 1.50$$

$$15 \quad 0.50 \leq (D_{53X}-1)/(D_{51}-1) \leq 1.50 \dots\dots \text{etc.}$$

$$D_{51}, D_{531}, D_{532} \dots D_{53X} \geq 1$$

The following examples demonstrate the present invention and its capability for use in manufacturing of different specification fabric.

20

Example 1: Denim Weft Stretch Fabric

A denim stretch fabric, construction 3/1 RHT, with 100% cotton Ne 10 in the warp and with Ne16 Stretch yarn in accordance with the present invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier. Both of the average draft is with 3.5. We can see the sample had weight 11.8 oz/sq.yd. (after washed), good stretch (26.13%), good shrinkage (-7%) and growth (3.6 %).

25

Example 2: Denim Weft Stretch Fabric

A denim stretch fabric, construction 3/1 RHT, with 100% cotton Ne 8 in the warp and with Ne16 Stretch yarn in accordance with the present invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier. Both of the average

30

draft is with 3.8. We can see the sample had weight 11.9 oz/sq.yd. (after washed), good stretch (36.26%), good shrinkage (-11%) and acceptable growth (4.9 %).

Example 3: Denim Weft Stretch Fabric

5 A denim stretch fabric, construction 3/1 RHT, with 100% cotton Ne10 slub in the warp and with Ne16 Stretch yarn in accordance with the present invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier with less pick, said 48. Both of the average draft is with 3.5. We can see the sample had weight 12 oz/sq.yd. (after washed) and resulted in high stretch (44.26%) and still have good shrinkage (-9 %) and 10 acceptable growth (4.8 %).

Example 4: Denim Weft Stretch Fabric

 A denim stretch fabric, construction 3/1 RHT, with 100% cotton Ne10 slub in the warp and with 70% Polyester/30% Rayon Ne16 Stretch yarn in accordance with the present 15 Invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier. Both of the average draft is with 3.8. We can see the sample had weight 11.8 oz/sq.yd. (after washed), good stretch (31.33%), good shrinkage (-8%) and growth (3.2 %).

Example 5: Denim Weft Stretch Fabric

20 A denim stretch fabric, construction 3/1 RHT, with 100% cotton Ne14 slub in the warp and with 70% Polyester/30% Rayon Ne16 Stretch yarn in accordance with the present Invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier. Both of the average draft is with 3.8. We can see the sample had weight 11.8 oz/sq.yd. (after washed) and have a higher stretch (65.2%) at good shrinkage (-13%) and acceptable 25 growth (6.73 %).

Example 6: Denim Weft Stretch Fabric

 A denim stretch fabric, construction 3/1 RHT, with 50% cotton/50% Rayon Ne12 slub in the warp and with 70% Polyester/30% Rayon Ne16 Stretch yarn in accordance with 30 the present Invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier. Both of the average draft is with 3.8. We can see the sample had weight 12.2 oz/sq.yd. (after washed), good stretch (34.4%), good shrinkage (-9%) and growth (3.06 %).

Example 7: Denim Warp & Weft Stretch Fabric

A two ways denim stretch fabric, construction 3/1 RHT, with 100% cotton Ne10 slub core 40D Spandex in the warp and with 70% Polyester/30% Rayon Ne16 Stretch yarn in accordance with the present Invention. The invention in the weft yarn is with cotton fibrous sheath and core with two 40D denier. Both of the average draft is with 3.8. We can see the sample had weight 13.5 oz/sq.yd. (after washed), good warp/weft stretch (14.13%/31.33%), good warp/weft shrinkage (-13%/-8%) and acceptable growth (2.93%/4.8%).

Example 8: Denim Weft Stretch Fabric

A denim stretch fabric, construction 3/1 RHT, with 91% cotton/9% Rubber Ne14 slub in the warp and with 74% cotton/26% rubber Ne10 Stretch yarn in accordance with the present invention. The invention in the weft yarn is with cotton fibrous sheath and core with two rubber threads. Both of the average draft is with 3.2. We can see the sample had weight 13 oz/sq.yd. (after washed), good stretch (55.4%), good shrinkage (-9%) and growth (5 %).

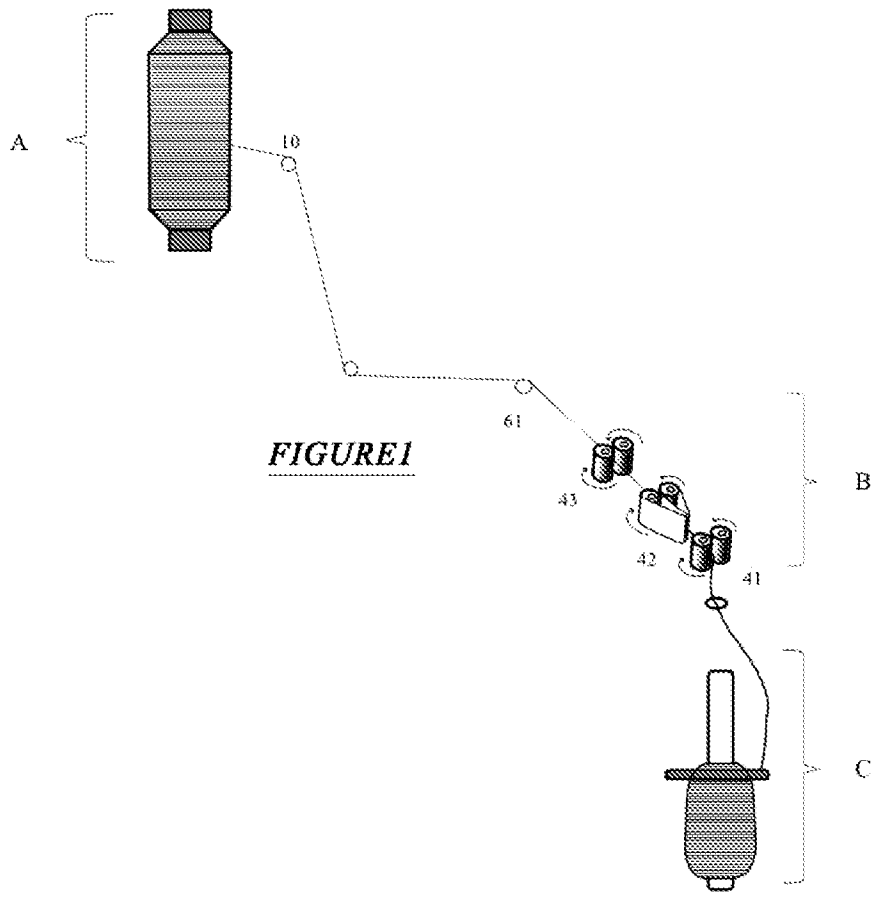
The present invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description, and all changes that come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

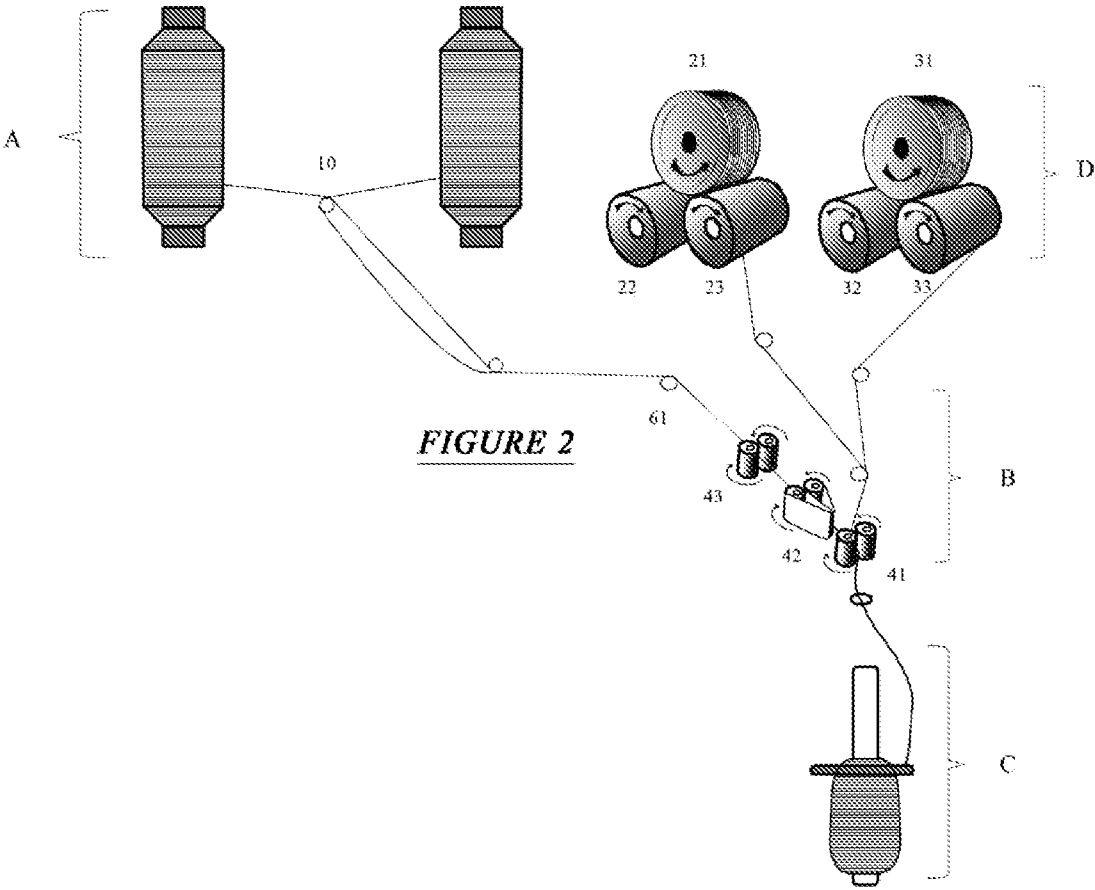
CLAIMS

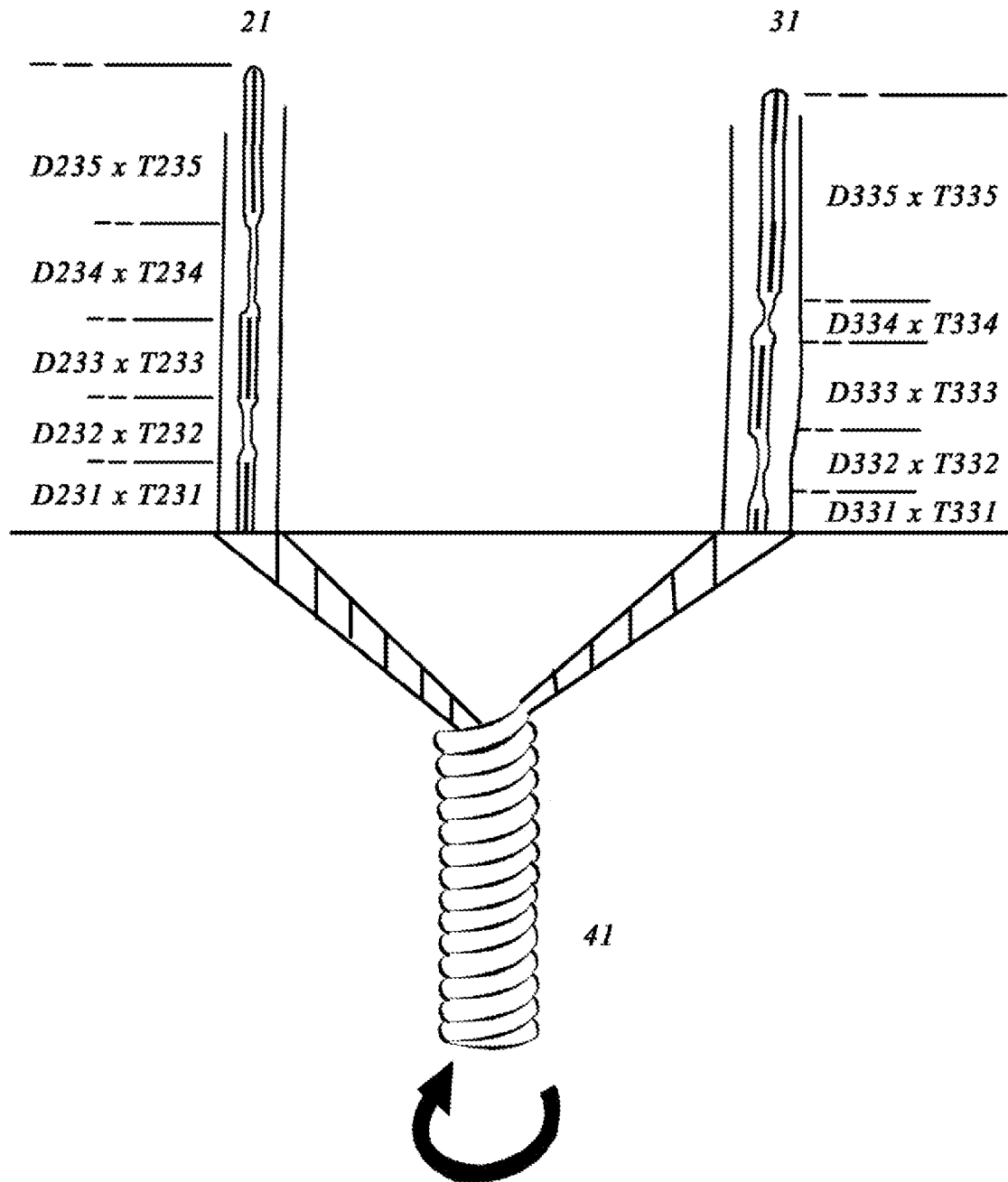
What is claimed is:

1. A ring spun stretch yarn comprising at least two elastomeric filaments with at least two different mean drafts, wherein the mean draft on individual filament is varied and two fibrous sheath of at least one staple fiber, and wherein the elastomeric filaments have a denier from 20 to 500 and said the fibrous sheath has an English cotton yarn count Ne from 4 to 60.
2. The stretch yarn of claim 1, wherein said fibrous sheath comprises natural or synthetic staple fibers, cotton, polyester, rayon, wool, nylon, acrylic or combination thereof.
3. The stretch yarn of claim 1, wherein the mean draft of the elastomeric filament is from 1.05 to 5.
4. The stretch yarn of claim 1, wherein the mean draft is calculated by individual actual draft/time along that elastomeric filament.
5. The stretch yarn of claim 1, wherein the draft/time of the elastomeric filament is controlled by electronic but not limited.
6. The stretch yarn of claim 1, wherein draft on individual filament is varied in the range from $\pm 50\%$ of the mean draft, but not limited to this range.
7. The stretch yarn of claim 1, wherein the elastomeric filament is spandex/elastane/elastomer but not limited.
8. The stretch yarn of claim 1, wherein the elastomeric filament can be at least one type material.
9. The stretch yarn of claim 1, wherein the fibrous sheath can be natural fibers, regenerated fibers, synthetic fibers and a combination thereof.

10. The stretch yarn of claim 1, wherein the stretch yarn can be used in producing slub yarn/normal yarn which can get some special fancy effect.
11. A woven fabric comprising the stretch yarn of claim 1 in warp or filling or both.
12. The woven fabric of claim 11, wherein the fabric is denim or piece dyed.
13. A knitted fabric comprising the stretch yarn of claim 1.
14. A sweater comprising the stretch yarn of claim 1.





FIGURE 3

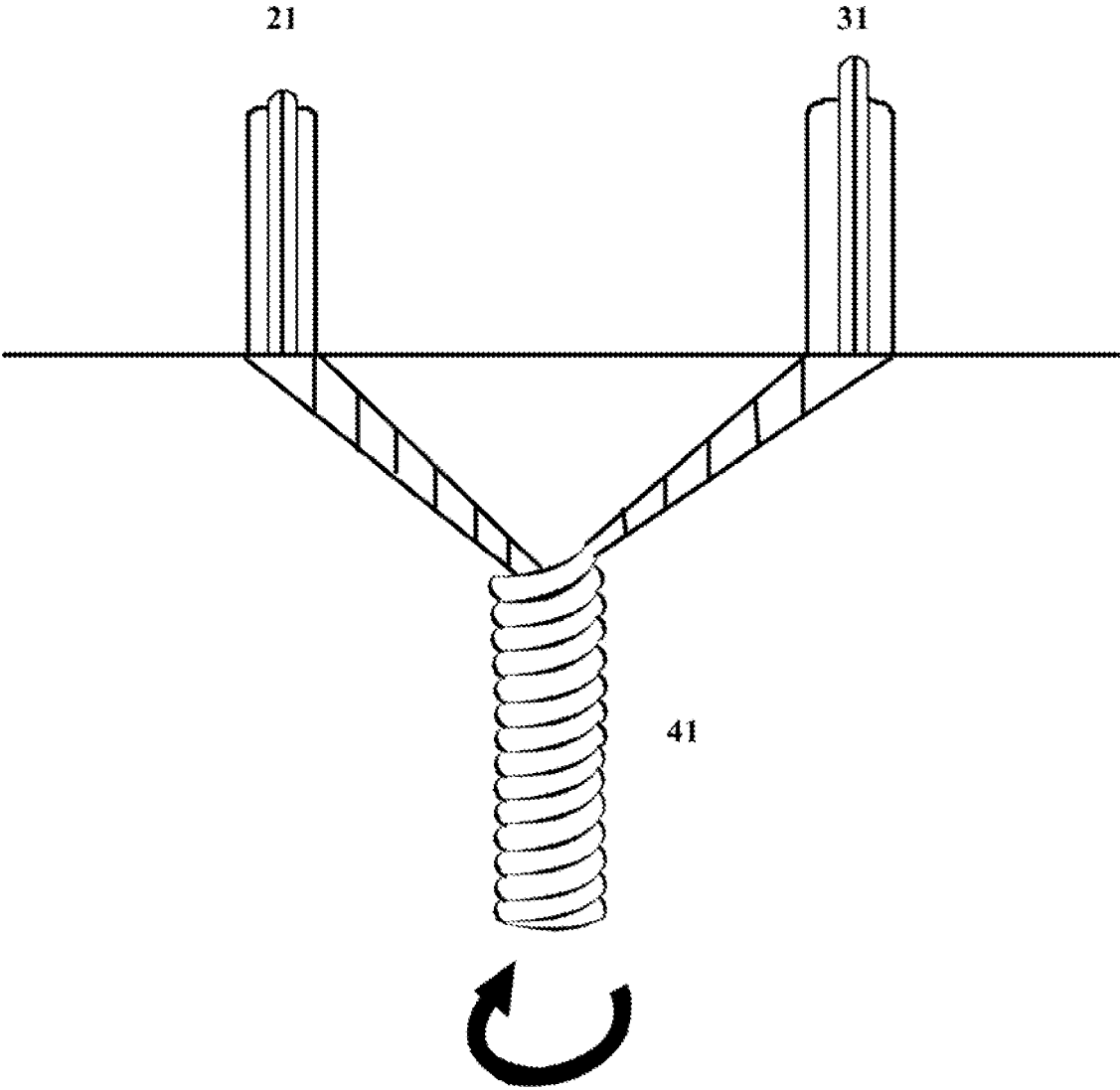


FIGURE 4

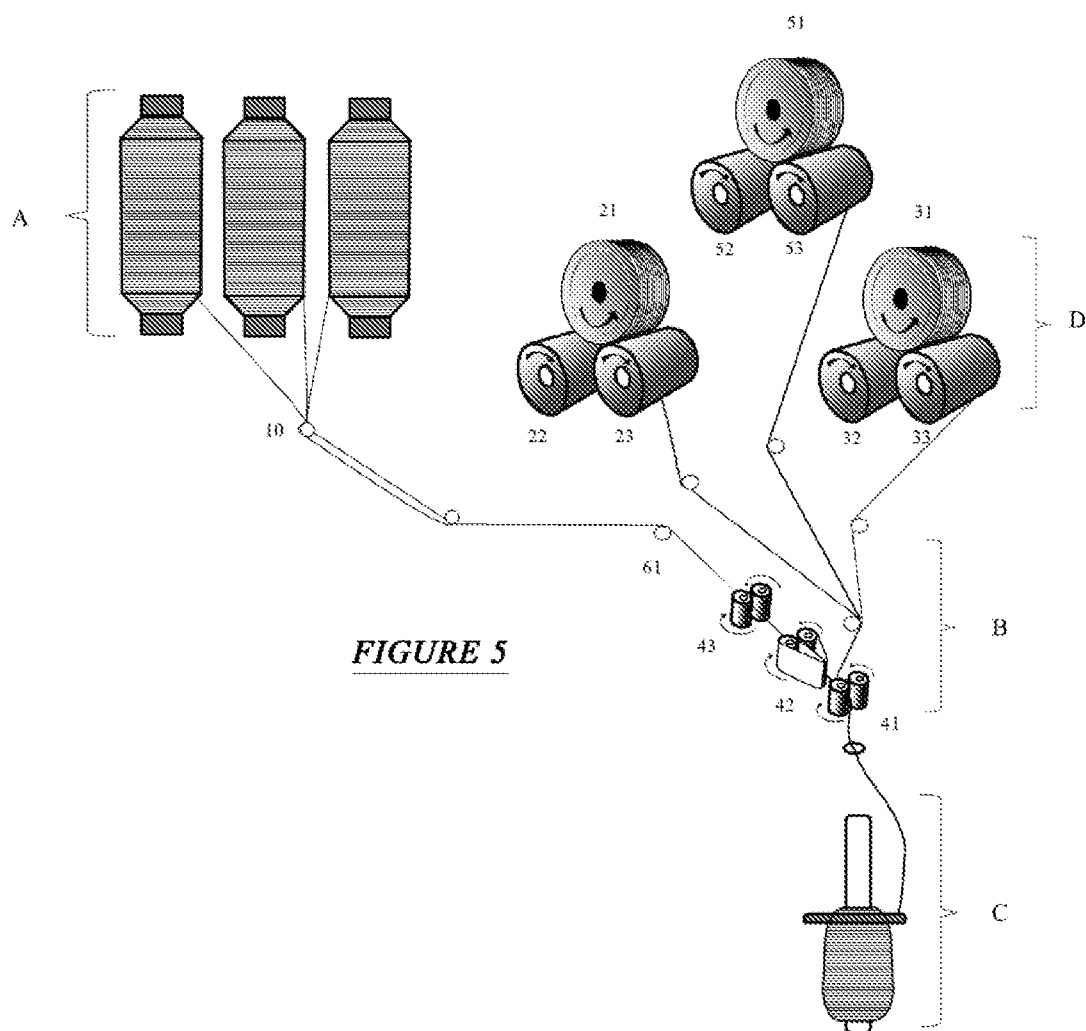
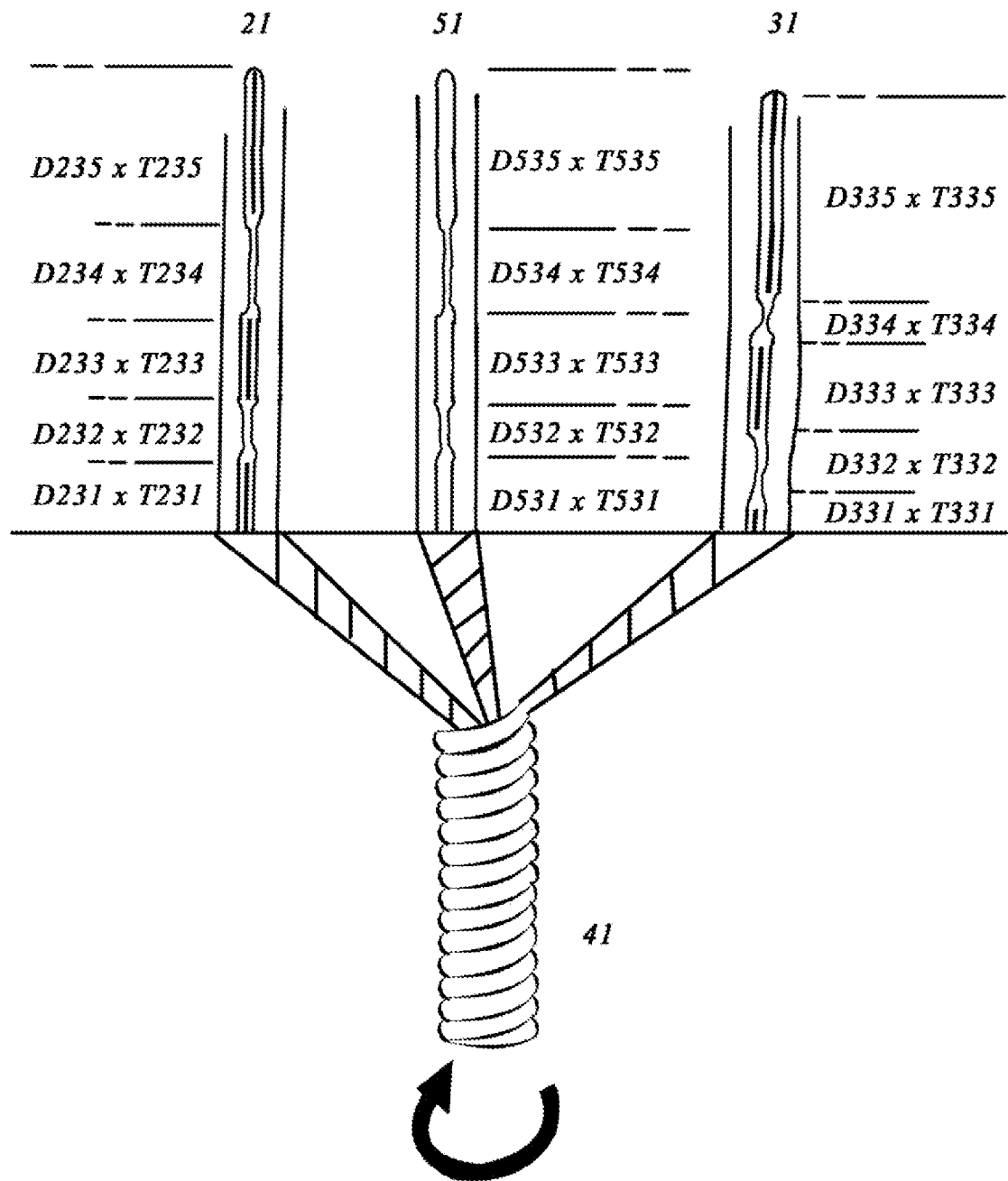


FIGURE 5

FIGURE 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/119868

A. CLASSIFICATION OF SUBJECT MATTER

D02G 3/32(2006.01)i

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)

D02G3/32, D02G3/36, D02F3/38, D01H1/02

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)

CNABS; CNTXT; VEN; CNKI; ISI WEB OF SCIENCE: filament?, fibre?, fiber?, fibrous, yarn?, ring, spun, ring type, stretch, resilient+, elast+, flexibil+, two, double, another, core?, sheath

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	HK 30008630 A2 (ATLANTIC MILLS HK LTD) 12 June 2020 (2020-06-12) page 4 line 1 to page 8 line 7, Example 7 of its description	1-14
A	CN 104278387 A (HONG KONG DAZHONG TRADING CO LTD) 14 January 2015 (2015-01-14) all the document	1-14
A	CN 105378166 A (CENT-N CENT FAB LTD et al.) 02 March 2016 (2016-03-02) all the document	1-14
A	CN 101492843 A (UNIV WUHAN SCI & ENG et al.) 29 July 2009 (2009-07-29) all the document	1-14
A	CN 102102248 A (UNIV XIAN POLYTECHNIC et al.) 22 June 2011 (2011-06-22) all the document	1-14
A	CN 106958057 A (MASCHFAB RIETER AG) 18 July 2017 (2017-07-18) all the document	1-14



Further documents are listed in the continuation of Box C.



See patent family 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 application or patent but published on or after the international filing date

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“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

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“&” document member of the same patent family

Date of the actual completion of the international search

28 December 2020

Date of mailing of the international search report

07 January 2021

Name and mailing address of the ISA/CN

National Intellectual Property Administration, PRC
6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing
100088
China

Authorized officer

WANG,Lina

Facsimile No. (86-10)62019451

Telephone No. 62084563

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
HK	30008630	A2	12 June 2020	None			
CN	104278387	A	14 January 2015	None			
CN	105378166	A	02 March 2016	US	2016024692	A1	28 January 2016
				EP	2867393	A1	06 May 2015
				CN	105378166	B	28 September 2018
				WO	2015032097	A1	12 March 2015
				HK	1210236	A0	15 April 2016
CN	101492843	A	29 July 2009	US	2010162677	A1	01 July 2010
				WO	2010075683	A1	08 July 2010
				EP	2371998	A4	20 June 2012
				CN	101492843	B	12 May 2010
				KR	101213558	B1	18 December 2012
				EP	2371998	A1	05 October 2011
				JP	2011526330	A	06 October 2011
				KR	20110026447	A	15 March 2011
				US	7913483	B2	29 March 2011
				EP	2371998	B1	30 March 2016
CN	102102248	A	22 June 2011	CN	102102248	B	26 December 2012
CN	106958057	A	18 July 2017	CH	711736	A1	15 May 2017
				EP	3178975	B1	30 September 2020
				EP	3178975	A1	14 June 2017