

Value Addition in Spinning



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ABSTRACT:

The field of value added yarns has been profiting. Value added yarns are yarns which are given pre-programmed 'characters' at the spinning stage, electronically controlled and consequently 100 % reproducible. It is generated during the spinning process by controlling the yarn diameter (that is to say, the number of fibres in the cross-section) and the length structure of the yarn, by the effect forming devices. The intentional variations are introduced in a pre-determined way to get a control over the design of yarn. This pre-determined way is governed by fundamental requirements of the textile product. Value added yarns are deployed by the designers to give products a natural, rustic and attractive appearance, in contrast to high quality yarns with absolutely regular yarn diameters. In spite of extensive use of these value added products the grouping of problems of such varieties are nearly in doubt. Up till now there were only some efforts to propose the ways for grouping of value added yarns and such investigation requires validity of suggestions. This document is dealing with different technologies use for value addition in spun yarns and their structural properties along with field of applications.

1. INTRODUCTION

Value addition in textile products is need of an hour in today's fashion world. This can be at fibre, yarn, fabric or processing stage. Fashionable yarns which termed as novelty or speciality yarns and fashion oriented yarns -generally incorporate deliberative 'defects' or deviation which are randomly distributed along its length. The value added yarns clearly differentiate themselves from standard commodity yarn in terms of raw material and production technique used. The value added yarns invariably go into creating fabrics which cater to crave for exclusivity in garments, upholsteries or tapestry, Furnishing Fabrics. These yarns are getting extended application in ladies dress material, blouses, shirts, ties, soft luggage bags, etc. If we look over the global scenario, 3-4% of all yarn produced globally is in fashion yarn it is expected to increase to 10% in next 3-4 years there is a growing market for apparel made from these types of yarn, often known as fancy yarns in Europe ,USA ,India and Japan, the method of adding value to spinning.

In every year even in every season there is run for something new, for the exclusive and particular yarn with high fashion multicolour compound effects the vital part of value added technologies in spinning today, is the “**microprocessor control**”, which allow problem free production of any imaginable value added yarn pattern and taking care of all control, operating and monitoring functions

2. CLASSIFICATION OF VALUE ADDED YARNS

Spun effect: made entirely on or be-fore spinning frame

Fibre mixing: staple length- Coloured fibres, coloured slivers

Twist effect: Differential twist effects- crepe, diamond yarn

Excess feed effect: Excess feed yarns-boucle, gimp, loop yarn.

Intermittent effect: By varying speeds-Slub, Multi-county, multiwist, knop.

By morphological structure: Optical effect - fancy yarn of multicoloured.

3. METHOD OF VALUE ADDITION IN SPINNING.

- 3.1. Manipulation of fibre specifications:** Fibre specifications such as type, length, denier, cross-sectional shape, crimp, initial modulus, colour, lustre, affinity for dyes, shrinkage etc of two or more fibre can be manipulated to produce value added yarns.
- 3.2. Manipulation of yarn specifications:** Manufacture of fancy yarns often involves plying and cabling together yarns of varying densities and twist densities.
- 3.3. Random pulse generator:** Specialised machines or attachments at spinning or at Pre-spinning and Post spinning stages for producing special effects in yarns. This produces Slub of varying size and twist.
- 3.4. Microprocessor controlled doubling machines:** The machine has facilities for feeding two or more yarns at speeds which are independently controlled, examples are loop yarn, snarl yarn spiral yarn, Slub yarn, knop yarn, boucle yarn and caterpillar yarn.
- 3.5. Using texturing and unconventional spinning systems:** Air texturing and unconventional spinning systems such as rotor spinning, self twist spinning, air-jet spinning, friction and hollow spindle spinning.

4. VALUE ADDED TECHNOLOGIES

Table no. 1 Value added yarn production technologies

Manufacturing technologies/value added yarn	Prior to spinning	Hollow spindle	Fancy twister	Cabling	Spinning	Chenille machine	Wet knitting machine
Boucle	X	X	X		X		
Button		X				X	
Gimp			X		X		
Loop		X	X		X		X
Grandrelle		X	X	X			
Mock chenille			X				
Flake	X						
Slub	X	X	X		X		
Snarl		X	X				
Nepp	X	X			X		
Cork screw			X				
Knop			X		X		
Marl					X		

5. VALUE ENHANCING DEVICES/METHODS ON RING SPINNING:

There are various devices attached on ring spinning and open end frames. With these devices one can manufacture Slub, Multi-count, Multi-count and multitwist, Multi-count with Slub, Multi-count and multi-twist with Slub .Value addition devices are fitted and modified on a customer specific basis, both to existing as well as to new spinning frames of all makes.

5.1 Amsler fancy device:

Principle: Varying the draft of the parent yarn by engaging an additional electronically controlled motor driven gear with the drafting rollers to produce a value added yarn with predetermined dimensions wherever necessary.

5.1.1. Slub yarn

Normal yarn is formed from the basis machine speed. A microprocessor controlled servomotor only overfeeds with a pre-programmed textile ramp. With this device the servo drive system is connected to the back and middle roller via the Amsler Slub gear box (Fig .1). Existing ring main drive constantly drives the back and middle roller and only at the time of Slub formation gear motor starts with a pre-programmed textile ramp additional speed is given to the drafting system. So with effect device system normal yarn formation is not disturbed.

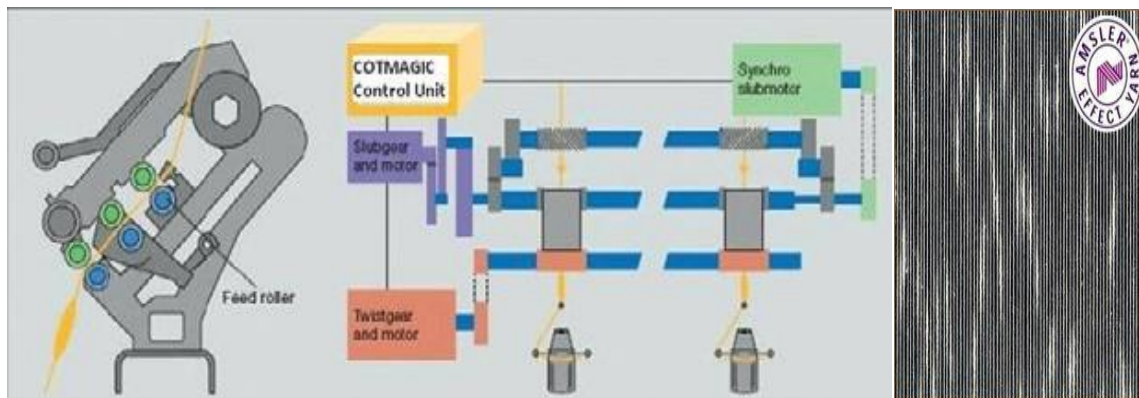
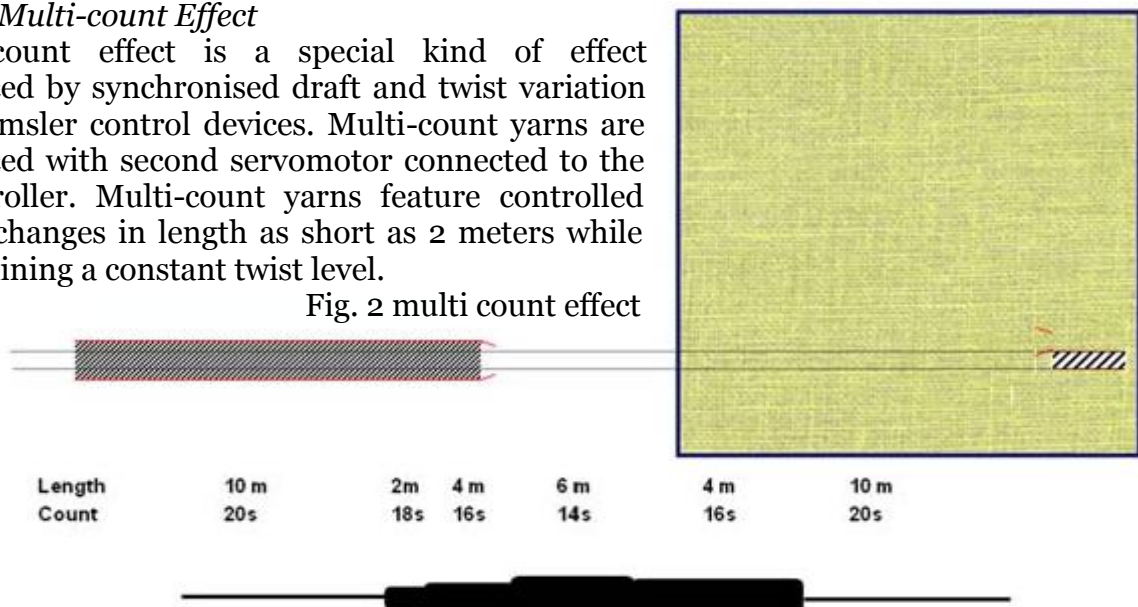


Fig. 1 Amsler device and slub effect

5.1.2. Multi-count Effect

Multi-count effect is a special kind of effect produced by synchronised draft and twist variation with Amsler control devices. Multi-count yarns are produced with second servomotor connected to the front roller. Multi-count yarns feature controlled count changes in length as short as 2 meters while maintaining a constant twist level.

Fig. 2 multi count effect



5.1.3. Multi-twist yarns:

Multitwist yarns are yarns that feature a constant count but have different twist levels inside yarn. These different twist levels create variations in the yarn's dye intake thus creating a special fabric appearance.

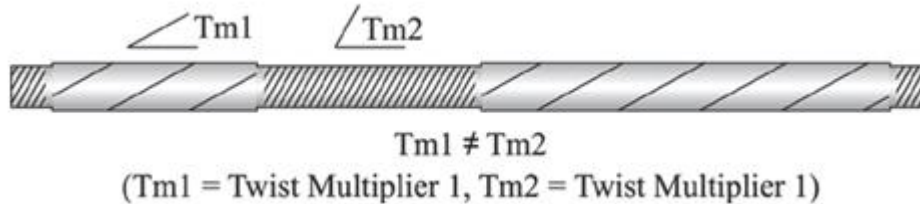


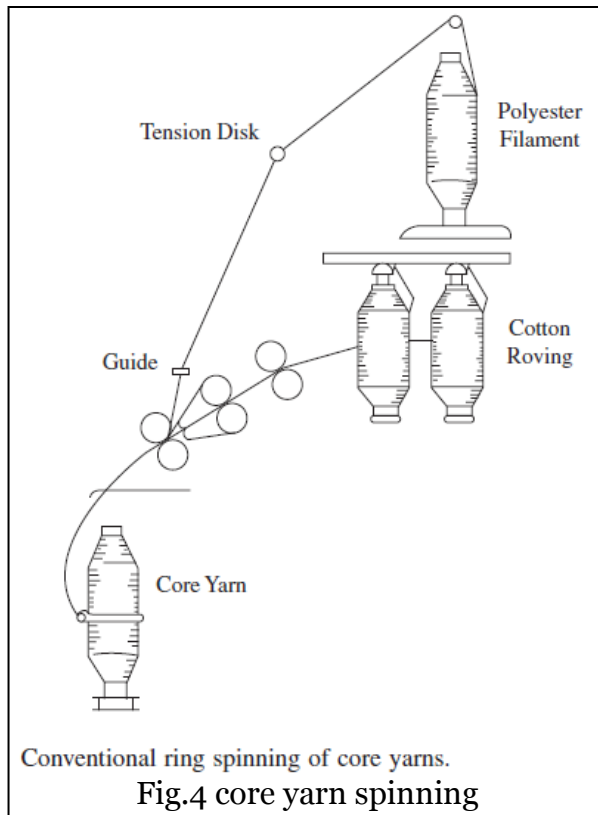
Fig. 3 Multi twist yarn

Table no. 2 Process variables on Ring frame.

Yarn	TPI	Count	TM	Delivery speed	Slub length
Slub	Constant	Changes	Changes	Constant	Smaller than 2 mtr
Multicounty	Changes	Changes	Constant	Changes	Smaller than 2 mtr
Multi twist	Changes	Constant	Changes	Changes	Any

5.2. VARIOspin - Rieter G35:

The integrate VARIOspin fancy yarn system in Rieter G35 enables fashionable effects to be produced economically. With this system spinning mills can respond flexibly to very different customer and market needs and produce various structured effects in ring-spun. VARIOspin is available as an option and is integrated in the machine and the control system. No complicated or costly retrofits are necessary. Switching between fancy yarn and standard yarn is performed easily and quickly at the operator panel via the machine control system.



5.3. Core yarn Attachment

Core yarns are usually two-component structures, one forming the yarn core and the other the covering. Generally, a continuous filament yarn is used for the core and staple fibers as the sheath covering.

5.3. Core yarn Attachment

The filament is introduced into the center of the drafted fiber ribbon, (fig no.4) at the nip of the front drafting rollers. It is usually pre-tensioned to an extension of around 5% for flat continuous filament yarns, about 30% for textured yarns, and up to 400% for an elastomeric core. If insufficiently tensioned, the filament will either periodically appear at the yarn surface,

referred to as *grin through*, or become wrapped around the fiber ribbon as the ribbon is being twisted. The amount of twist, and the ratio of sheath to core employed, will depend on end use and particularly on preventing the sheath covering sliding along the core.

6. VALUE ADDED DEVICES/METHODS ON ROTOR SPINNING

6.1. Caipo device:

Rieter BD rotor machine is equipped with Slub yarn device from Caipo Automazione Industriale, Italy. The motorised variable sliver feed gives various effects like Slub yarn (coarse or fine), Multi-count with twist variation, multi-twist etc, through Slub programming software at constant yarn delivery. Slub can be programmed at regular or irregular length with regular or irregular spacing and are reproducible. The Slub device can be integrated into existing machine and does not require any extra installations and can be performed on 280 (max) spinning units.

6.2. Amsler device

Principle: Controlling the feed roller speed to give variation in draft is the basic principle of the effect yarn to be produced in rotor spinning. Similarly Savio rotor machine is equipped with system from Amsler Tex AG, Switzerland for producing Slub yarns.

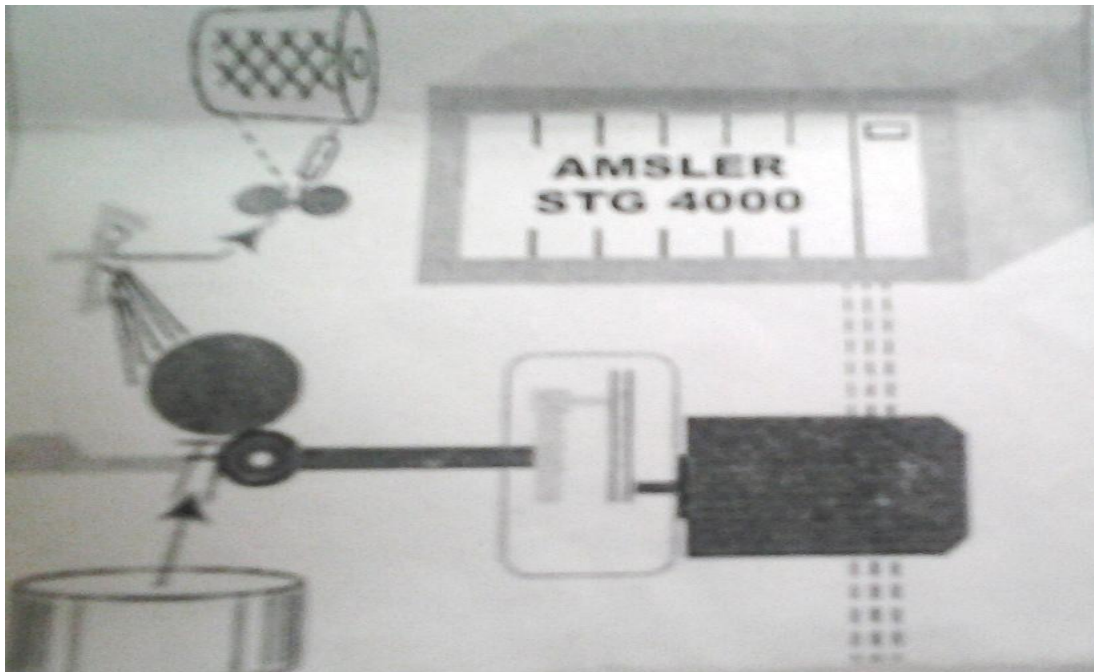


Fig. 5 Amsler rotor spinning device

6.3. Loop yarn on Rotor spinning

The fig no. 6 shows that the core component is fed into the yarn formation zone from the supply bobbin (1). They installed an electric tension meter (Shimpo Co., DTMX-0.5) between the tensioning device and the feed tube to measure core tension during the spinning. The effect filament yarn is fed from the supply bobbin (2) through the effect

filament feed rollers with a constant feeding speed. However due to the back-doubling action inside the rotor, it is not possible to produce slub shorter than the circumference length of the rotor because any variation in the fibre feed stock is spread over a minimum length of the rotor circumference.

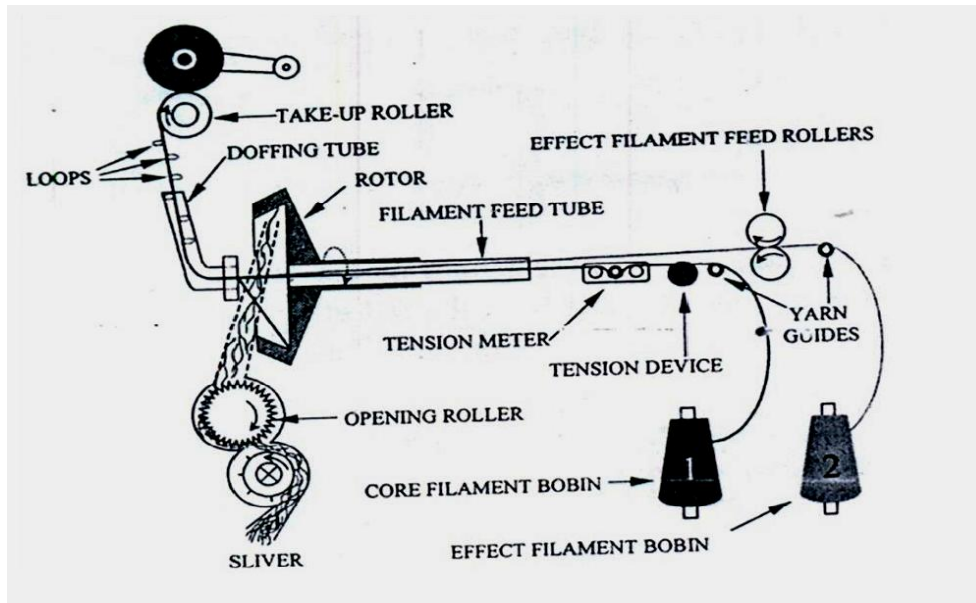


Fig .6 Rotor spinning for loop yarn

7. DREF-3 SPINNING

This is a core-sheath type spinning arrangement. The sheath fibres are attached to the

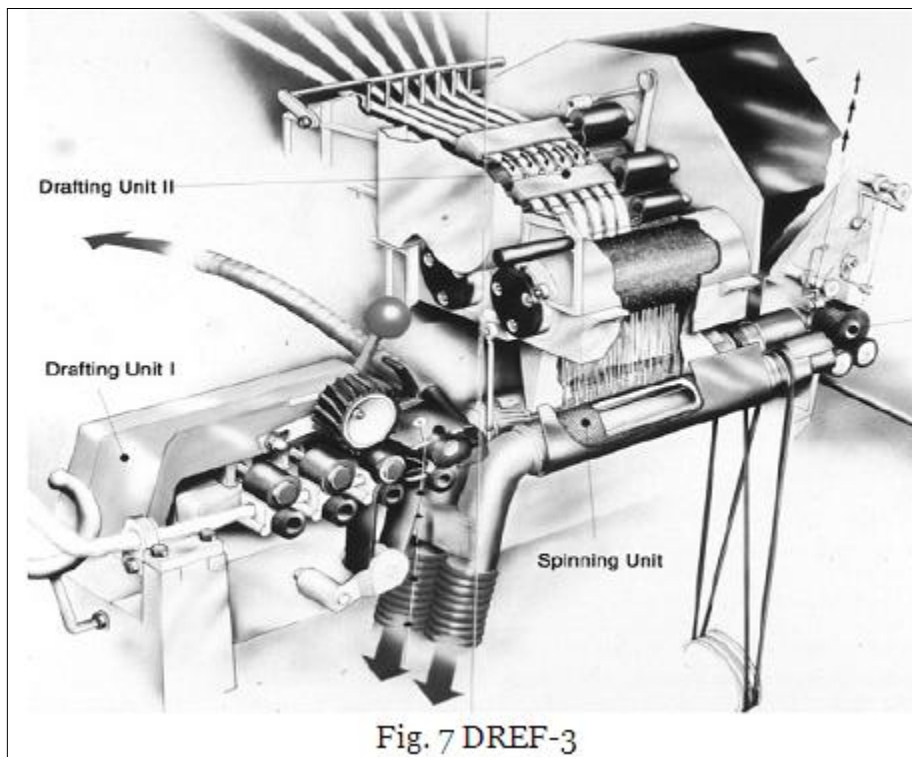


Fig. 7 DREF-3

core fibres by the false twist generated by the rotating action of drums. Two drafting units are used in this system, one for the core fibres and other for the sheath fibres. This system produces a variety of core-sheath type structures and multi-component yarns, through selective combination and placement of different materials in core and sheath. Delivery rate is about 300 m/min. Refer Fig no. 7.

Apart from these, there are some more technologies for producing value added yarn such as two spindles wrap system, combination of ring in hollow spindle, Air jet spinning, leno weaving and hollow spindle etc.

8. STRUCTURES AND APPLICATIONS

8.1. Spiral yarn

Spiral yarn or corkscrew yarn is a plied yarn that displays a characteristic of smooth spiralling of one component around other. The application areas for these yarns includes fancy upholstery, lace and designer bags

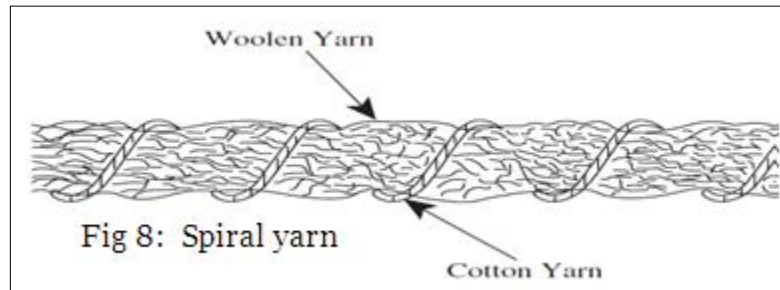
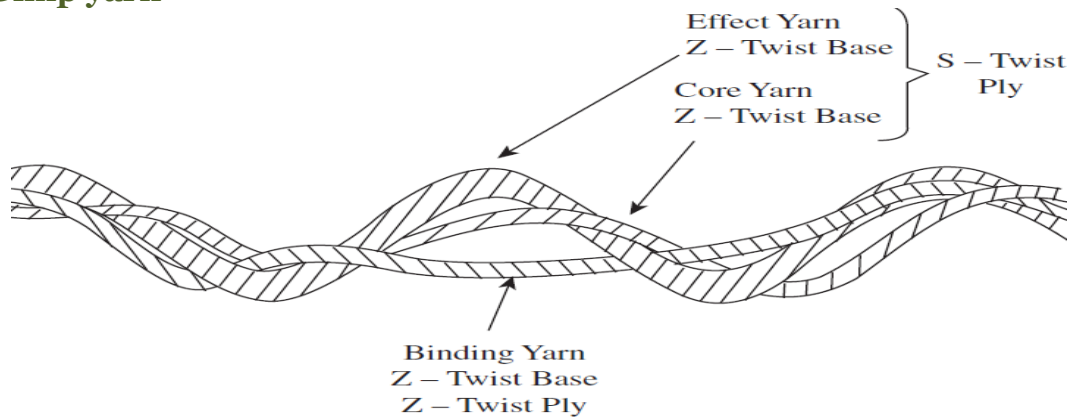


Fig 8: Spiral yarn

8.2. Gimp yarn



Structure of gimp effect yarn.

Fig .9 Gimp yarn

A gimp yarn consists of a twisted core with an effect yarn wrapped around it so as to produce wavy projection on its surface. A binder yarn is needed to ensure stability of structure. Application areas are many, chief among which are high quality embroidery trimming and decorative laces etc.

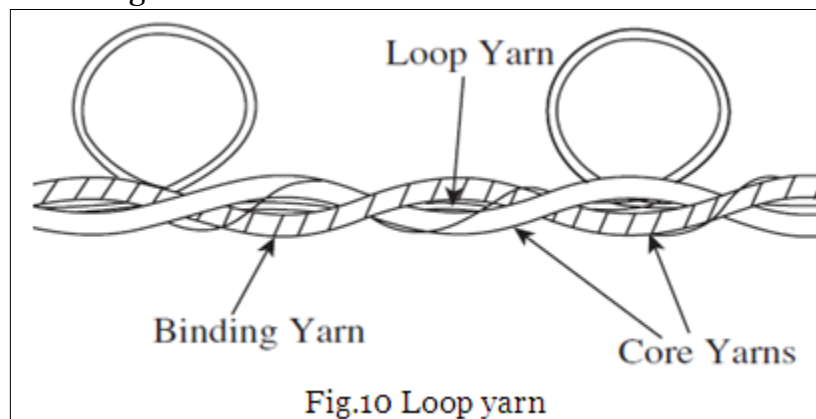


Fig.10 Loop yarn

8.3. Loop yarn

In a loop yarn as per general rule, four yarns are involved, of which two form the core yarn and remaining two form effects. Over feed so as to produce almost circular projection on its surface. Longer the fibre, the better is loop formation.

Size of loop is influenced by amount of overfeed. Applications are woven fabric and knitted fabrics, sportswear, coatings, terry towel etc.

8.4. Snarl yarn

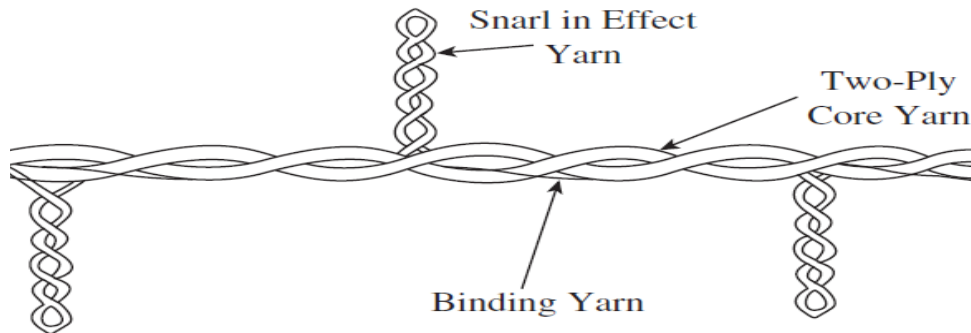


Fig.11 Loop yarn

This type of yarn is generally produced with the plying process. The profile component has to be a highly twisted yarn. Typically, it is a short staple cotton or synthetic fiber singles yarn of 25 tex with 25% greater twist level than normally used for a conventional singles yarn. Applications are furnishing fabric, attractive over coating, scarf etc.

8.5. Knop yarn

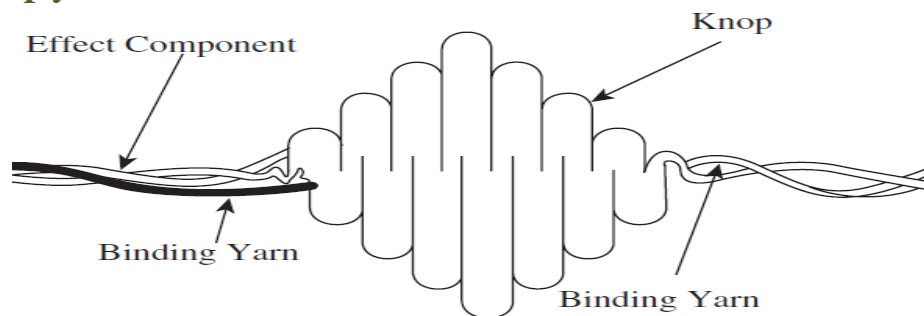


Fig. 12 Knop yarn

A knop yarn is one that contains prominent bunches of one or more component threads, arranged at irregular intervals along its length. The knop can be constructed by the spinning or the plying system using an over feed of 150 to 200%. Uses: light weight, novelty fabrics, suiting, dress goods, curtains, and decorative fabrics.

8.6. Slub yarn

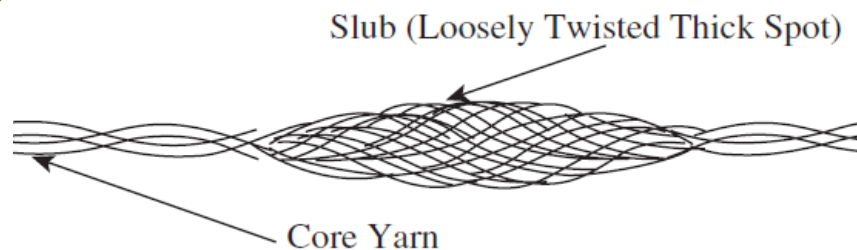


Fig. 13 Slub yarn

Slubs are thick places in the yarn. They can take the form of a very gradual change with only a slight thickening of yarn at its thickest point. Uses are Denim, Formal wears, Knitted fabrics, Home textiles.

9. CONCLUSION

The suggested classification in this paper gives the potential for value added yarns and it is very needful for the designing of novel textile products. Awareness of the variety of fancy yarns and its effect has risen. This in turn encouraged investment and research. Such as better machinery, trained manpower, satisfied customer and increased profitability. New products stimulate further invention and so one can expect that range of fancy yarns available will continue to grow. Italy, India and some of far eastern countries are responsible for bulk production. The commercial successful non-conventional yarn manufacturing machines have incorporated numerous innovations and developments on the machines that lead to improved yarn quality and power saving. These spinning systems become more flexible and thus now it is possible to spin various fancy/effect and core spun yarns. The conventional ring spinning system is going to face tough competition in near future.

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