

# RECENT ACHIEVEMENTS IN DEVELOPING SINGLE SPUN FANCY YARNS

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**REZUMAT.** În ultimii ani, atât pe piața produselor de îmbrăcăminte, cât și în sectorul materialelor pentru tapițerie sau al textilelor pentru casă, cererea de țesături noi, moderne și rafinate, cu caracteristici distinctive a crescut continuu. Ca urmare a crescut și cererea de fire de efect care să permită, printre altele, obținerea acestor țesături. Această lucrare prezintă cele mai noi realizări ale producătorilor de utilaje pentru filatură în domeniul producerii firelor de efect pe mașinile de filat, ca răspuns la cerințele clienților pentru utilaje flexibile, productive și ușor de utilizat, capabile să producă o mare varietate de fire obișnuite sau de efect.

**Cuvinte cheie:** filatura, fire filate, fire de efect, mașini de filat

**ABSTRACT.** During the last years, on the clothing market as well as in the furnishing and home textiles sectors, the demands for new, modern and refined fabrics with distinguishing features increased continuously. Consequently, the demand for new and fancy yarns has grown as well. This paper presents the latest achievements of the manufacturers of spinning machines in the field of producing single spun fancy yarns, in response to the customers' demands for flexible, highly productive and easy to operate machinery, able to produce a large variety of regular or fancy yarns.

**Keywords:** spinning, spun yarns, fancy yarns, spinning machine

## 1. INTRODUCTION

During the last years, on the clothing market as well as in the furnishing and home textiles sectors, the demands for new, modern and refined fabrics with distinguishing features increased continuously. Consequently, the demand for new and fancy yarns has grown as well.

Whether used for outerwear, home textiles, upholstery fabrics or industrial textiles, fancy yarns account for an increasing share from the total quantity of yarns produced worldwide.

Usually, one of the most important aims for spinners is the manufacture of yarns with a high degree of uniformity in terms of yarn fineness and twist degree. Nevertheless, to enhance the aesthetic effect of the fabrics, such as obtaining an uneven and rough texture that gives the feeling of moving, or variations of colour intensity that make the fabrics more attractive for customers, the use of yarns with a certain degree of irregularity is required sometimes.

The yarns that features some deliberate variation of either colour or form, or of both colour and form are generally described as fancy yarns [1]. Unlike fancy doubled yarns, which have a complex

structure and are produced using specially designed equipment, *single spun fancy yarns* represent a category of yarns featuring attractive aesthetic characteristics that can be easily obtained directly on the spinning machines. These yarns contain purposely introduced irregularities, derived from the change in yarn fineness (thick or thin places) and/or in yarn twist, obtained as results of varying the spinning process parameters by using devices specially developed for this purpose. [2].

To meet the demands in continuous growth for fancy yarns, the textile machinery manufacturers come up with innovative solutions to increase the equipment flexibility and allow the production of fancy yarns on the same machines used for the regular yarns. As a result, the modern ring-spinning and rotor spinning machines are equipped with devices able to produce single spun fancy yarns. Some manufacturers offer these devices on request, but in other cases, these are supplied as standard option.

Some solutions offered by the textile machinery manufacturers for producing single spun fancy yarns were presented in a previous work [3]. This paper continues to present the latest achievements in the field, in response to the customers' demands for

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flexible, highly productive and easy to operate machinery, able to manufacture a large variety of regular or fancy yarns.

### 2. SINGLE SPUN FANCY YARNS

Among the important markets for single spun fancy yarns, the denim market is one of the most dynamic ones. The global denim market was valued at \$56,178.1 million in 2017 and is forecasted to witness a CAGR of 5.8% during 2018–2023 [4].

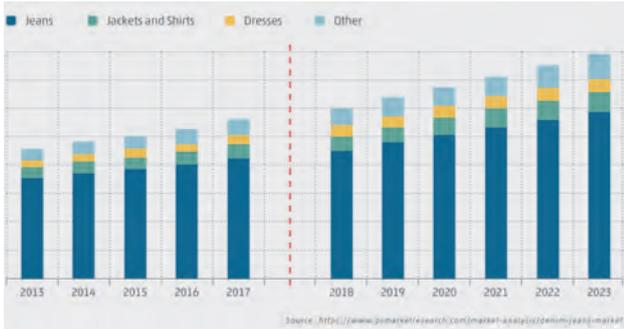


Fig. 2.1. Global denim market forecast [4]

Apart for denim production, the single spun fancy yarns are frequently used for upholstery fabrics and drapes as well as in production of single jersey and fine outerwear fabrics (Fig.2.2).



Fig. 2.2. Various types fabrics containing single spun fancy yarns (<https://thedesigncart.com>, <https://www.zsfabrics.com>)

Based on the types of introduced effects, the single spun fancy yarns can be described as follows: slub yarn, multi-count yarn, multi-twist yarn and multi-effect yarn (Fig. 2.3) [2].

**Slub yarn** is the most frequently used type of fancy yarn in which slubs or thick places of different thickness and length are intentionally created to obtain the desired effect (Fig. 2.3.a). Usually, slub yarns are characterized by rather short effects, with the length varying between 3 and 10 cm.

On the ring spinning machine, the slub effect is produced by varying the speed of the back and middle bottom rollers, while the speed of the front roller, as well as the spindles speed, are maintaining constant. This means that the twist per meter in the yarn remains constant ( $T_1=T_2$ ) and the yarn is characterized by count variations with varying twist factor [2].

On the rotor spinning machine, the slub yarns are produced by variations of fibres amount supplied into the rotor by the acceleration of feed roller, while the rate of yarn delivering speed is kept constant. Due to the doubling action that takes place inside the rotor, the minimum length of the slubs cannot be less than the circumference length of the rotor. For example, with a rotor diameter of 36 mm, the slub effects produced on rotor spinning machines are at least 11.3 cm long [2].

The random variation of thickness, length and pause between slubs gives a wide range of effects, ensuring the use of slub yarns in many applications like denim, knitwear, casualwear, ladies dress but also for curtains and upholstery.

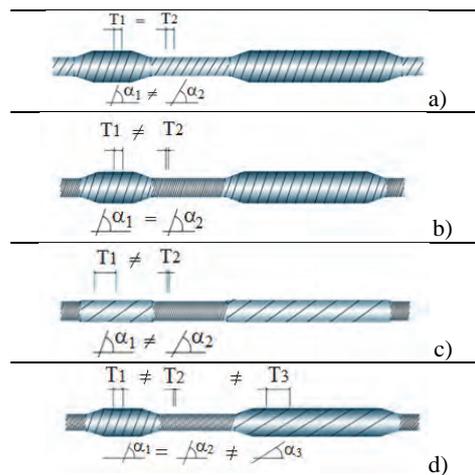


Fig. 2.3. Structure parameters for single spun fancy yarns  
a) Slub b) Multi-count c) Multi-twist d) Multi-effect

**Multi-count yarn** is described as a succession of yarn segments with different fineness. This effect is achieved by controlled changes of yarn thickness on a certain length, while the twist factor is maintained constant ( $\alpha_1 = \alpha_2$ ) (Fig. 2.3.b).

The mass variation along the yarn is achieved by periodically reducing the main draft through temporary increases in speed of the back-bottom roller and middle bottom roller. The twist is adapted to each segment of yarn with different count, so the yarn shows a succession of segments with various thicknesses but with the same twist factor.

The multi-count yarns are similar in many respects to the slub yarns, but due to the modified twist, feature a higher tenacity in the thinner places. In contrast to slub yarns, the length of effect

segments in multi-count yarns may vary between 0,5 and 5 meters, giving a special look to the fabrics. Presently, multi-count yarns with short effects are in high demand for denim yarns while those featuring long effects are used for home textiles.

**Multi-twist yarn** is produced by applying different twist factors ( $\alpha_1 \neq \alpha_2$ ), which result in different twist per meter ( $T_1 \neq T_2$ ), to the yarns with constant count (Fig. 2.3.c). The differences in twist create variations in the yarns dye intake and allow obtaining fabrics with a special appearance due to colour variations. Usually, multi-twist yarns are produced with rather long effects of 10-50 cm.

**Multi-effect yarn** features a combination of slub effects, multi-count effects and multi-twist effect (Fig. 2.3.d). A change in mass can be combined with a twist factor  $\alpha$  which is not predefined. This means that the twist and change in mass in the yarn can be freely selected [2].

### 3. SYSTEMS FOR PRODUCING SINGLE SPUN FANCY YARNS

Due to the impressive and consistent demand for single spun fancy yarns, more and more spinners are including these yarns in their product range. Consequently, the spinning machine manufacturers developed flexible solutions that allow obtaining of fancy yarns on the same machines used for regular yarns. Production of fancy yarns directly on spinning frames is accomplished by using computer-controlled servomotor systems for control the spinning process parameters. These allow precisely change of the rollers speed, and consequently of the draft and/or the twist, enabling thus the creation of yarns with various effects.

The Amsler Tex company provides solutions for production of fancy yarns on both ring-spinning and rotor-spinning machines. The company cooperates with all important manufacturers of spinning machinery (Marzoli SpA, Rieter AG, Saurer, etc) to develop complete systems for production of fancy yarns, as alternative to ordinary yarns, on the same machine [5].

#### 3.1. MARZOLI MSS – Marzoli Super Slub

The well-known supplier of machinery for the textile industry **Marzoli SpA**, was the first who introduced a fully integrated device for fancy yarns on its ring spinning machines. The *Marzoli MSS – Marzoli Super Slub* technology is the latest result of close cooperation with some important customers, mainly with those working for the denim market [4].

The integrated device, available on ring spinning frames MDS2 and MP1N, is able of producing fancy

yarns of various forms and designs without any modification to the spinning frame. The twist and draft variations are accomplished by modifying the speed of the independent motors that are already installed on the spinning frame.

Through continuous variation of the drafting rollers speed, various effects can be obtained, such as slub, multi-count, multi-twist, reverse slub. Multiple ways to combine these effects allow creating a large diversity of yarn and fabric designs.

*Draw your Slub* is the application for editing fancy yarn recipes in a quick and simple manner. First, the slub's profile is drawn in a dedicated editor by creating single points connected with lines. The line shows the trend of the multiplier, i.e. the diameter of the slub ( $y$ ) as function of the length of the slub ( $x$ ). Secondly, the fancy yarn is designed using the previously created slub, by setting its length and the distance between this slub and the next one. The example in figure 3.1. show the steps to design a fancy yarn using a saw tooth shape slub with different lengths [6].

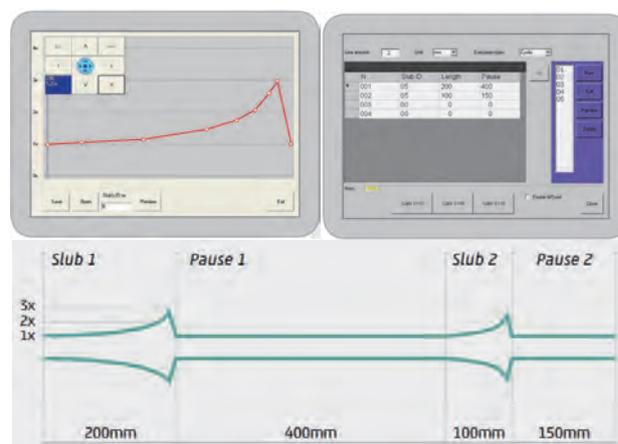


Fig. 3.1. Fancy yarn design using *Draw your slub* application

#### 3.2. RIETER VARIOspin 4

G38, the last generation of ring-spinning machines from **Rieter AG**, include as standard option the device for producing fancy yarns *VARIOspin 4*, the result of cooperation between Rieter AG, the manufacturer of systems for short-staple spinning and AmserTex, provider of systems for producing fancy yarns [7].

The system is based on the drafting system drive FLEXIdraft which allows separate actuation of the drafting system drives and can be programmed by the user. This allows fancy yarns with high quality to be produced efficiently and profitably.

A range of fancy yarn designs can be programmed on the operating unit or on an external computer with the appropriate software, and reliably reproduced. Effects differ in the variation of the

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effects mass (thickness) and effects length. Yarns with long thin places, finer than the basic yarn count can be produced, especially for knitwear, while other special effects such as overlapping effects (effect on effect) complete the possibilities of this system (Fig.3.2).

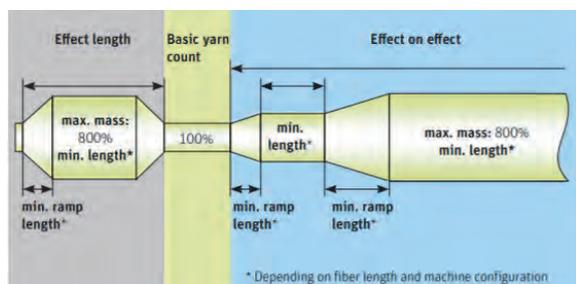


Fig. 3.2. Various effects parameters [7]

The slub yarns are produced by mass changes obtained via controlling the speed of the feed bottom roller and the middle bottom roller. For increasing the mass, they are accelerated thus reducing the total draft while for a reduction in mass they are slowed down, so the total draft increases. To obtain the change in mass without the twist modification, the yarn delivery speed and the spindle speed remain constant.

When multi-count yarns and multi-effect yarns are spun, changes in mass together with modification of twists per meter are performed; all drafting bottom rollers changes their peripheral speed simultaneously, in coordination with each other. The yarn delivery speed is also changed [8].

*VARIOspinData* programming software is used for defining the effects and design the fancy yarns. It enables the effect patterns and their repeats to be programmed, visualized, optimized and managed on the computer. The formation of moiré pattern on the fabric, caused by a regular distribution of effects, can be prevented by modifying the program if such an effect is not wanted. It provides also the basis for data conversion and transfer of fancy yarn data between PC and machine control system via a USB stick or optionally via the SPIDERweb, data collection system [9].

### 3.3. SAURER Fancynation

The rotor spinning machine allow remarkable flexibility in term of fancy yarn production. In this respect, **Saurer Company** optionally provides on Schlafhorst rotor spinning machines a modular system, hardware and software, fully integrated for fancy yarn production. The system, known as *Fancynation*, includes [10]:

- *FancyPilot* – software for creating fancy yarns,

- *FancyOasis Gold* – software for 3D simulation of woven and knitted fabrics,
- *FancyProfile* – software for measuring the effects on the yarn profile,
- *FancyLink* – software for scanning real yarns and generating the fancy control data source.
- *Single Drive Sliver Intake (SDSI)* - a small stepper motor used to produce fancy/slub effects.

On Schlafhorst Autocoro rotor spinning machine, the *Fancynation* option allows simultaneously producing up to 5 different types of fancy yarns, or fancy yarns and standard yarns in parallel on the same machine. Moreover, the system stores in a database all the settings for fancy yarns already produced, which enables to reproduce any yarn quickly at any time [11].

The ring spinning machines Zinser are equipped with the electronic system for drafting control *FancyDraft* and the *FancyDesigner* software for designing and producing fancy yarns, both from short-staple and long-staple fibres. The draft and the twist can be varied in a controlled manner, so slubs of different thickness and lengths can be introduced in yarn. The twist can also be varied to produce multi-twist yarns [12].



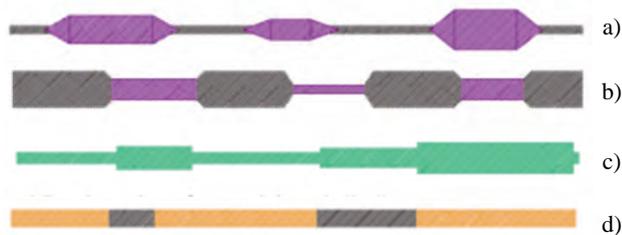
Fig.3.3 *FancyPilot* software and *Fancynation* option [12]

### 3.4. TOYOTA Fancy Yarn Spinning Device

The ring-spinning machines RX300E from **Toyota Industries** include optionally the *Fancy Yarn Spinning Device* that allows the manufacture of many types of fancy yarns such as slub yarns, multi-count yarns, multi-twist yarns.

The operating principle of this device is based on e-Draft System, the independently drive system for all three bottom rollers of the drafting system. The rollers are driven by specialized servo motors that allow setting and changing the speed of each draft roller independently, which makes possible slowing down the front roller and/or speeding up the back roller in order to produce varied effects in yarn.

Figure 3.4 presents various types of yarn that can be manufactured on Toyota ring-spinning machines RX300E [13].



**Fig.3.4** Types of fancy yarns manufactured on Toyota RX300E ring-spinning machine

- *Positive slub yarn* that shows thick segments distributed along the yarn, with increases of thickness up to 500% comparing the cross-section of base yarn (Fig.3.4.a), can be produced with one of the following options:
  - Front roller deceleration control (with change of twist),
  - Back roller acceleration control (with no change of twist),
  - Combined control of the front and back roller (degree of twist change can be adjusted).
- *Negative slub yarn* shows decreases of thickness up to 30% comparing to the cross-section of base yarn (Fig.3.4.b) and is produced by back roller acceleration control.
- *Multi-count yarn* consisting of a succession of yarn segments with different fineness (Fig.3.4.c), can be obtained with various twist parameters:
  - Fixed number of twisted threads (2-6)
  - Fixed number of twists (1-70 twist/inch)
  - Any number of twists (1-70 twist/inch)
- *Multi-twist yarn* with constant count but different twist on segments along the yarn (Fig.3.4.d) may have 1,5 - 10 twisted threads.

Other combinations of effects such as *Multi-count + Multi-slub*, *Slub on slub* or *Natural slub like* can also be obtained.

The special developed software, *Data Creator for Fancy Yarns*, makes it easy to record and manage the pattern simulations and settings data.

## 5. CONCLUSIONS

Nowadays the single spun fancy yarns are in considerable demand, being used often by the fashion designers for refined fabrics with distinguishing features. When compared with traditional fabrics, these sophisticated fabrics provide a higher profit margin for the producers, so

more and more spinners are interested to include fancy yarns in their product range.

To meet the demands in continuous growth for fancy yarns, the textile machinery manufacturers come up with innovative solutions to increase the equipment flexibility and allow the production of fancy yarns on the same machines used for the regular yarns.

The modern ring-spinning and rotor spinning machines can be equipped with slub devices able to produce single spun fancy yarns. The desired effects are obtained by using of microprocessor-controlled servomotor systems to controls the spinning process.

Four basic types of slub effects can be obtained: slub, multi-count, multi-twist, and reverse slub. The various combinations among these effects can create a large diversity of yarn and fabric designs.

The possibility of producing both fancy yarns and regular yarns on the same spinning machines, by employing new and more advanced integrated slub devices, allows to the spinning mills diversifying the range of products without additional running costs as well as strengthens their relationships with the customers.

## REFERENCES

- [1] Gong, R.H., Wright, R.M., *Fancy yarns: Their manufacture and application*, Woodhead Publishing Ltd. Cambridge, England, 2002
- [2] Maier, R., *Through thick and thin – with Rieter's VARIOspin*, Link-The customer magazine of Rieter Spun Yarn Systems, Vol. 22, No. 56/2010, p.8-9.
- [3] Piroi, C., *Fancy yarns for fashionable fabrics-recent developments*, International Scientific Conference eRA-11, Piraeus University of Applied Science, 21-23 sept 2016.
- [4] \*\*\* *MSS Marzoli Super Slub* - Brochures of Marzoli SpA Company
- [5] Amsler-TEX, *Slub yarn devices for spinning machines*, <http://www.ptj.com.pk/2008/02-08/PDF-February2008/49-%20Spinning%20-%20Amsler.pdf>
- [6] \*\*\* *Fancy Yarn - Technology for superior flexibility*, Brochures of Marzoli SpA company
- [7] \*\*\* *Ring Spinning Machine G38*, Brochures of Rieter AG Company
- [8] Werner, M., *Rotor-spun yarns with fashionable effects for "fancy denim"*, Link-The customer magazine of Rieter Spun Yarn Systems, Vol. 22, No. 56/2010, p.12-13.
- [9] R. Maier, *VARIOspin – for individual effects in ring-spun and compact yarns*, Link-The customer magazine of Rieter Spun Yarn Systems, Vol. 22, No. 56/2010, p.10-11
- [10] \*\*\* *Autocoro 480 A step Ahead*  
[https://issuu.com/oerlikontextilegmbh/docs/aco\\_480\\_ll\\_en2](https://issuu.com/oerlikontextilegmbh/docs/aco_480_ll_en2)
- [11] <http://schlafhorst.saurer.com/en/autocoro-9/>
- [12] \*\*\* *Saurer, Fancynation*  
- <https://issuu.com/oerlikontextilegmbh/docs/fancynation>
- [13] \*\*\* *Ring spinning frame RX300*, Brochures of Toyota Company.

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