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NEW DEVELOPMENT IN THE CORE YARNS MANUFACTURE

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Abstract : A new mechanism for the regulation of feeding tension of elastic filaments has been de veloped, in cooperation with a reputable manufacturer of textile machinery, to obtain "core spun" yarns. This device reduces, of a very significant form, the coefficient of variation of the elongation of the yarn and, consequently, the fabrics obtained with this yarns are more regular appearance. This mechanism is fundamental when the new spools of T-400, with diameter and weight superiors to the standard size, are processed.
Keywords: Core yarn. New device. Feed tension control. T -400.

1. INTRODUCTION

In the manufacture of "core spun" yarns (1), or the yarns constituted by a nucleus of elastic filament or elastomer, surrounded by a natural or chemical staple fibres, nowadays has originated a problem due to the tendency, every day increased, to use elastomer spools of dimensions and weights superiors to the standard size. (Figure 1).

Figure 1: Left: standard spools. Right: New spool

On the one hand an increase of productivity, in significant form, is obtained due to the reduction of number of changes of elastomer spool during the spinning process; but on the other hand the high diameter and weight of these new spools, 260 x 150 mm and 4400 g of weight, in front of the 600 g and 57 x 165 mm of the conventional spools cause problems for the control of the feeding tension, mainly when the diameter of the spool is reduced due to its consumption during the spinning operation.

It causes, especially, irregularities in the yarn that will give rise to faults in the weaving process, mainly bars and differences of color in the dyeing. These problems are more importants when is processed the elastomultiester (EME) designated commercially as T -400, that offer in a same filament the properties of the polyester and the advantages of an elastic fil ament.

These new fabrics made by T- 400, just appeared in the world-wide textile market, offers more durability of the elastic behavior, low shrinking, good resistance in front of chlorine and the lye, good resistance to wrinkling and good dimensional st ability.

2. A NEW DEVICE

In order to solve the problems before exposed, the Technological Innovation Centre CTF, in cooperation with the Pinter, S.A., Spanish company manufacturer of spinning machinery and its accessories, came to the design and constru ction of a new device that contributed at the tension control and the supply regulation of elastomer spools.

In the conventional ring spinning machines, for manufacturing elastic covered yarns, the development of the filament is carried out by two cylinde rs, wich ones in contact with the filament spool, move it by friction.

By means of the control of the relation of speeds between the feed rollers and the drafting rollers of the drawing train in the spinning machine, can be obtained yarns with different elasticity .

When we works with hight draw ratio (between 3 and 5), the contact force generated by the weight of the elastomer spool is not sufficient to avoid false drawing, which will cause bars in fabrics made with these yarns. By the twisting given to the yarn, the elastic nucleus remains covered by the staple fibers.

Two different mechanisms were designed, one for the production of elastic yarns surrounded by short fibre and the other for elastic yarns surrounded by long fibre.

Both mechanisms were installed in two "Merlin" spinning machines (2), manufactured by Pinter, S.A., type *spa* for short fibre and type *spl* for long fibre.

Figure 2 shows the spinning machine for short fiber, indicating the main work areas for the “core spun” yarn production. Figur e 3 shows the situation of creels and the guide device of the elastomer.

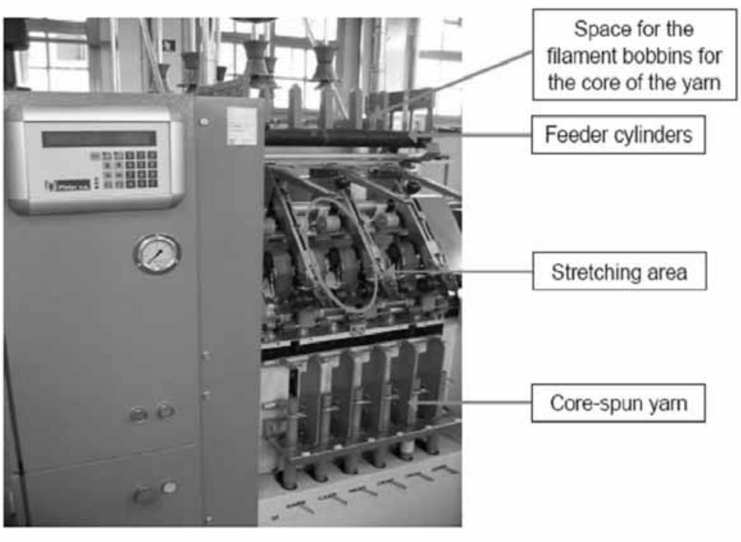

Figure 2: Merlin spa spinning machine for manufacture of surrounded elastic yarns

The new device can be applied to all the machines existing in the market, made in the last five years. This new mechanism, with a totally mechanical structure, has a sensor that detects the tension in each phase of the feeding of the filament spool of T -400, from the origin, when the spool is full at to the end of the spool. Each elementary te nsion is translated in a signal, that properly codified and treated, is transformed into a stimulus to the regulator of the feeding tension.(Pending patent).(3).

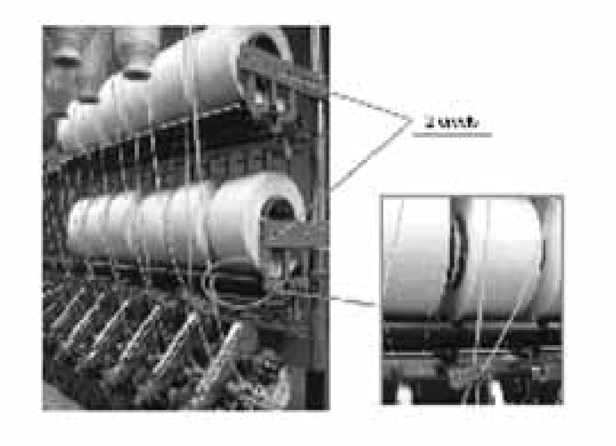

Figure 3: Situation of creels and the supply device of the elastomer

To the being the device totally mechanic, its maintenance is easy and is free of failures.
All investigations carried out in our laboratories about the deviations of the feeding tension, between the different spindles of the ring spinning that they work with different d iameters of T-400 spools, do not offer significant differences to 95% of confidence level.

3. EXPERIMENTAL PART

With the mechanism already described we carried out to manufacture diverse yarns, in industrial conditions, for validate the effectiveness o f the new development. (4).

We have made "core spun" yarns of cotton and "core spun" yarns of wool, using like elastomer the T-400 filament made by Invista.

For each spinning system they were obtained, respectively, five yarns of different count, representative of commercial market and that cover the long range of yarns. In table 1 are indicated the count of the "core spun" yarns surrounded of cotton and wool, respectively. The cotton yarns have received an alpha twist coefficient of 4 and the wool ya rns a twist coefficient K of 85.

Table 1: Count of core spun yarns of T - 400 surrounded by cotton (Ne) and surrounded by wool (Nm)

Cotton Yarn count (Ne)	8	10	12	14	16
Wool Yarn count (Nm)	20	25	30	35	40

In the tables 2 and 3 are exposed the main parameters of the yarns obtained.

Table 2: Main parameters of core spun yarns of T - 400 surrounded by cotton

Parameters		8 Ne	10 Ne	12 Ne	14 Ne	16 Ne
Mass evenness	CV (%)	9,4	9,4	9,3	9,1	9,1
	Thin parts (-50%)	0	0	0	1	1
	Thick parts (+50%)	5	6	6	5	5
	Neps (+200%)	0	1	1	0	1
	DR (%)	6,9	7,0	7,4	7,5	7,3
Tensile strength	Breaking load (cN)	1238	1254	1318	1403	1498
	CV breaking load (%)	4,5	3,9	4,2	4,7	4,4
	Elongation (%)	7,2	7,1	6,9	7,0	7,0
	CV of elongation (%)	8,8	9,6	12,8	13,5	16,1
Friction Coefficient		0,210	0,210	0,210	0,215	0,220

Table 3: Main parameters of core spun yarns of T - 400 surrounded by wool

Parameters		20 Nm	25 Nm	30 Nm	35 Nm	40 Nm
Mass evenness	CV (%)	14,3	14,5	14,6	14,9	15,6
	Thin parts (-50%)	10	10	14	8	6
	Thick parts (+50%)	24	20	16	22	17
	Neps (+200%)	45	32	38	26	34
	DR (%)	18,4	14,1	11,6	12,7	9,5
Tensile strength	Breaking load (cN)	1047	1104	1235	1287	1294
	CV breaking load (%)	4,7	5,2	5,8	4,3	4,9
	Elongation (%)	8,3	8,1	8,2	8,0	8,1
	CV of elongation (%)	12,4	14,1	15,3	16,8	17,7
Friction Coefficient		0,220	0,225	0,220	0,235	0,230

The DR (Deviation Rate) is a new coefficient of deviation of mass, that is very related to the aspect of finished fabrics. This parameter was completed, some years ago, by the technical services of Keisokki jointly with our Technological Innovation Centre CTF.

A DR index of 40% indicates that 40% of the tested metres, taking like reference a length of 1,37 metres in each reading of evenness tester, surpass the established limits corresponding to the average mass plus 5% and the average mass minus 5%.

From obtained yarns we made knitting fabrics, with a structure of smooth knitt in a circular machine of laboratory, of small diameter, for verify the possible presence of aspect irregularities.
These knitted fabrics are dyed to three intensities of colour (low, medium and high) with specific and sensitive dyes for show the bar faults.

A team of experts has evaluated the aspect of dyed fabrics, by the Spearman technique. The correlation coefficient between the aspect of fabrics made with yarns obtained with the new mechanism and the fabrics considered as reference patterns has been of 0,98.

This correlation coefficient lowers to 0,34 when the calculation is repeated with fabrics made with conventional guide device of the elastomer, available in the market, used before developing the device exposed in this work.

For the range of cotton yarns studied, when they are made with conventional guide devices, the coefficient of variation of the elongation varies between 14 to 23%. In the variability of the elongation to the breakage by traction, a significant smaller dispersion is appraised, to 95% of confidence level. It will cause a better aspect of finished fabrics.

The same tendency is obtained for wool yarns. When they have made with the conventional mechanism the variability of the coefficient of variation of elongation to the breakage by traction oscillates between the 16,5 to 27%.

The coefficient of variation of mass, determined in a digital evenness meter, is reduced of the order of 1 point in all the tested yarns. The variations oscillate between 0,7 to 1 point in the value of the CV (%), depending of the thickness of the yarn.

The other evaluated parameters, showed in tables 2 and 3, for cotton and wool "core spun" yarns, do not offers significant differences at the 95% of confidence level.

4. CONCLUSIONS

The main parameters of the cotton elastic yarns studied, of a comparative form, with yarns of identical characteristics elaborated with the conventional device available in the market, offers significant differences, to 95% of confidence level, in the evennes of mass, in the coefficient of variation of the elongation at break by traction and in the aspect of the obtained fabrics with this yarns.

For all the range yarns studied, the new supply device of the elastomer represents a significant improvement in the manufacture and in the quality of these “core spun” yarns, specially for the more thin yarns.

In the elastic yarns obtained with the worsted system, the same tendencies enunciated for cotton yarns have been observed.

5. ACKNOWLEDGEMENTS

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