An Investigation Of Air Vortex Yarn With Different Blend Proportion

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Abstract

Innovation in the current scenario is not only focus on quality improvements, but also on economic way of producing a product. Air vortex yarn produced by Muratec, found to be slowly replacing conventional ring spun yarn. Now it becomes more difficult to produce Ring yarn due to scarcity of manpower, shortage of power and more supervision in many stages of process.

The aim of the project work is to produce Air Vortex yarn & in Conventional Ring spun machine of Ne32/1 PC(18.45Tex) with various blend proportions such as PC-35/65, 65/35, 50/50.Currently air vortex is supplying spindle of size suitable for PC in feed silver hank(Linear density) and air supply of 0.65 mPa. We are going to conduct trials with three different air pressure such as 0.45 mPa, 0.55 mPa & 0.65mPa.

The structural analysis is studied using SEM. Physical properties and classimat are tested by using Uster tester. With Minitab statistical significance also verified. Compared to Ring yarn Among all 3 blends 65/35 PC AIR VORTEX yarn is comparable and with 0.45 mPa pressure is optimum and it has no hairs & long thin faults.

Key words: Air pressure, Air vortex, Blend proportions, Hairiness, in feed sliver, & Spindle.

1. INTRODUCTION

1. 1 INTRODUCTION TO RING SPINNING

Ring spinning is a continuous spinning system in which twist is inserted into a yarn by a circulating traveller. The yarn twist insertion and winding action take place simultaneously by means of a rotating spindle. Ring spinning is the widely used spinning method because of improved yarn quality parameters, of using various fibers and the wide range of yarn counts. Drawbacks of ring spinning can be ordered as; lower production rates because of heat generation in the traveller at higher speeds, hairiness and yarn breakage due to spinning triangle and frictions. Because of these problems, new spinning methods gain importance nowadays.

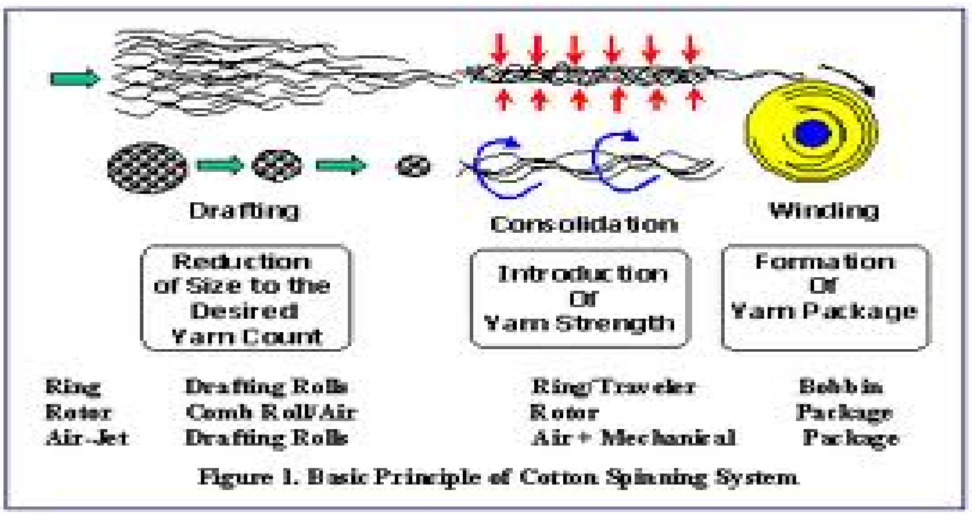

Figure.1 Basic Principles of Cotton Spinning System

There is no non-twisted section, twists of are given to the entire yarn from the center to the surface of the yarn. Twisting is concentrated at the thinner sections, while twisting is loose at the thicker sections and hairiness tends to come out.

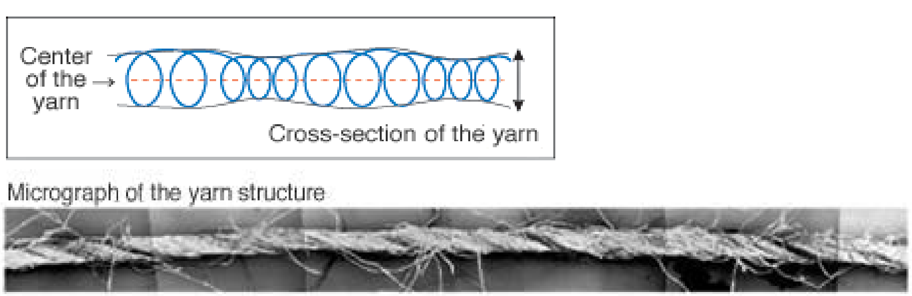

Figure.2.Ring Yarn cross section &yarn structure

1.2.AIRVORTEXSPINNING

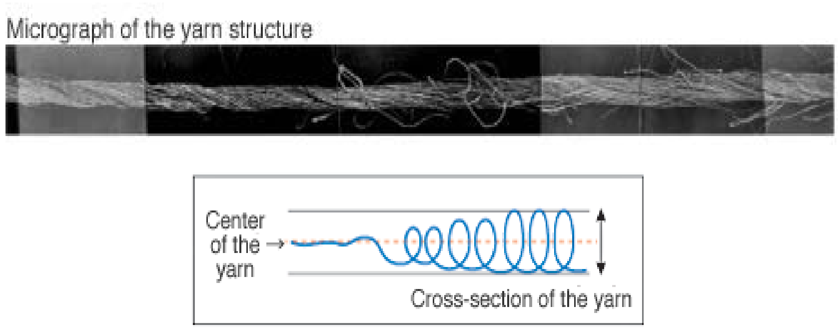

Figure.3.Air vortex cross section &yarn structure

One of the newest spinning methods is air-vortex spinning. The tip of the fiber is focused to the center of the yarn by the vortex of compressed air so that the center of the yarn is always made straight without twisted. The other tip forms the outer layer that twines another fiber. Since air-vortex spun yarn has the least hairiness as an advantage among all the types of spun yarn, air-vortex enables to create textiles with characteristics such as anti-pilling and anti-abrasion performance. Air-vortex's fiber structure itself is superior in moisture absorption and diffusion rate thus provides refreshing comfortableness (1). This method is the fastest method than other spinning methods. Spinning speed is quite high because there is no mechanical twist insertion device. And this yarn is directly spun from draw frame sliver and it is very flexible that various types of fibers can be spun at any fineness. Furthermore range of yarn fineness of air-vortex spinning is similar to that of ring spinning.

Literature Review: -

- High nozzle angle and high nozzle pressure, reduced hairiness and it did not have any significant effects on yarn tensile properties. (Basal and Oxenham (2006) [2]).
- The delivery speed, nozzle pressure and yarn count were all significant parameters for yarn evenness, imperfections, hairiness and tensile properties . (Ortlek and Ulku (2005) [3])
- The ring spun yarn has the highest tenacity, it has poor bulkiness and hairiness values with respect to the air-vortex yarn.(Soe et al (2004) [4]).
- The physical properties of vortex and air-jet yarns produced from different polyester cotton blends, results indicated that vortex yarns have tenacity advantages over air jet yarns, particularly at high cotton contents.(Basal and Oxenham (2003) [6]).

2. MATERIALS AND METHODS

2.1 MATERIALS

Materials used in our trials are Polyester 65%/Cotton 35%, reverse blend of Polyester 35%/Cotton 65% and 50/50. Blending is done at mixing stages it and carded process. These are process controlled in the sequence of departments as per short staple spinning systems parameters as mentioned below.

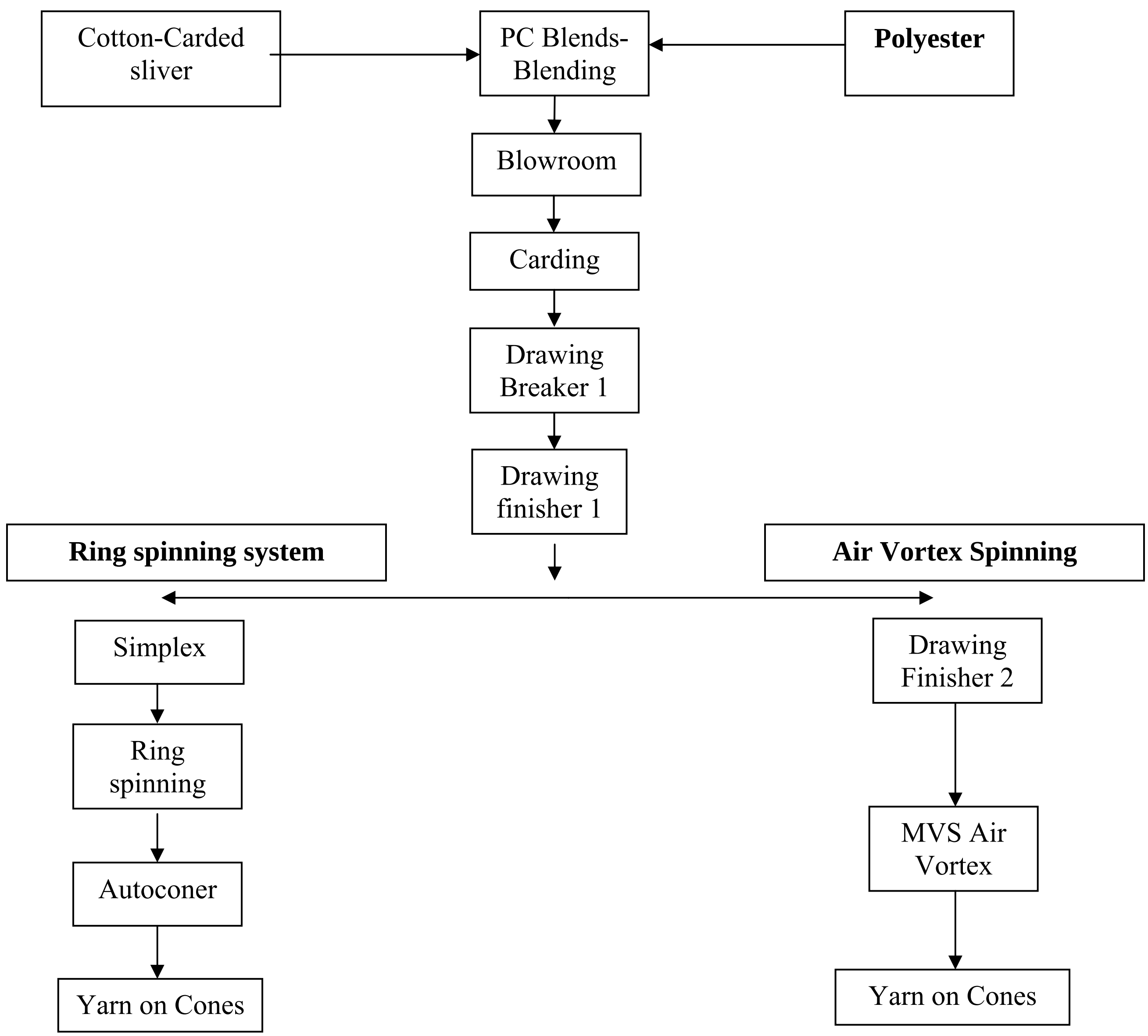

Fig 7 Process sequence of Ring spinning & Air Vortex Spinning

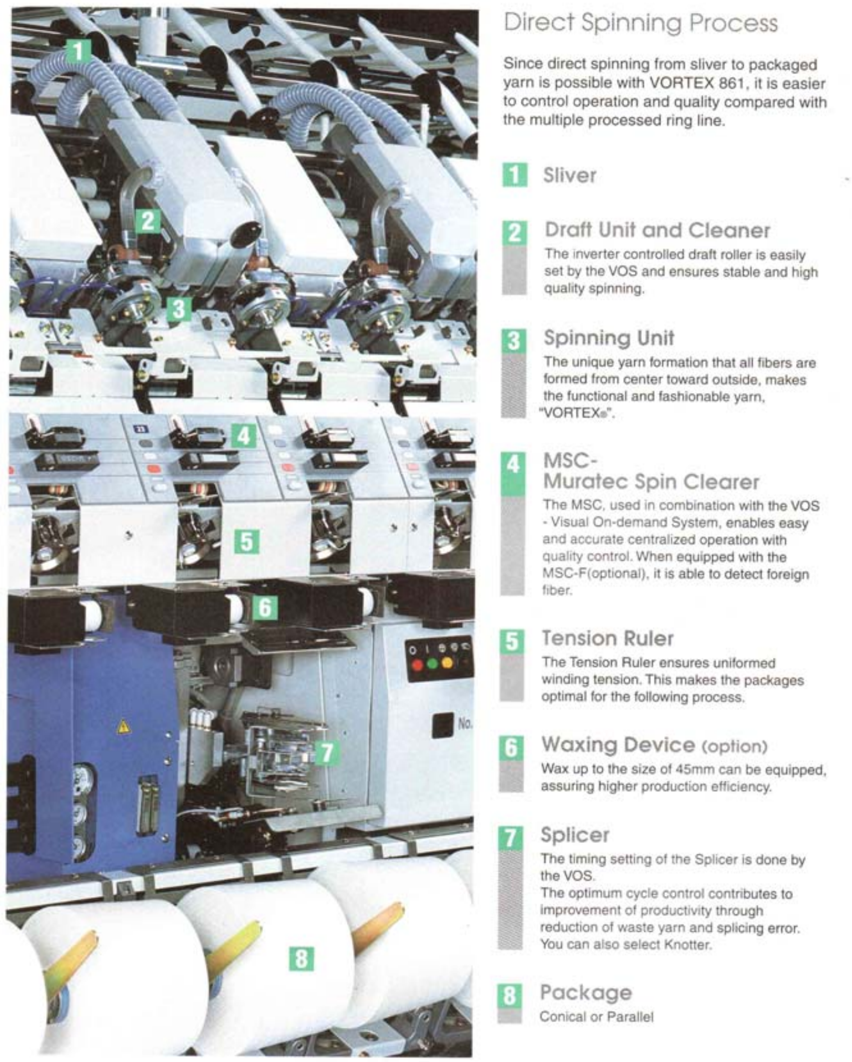

Fig.6 Muratec MVS Airvortex Spinning system

2.2 EXPERIMENTAL DESIGN

As already highlighted this project is an attempt to investigate the process parameter in Air –Vortex spinning. We have taken the main factors which will directly impact the yarn quality. These are decided considering the raw material (bulkiness nature of fibre), atmospheric conditions, work methods.

Sl. No	Factors/Blend	35/65	65/35	50/50
1	Air Pressure(mPa)	0.45	0.45	0.45
2	Air Pressure(mPa)	0.55	0.55	0.55
3	Air Pressure(mPa)	0.65	0.65	0.65

Table 1 Air Pressure Experimental design

3. RESULTS & DISCUSSIONS

I processed material up to draw frame in a controlled condition and checked materials in both online and offline testers. The material then processed simultaneously in ring frame as well as Air Vortex with ambient conditions. The yarn was tested at SITRA and the results were tabulated as below.

PROCESSED COUNT IS Ne 32/1 PC

COMPARISION OF RING YARN vs. AIR VORTEX

PARTICULARS	RING YARN			AIRVORTEX								
	35/65	65/35	50/50	35/65			65/35			50/50		
				0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65
AVE. COUNT	31.57	33.3	31.04	31.52	31.37	30.9	30.47	30.53	30.52	30.98	30.72	30.64
LEA STRENGTH	97.6	116	115.2	95	91.4	89.1	118.5	119.5	117.4	107.5	106.7	98.8
CV% OF COUNT	3.5	1.65	1.76	0.65	0.6	0.96	2.44	0.72	1.02	0.69	1.09	0.7
CV% STRENGTH	6.05	4.74	5.5	5.14	4.96	5.29	6.72	6.98	6.15	4.37	5.86	6.01
CSP	3079	3879	3576	2994	2846	2753	3611	3661	3583	3331	3278	3028
U%	12.01	11	11.23	11.86	11.95	12.1	10.85	11.02	11.15	11.29	11.54	11.54
C.V%	15.38	14	14.38	15.05	15.2	.15.38	13.76	13.97	14.14	14.34	14.65	14.66
THIN/KM (-50%)	13	1	2	14	21	20	5	5	4	6	12	11
THICK/KM(+50%)	232	128	176	97	120	123	56	62	67	86	91	98
NEPS/KM(+200%)	407	315	375	255	302	335	132	172	185	195	212	272
TOTAL IMPS/KM	652	444	553	366	443	478	193	239	256	287	315	381

Table 2 Comparison between Ring Yarn & Air vortex Yarn CSP & IPI

PARTICULARS	RING YARN			AIRVORTEX								
	35/65	65/35	50/50	35/65			65/35			50/50		
				0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65
S3 VALUE	447.4	229	355.6	6	2.4	2	3.8	3	2.6	12.2	2.2	3.2
INDEX	38.22	8	37.43	0	0	0	0	0	0	0	0	0
SINGLE YARNST.	360.3	429	404.8	322.6	310.2	308.7	417.1	407.4	399.8	362.2	354.8	350.9
CV% OF SYS	9.21	8.25	9.4	9.29	8.68	9.83	8.17	9.84	10.47	10.38	10.38	9.43
%ELONGATION	8.16	9.6	9.22	7.58	7.51	7.43	9.59	9.47	9.33	8.68	8.53	8.31
CV% OF ELONGATION	8.24	8.67	9.35	11.1	11.3	11.2	8.4	9.64	10.09	10.88	11.1	9.61
RKM	19.52	23.3	21.93	17.48	16.81	16.72	22.6	22.07	21.44	19.62	19.22	19.01

Table 3 Comparison between Ring Yarn & Air vortex Yarn RKM & S3

PARTICULARS	RING YARN			AIRVORTEX								
	35/65	65/35	50/50	35/65			65/35			50/50		
				0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65
A1	262	267	330	406	373	402	249	246	202	232	192	210
H1	142	49	175	42.5	61	17	14	10	4	17	25	28
A4	1	0	1	2	4	2	0	0	0	0	0	0
B4	0	0	2	10	13	16	0	4	6	4	4	5
C4	0	0	0	4	4	2	2	0	2	4	0	2
D4	0	0	0	0	0	0	0	0	0	0	0	0
C3	0	0	0	10	15	6	6	0	2	4	7	5
D3	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0
F	3	2	4	0	0	0	0	0	0	0	0	2
G	2	0	1	0	0	0	0	0	0	0	0	0
SHORT THICK(A1+B1+C1+D1)	297	324	385	491	521	507	305	296	268	290	236	248
LONG THICK(E+F+G)	5	2	5	0	0	0	0	0	0	0	0	2
LONG THIN(H1+I1)	173	57	216	43	61	17	14	10	4	17	25	25

Table 4 Comparison between Ring Yarn & Air vortex Yarn-Classimat faults

COMPARISION OF AIR VORTEX YARN Vs. RING YARN ON APPERANCE BOARD

AIR VORTEX YARN:

RING YARN:

Fig. 9 Comparison of air vortex yarn vs. Ring yarn on appearance board

COMPARISON OF AIR VORTEX VS RING YARN - COTTON YARN

Fig 5.25 Comparison of Air Vortex Vs Ring Yarn - Cotton Yarn

4. CONCLUSION

- **In Air Vortex , with all three PC blends (35/65,65/35&50/50) air pressure value of 0.45 Mpa (4.5 bar) gives optimum results in case of yarn quality attributes. Increased pressure results in over twisting, disturbing yarn formation.**
- **Air Vortex yarn shows lower strength and elongation by about 10% than ring yarn.May be due to lesser cohesion and parallel.**
- **Air vortex shows lower imperfection the ring yarn considerably. May be due to better drafting and reduced sequence of process.**
- **In case of classimat faults it is comparable with ring yarn at 65/35 and 50/50 when blends where as 35/65 blends shows 30% higher classimat faults than ring yarn.It may be due to setting kept for polyester fibre in cotton prodominent (35/65).**
- **However in all blends classimat long thin place is predominantly reduced by about 65% than ring yarn.Due to lesser sequence of process ,low stretch in creel, It may be due to lesser material handling by man and by machine.**
- **There is no hairiness that means Air vortex yarn shows 99% lower hairiness value S3 value than ring yarn. In hairiness point of view,S3 hairiness value may be even better than compact yarn. It may be due to the limited influence of air disturbance ,better fibre alignment of fibre and other factor.**
- **Among the three chosen blends, 65/35 blend Air Vortex Yarn shows better results than other two blends as well it is comparable with ring yarn of same blend in term of CSP, RKM, IPI.May be due to process optimized for Polyster.**
- **It is better than Ring Yarn in terms of Hairiness & Classimat faults. All fibres are parallel to next fibres and twisted .**

5. REFERENCES

1. Murata Vortex Spinner, No. 810 Instruction Manual, Murata Machinery Ltd., Muratec.
2. Basal, G., Oxenham, W., 2006, "Effects of some Process Parameters on the Structure and Properties of Air-vortex Spun Yarn", Textile Res. J., Vol.76(6), pp. 492-499.
3. Ortlek, H., Ulku, S., 2005, "Effects of Some Variables on Properties of 100% Cotton Air-Vortex Spun Yarn", Textile Res. J., Vol. 75(6), pp. 458-461.
4. Soe A.K., Takahashi M.,Nakajima M., 2004, "Structure and Properties of MVS Yarns in Comparison with Ring Yarns and Open-End Rotor Spun Yarns", Textile Res. J., Vol. 74(9), pp. 819-826.
5. Beceren, Y., Uygun Nergis, B., 2008, "Comparison of the Effects of Cotton Yarns Produced by New, Modified and Conventional Spinning Systems on Yarn and Knitted Fabric Performance", Textile Res. J., Vol. 78(4), pp. 297-303.
6. Basal, G., Oxenham, W., 2003, "Vortex Spun Yarns vs Air-jet Spun Yarn", AUTEX Res. J., Vol. 3(3), pp. 96-101.
7. Li, Q., Brady, PR., Hurren, CJ. 2008, "The dimensional and mechanical properties of wool/polyester fabrics made from vortex and ring-spun yarns", The J. of The Textile Institute , Vol. 99(6), pp. 561-568.
8. Ortlek, HG., Onal, L., 2008, "Comparative Study on the Characteristics of Knitted Fabrics Made of Vortex-Spun Viscose Yarns", Fibers and Polymers, Vol. 9(2), pp. 194-199.
9. Omeroglu, S., Becerir, B., 2005, "Comparison of Color Values of Plain Cotton Fabrics Woven from Ring- and Compact-Spun Yarns", Indian J. of Fibre Textile Res., Vol. 30(4), pp. 402-406.
10. Becerir B., Omeroglu S., 2007, "Comparison of Color Values of Plain Cotton Fabrics Knitted from Ring- and Compact-Spun Yarns", AATCC Review, Vol. 7(6), pp. 41-46.
11. Ali Kirecci,Pinar Parlakyigit&Halil Ibrahim ,2009, "Comparison of the fastness properties and color values of Cotton fabrics knitted from Air-Vortex –and Ring spun yarns", TEKSTİL ve KONFEKSİYON, Vol-4(1),pp.304-311.
12. Basal, G., and Oxenham, W., Vortex Spun Yarn vs. Air-Jet
13. Spun Yarn,AUTEX Res. J.3(3), 96 –101, (2003).
14. Basu, A., Progress in Air-jet Spinning,Textile Progress, 29(3), Textile Institute, Manchester, p. 1., 1999.

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