Technology and the future of Compact spinning and conventional spinning

by Muhammad Mushtaq Ahmad.

After advent of compact spinning, yarn quality parameters have changed, especially in respect of hairiness, strength and in some respect Imperfections. The article presents the comparison of modified spacer and cradle versus normal spacers. The author has analyzed and compared the physical and mechanical parameters from the same raw material and same spindles at different mills with state of the art machines and conventional machines. The purpose of this study is to determine the influence of modified and normal spacers and cradles on yarn quality in compact and conventional spinning and to compare the produced yarn, especially Imperfection (long/short).

Key words: Conventional spinning, compact spinning, normal spacers, modified spacer, normal cradle, modified cradle yarns, imperfection (IPI), uniformity (U%)

Introduction

In spite of modernization and rapid technological development in the field of ring spinning, the mechanism of ring-traveller spindle has remained almost the same until now. Furthermore, ring spinning remains the dominant spinning technology. The manufacturers of modern spinning frames have been developing the machines with improved construction of different working elements and optimal spinning geometry, with a ring diameter of 36 mm, a tube length of 180 mm and spindle speed of up to 25,000 RPM.

Besides the conventional functions (spindle speed, delivery speed, productivity, twist, draft, machine efficiency), computer-based system controls enable the optimization of spinning conditions (formation of bobbins, position of ring rail, automated doffing and setting of empty tubes, cleaning and oiling of main machine parts). Construction improvements of different working elements of the ring-spinning frame and optimized spinning geometry has led to increased productivity, better yarn quality, as well as flexibility and profitability of the process.

The irregularity introduced in drafting mainly depends upon the parameters of the drafting system, mechanical faults and quality of the input material. When mechanical faults are eliminated, drafting irregularities depend upon the control on the floating fibers in the drafting zone. Setting between the roller nips, distance between the apron nip to front roller nips, and pressure on the top roller are some of the factors. The characteristics of the fed material to the drafting system also exercise considerable influence on the irregularities introduced and drafting system operated under the optimum conditions. Short fiber content, neps, trash and other impurities, with a degree of fiber parallelization and number hooks in the fibers together with their direction of presentation are some of the important factors, that characterize yarn quality and determine its behavior during drafting.

Nutter and Slater examined the effect of hooked fiber on yarn strength and found that better strength is obtained, when a fiber tip is presented to the drafting system than a hooked end. **Grade, Wakanker and Bhaduri** found better yarn regularity and strength when majority hooks are fed as leading. **Simpson, Deluca and Flori** also confirmed that feeding majority hooks as leading to the ring frame contributed to poorer yarn quality and more breakages, the effect being pronounced in case of fine yarns. Apart from hooks, the fiber parallelization may also effect on drafting irregularities.

The treatment given to raw material during spinning process through various machines greatly influences not only the quality of spun yarn, but also its quantum. Factors like setting between rollers, draft distribution, Pressure on top rollers, shore hardness of rubber cots, spacers, type/size of ring travelers, rings, relative humidity in the plant and mixing of raw material etc, contribute towards the quality and quantity of yarn. Moisture content in the raw material especially in cotton is very important because of its direct effect on yarn strength as well as elongation and neps in

Comparison of Tex 14.76 (Ne 40)

Combed Conventional Spacer (Normal) VS Spacer (Modified)

Parameter	Spacer (Normal)	Spacer (Modified)	Improvement %
	Cradle (Normal)	Cradle (Normal)	
U %	11.04	10.66	(3)
CVb %	0.78	1.18	
CVm (1m) %	3.86	3.69	
CVm (3m) %	3.11	2.98	
CVm (10m) %	2.52	2.39	
Thin Places (-30%)	2075	1745	(16)
Thin Places (-40%)	285	153	(46)
Thin Places (-50%)	10	8	(20)
Thick Places (+35%)	501	365	(27)
Thick Places (+50%)	61	36	(41)
Neps (+140%)	480	360	(25)
Neps (+200%)	90	78	(13)
IPI (Long)	161	122	(24)
IPI (Short)	3341	2623	(21)
IPI (TOTAL)	3502	2745	(22)
Hairiness (H)	3.73	3.71	(0.5)
Sh	0.87	0.86	
H (max, 1 m)	4.12	4.09	
H (min, 1 m)	3.35	3.34	
B-Force (gf)	283.8	292.4	
CV %	8.3	7.8	
Elongation %	3.34	3.35	
CV %	11.1	10.5	
Tenacity	19.22	19.81	(3)
CV %	8.3	7.8	

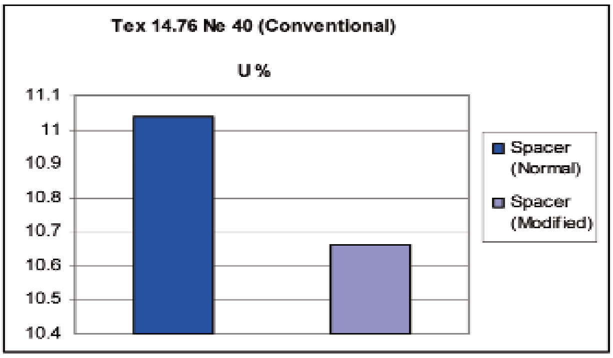
the yarn. Whereas the strength and elongation directly affect the performance of yarn in warping, the neps influence surface of finished cloth and dye take up.

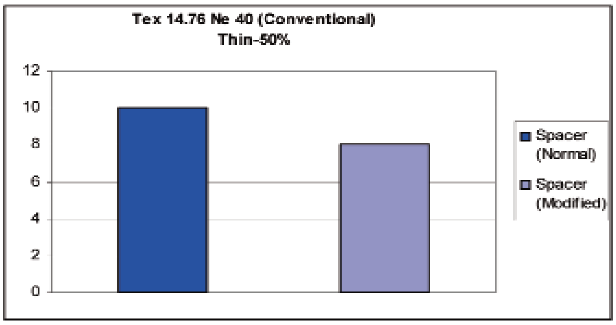
Fiber breakage is a very important factor, because any increase in breakage can lead to additional fly waste and greater number of ends down. Fiber breakage is a function of two main factors; the ratch setting and the roving twist. To avoid breakages, it is necessary to set the ratch longer then the longest fiber, because a shorter ratch will break all fibers greater in length. For a given ratch the extent of machine control over the fiber depend on the length distribution; a wider distribution and a longer ratch lead to lesser fiber control. The strain and distortion imposed on fiber ends during drafting due to the initial pull, continually repeated at each operation also lead to an increase in breakages. It is to be expected, therefore, that fiber will be beheaded or be tailed as a result of this stress and fatigue, the effect being more pronounced in case of longer fibers.

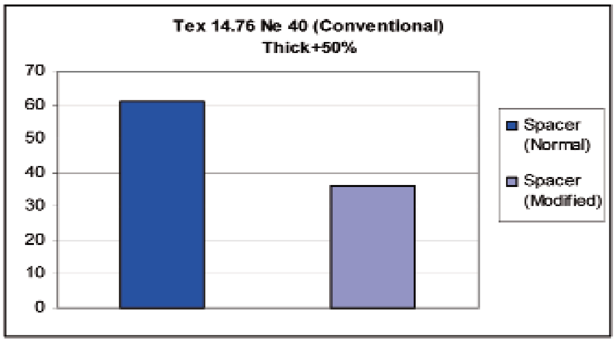
If a given mix is not handled properly, some of the fibers may be damaged during its passage through various machines, as a result short fibers would increase and the quality of yarn would decorate. Moreover, the yarn manufactured under such conditions would be costlier resulting in reduced profit margin.

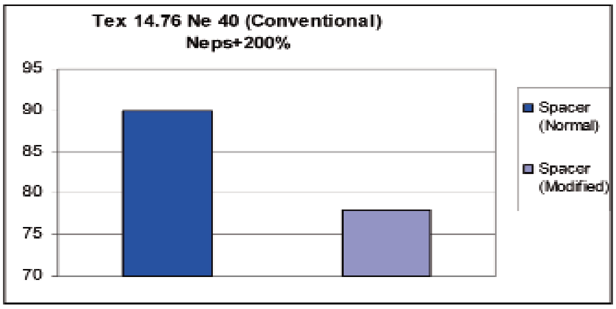
Comparison of Tex 14.76 (Ne 40)
Combed Conventional Cradle (Normal) VS Cradle (Modified)

Parameter	Cradle (Normal)	Cradle (Modified)	Improvement %
	Spacer (Normal)	Spacer (Normal)	
U %	11.04	10.65	(4)
CVb %	0.78	0.85	
CVm (1m) %	3.86	3.70	
CVm (3m) %	3.11	2.81	
CVm (10m)%	2.52	2.40	
Thin Places (-30%)	2075	1785	(14)
Thin Places (-40%)	285	148	(48)
Thin Places (-50%)	10	6	(40)
Thick Places (+35%)	501	430	(14)
Thick Places (+50%)	61	43	(30)
Neps (+140%)	480	405	(16)
Neps (+200%)	90	85	(6)
IPI (Long)	161	134	(17)
IPI (Short)	3341	2768	(17)
IPI (TOTAL)	3502	2902	(17)
Hairiness (H)	3.73	3.68	(1)
Sh	0.87	0.90	
H (max, 1 m)	4.12	3.99	
H (min, 1 m)	3.35	3.40	
B-Force (gf)	283.8	290.0	
CV %	8.3	7.90	
Elongation %	3.34	3.40	
CV %	11.1	10.80	
Tenacity	19.22	19.78	(3)
CV %	8.3	8.0	









Materials and methods

Material

These studies were carried out in modern mills and normal mills. (On state of art machines and normal machines). By using the same mixing, which mills were using for there regular production, on conventional and compact spinning. With same mixing, preparatory process, spinning parameters with same roving and on same number of spindles. In each mill, spinning was done minimum of one week and in two of the group mills, spinning is performed more than two months and yarn is tested daily on the same doff position. Results are the average of all test results done at the respective mills.

Yarn testing

All testing are done in there own mills laboratory, where experiments are performed and results were tabulated.◆