Cotton Yarn Spinning Part I: Ring Spinning

When looking at a fabric we usually ignore the fact that it’s made up of very thin yarns arranged in different ways. Being brought up watching my mom hand knitting different kinds of yarns, I always used to be fascinated by the yarns. I used to think how cotton, which looks more like fluffy ball, becomes a yarn with significant strength and evenness.

Cotton flower

I ended up in learning Textile Engineering unintentionally. My first interest was to find the secret how yarn is made and how it’s made so even. Hence started my obsession with spinning. In this article I shall explain the spinning process for a layman.

Cotton spinning process consists of many stages as shown below, the stages differ depending on the type of the cotton yarn you are producing whether it is a carded cotton yarn or combed cotton one.
Spinning Stages Between Carded and Combed

In the spinning process the cotton arrives in bales. Which are compressed cotton fibres – how cotton fibres are separated from the cotton seed is called ginning which is out of the scope of this article – The fibres are compressed into bales form for easy transportation. As ginning is a separate industry by itself, ginning mills are usually located at the cotton growing areas.

Opening and Cleaning

Opening and cleaning is the first operation which takes place in the spinning mill. The department where cleaning and opening is performed has a funny name, Blow Room, it is called this way because the cotton is transported from one machine to another by blowing it through the ducts. Blow room is combination of machines varying significantly unlike other processes in spinning. The main objective of the blow room is to open, mix, clean and even feeding to the next process, which is carding.
The cotton bales arrive in the spinning mill contains a lot of debris, dust and leaf particles, which needs to be removed before proceeding to the next stage. At this stage, because the fibres are compressed the impurities get enclosed between the compressed fibres, to remove it the fibres need to be opened. This is done by using the rollers with different spikes, some provide very harsh fibre opening and result in fibre damage while others provide mild opening. As the fibres are being opened the impurities get separated and fall down due to their high weight comparing to the fibres and won’t be carried through the ducts by the air.
Mixing Chamber, Rierter. It is for Further Cotton Mixing
Beater, Rieter. Another Part of the Cleaning and Opening System

The illustrates below, show a typical Blow Room sequence. (1) the automatic bale opener, (2) A condenser drum, (3) beater/grid-bar-airflow system, (4) multi-stack continuous blender, (5) multi-beater cleaner for intensive opening and cleaning, (6) a final dedusting step, then to Carding.

An Example of Blow Room Sequence, courtesy of Trutzschler GmbH

Carding
Carding is the next process in the spinning line after the opening and cleaning process. As it’s obvious from the name (CARDING card › Heart) it’s the heart of the spinning. Here the fibres are being straightened and made into the sliver. First time in the spinning process the fibres resembles to the thick rope like strand. How it’s done is in itself a whole science.
Combing

This stage removes the short fibres, increase and improve the straightening and the alignments. Also it considers as an extra cleaning for the fibres in which the remaining neps and trash particles are being removed. The produced yarns are stronger, more uniform and smoother than the carded yarns. This stage will need a preparing stage to form a web form several slivers.

Drawing

Drawing is one of the simplest process here, a number of slivers from the carding are stretched to make one sliver. This process is purely done to improve the evenness of the end product. A thin spot in one sliver when mixed with 5 to 7 and some time more sliver becomes insignificant. The Drawing stages might be one or two.
Drawing Frame, Rieter
Combining Silvers on the Drawing Machine

**Simplex /Roving**

This is an intermediate stage before the final yarn is made in the next stage. The problem with the sliver is that it is too thick to put directly into spinning. To make yarn it needs to be stretched gradually the simple/roving is just an intermediate drawing stage, here the sliver is get stretched and slightly twisted to keep the strand intact while transporting to next stage.
Spinning

The rovings are taken to the ring frame, which stretches the roving to the required thickness and imparts twists to give strength to the yarn.

Stretching is performed by increasing the speed of the roller pairs gradually so the back roller pair runs slower than the middle pair and the middle pair runs slower than the front creating a stretch in the fibre strand (stretching is performed same way in drawing and simplex too).
The twists are imparted by the traveller through which the yarn is passed on to the bobbin which rotates at very high speed (some times as high as 25,000RPM) the rotation of the bobbin causes the traveller to rotate onto the ring which causes the twists in the fibres leaving the front roller.

**Spinning**

**Ring Spinning Frame**

**Winding**
Converting Bobbins to Packages by the Winding stage

In this stage the spinning bobbins is being converted to a packages for better transportation and longer yarn in the package. Also this stage can work as a quality control on the yarn where all thin areas and thick areas can be eliminated for better more even yarns.
Winding Head
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References
- http://www.rieter.com/

