COTTON SPINNING

Since the beginning of civilisation, man has learned that following the harvest of the *cotton* fruit (or rather the fibre of the same name), he must separate the seed and the actual textile fibre. Using special equipment, he can obtain yarn, a resistant and uniform product that is also thin. Although the process is a difficult one, the most ancient findings related to cotton fabric reflect that the textile mastery of ancient Greeks included a remarkable operative capacity and achieved excellent levels of quality, even in the production of yarns and cotton fabrics.

Carded cotton spinning

Spinning cotton is also know as spinning short cut fibres, as the raw material comes in lengths of between 15 and 50 mm. For thousands of years, cotton processing has involved a single process, historically defined as carding, still used today in over half of the world's production.
The processing of cotton carded yarn is illustrated in the cycle shown below, where the following is described: processing stages, relative machinery used, the type of entry and delivery material of each stage, and the packaging form for the delivery material.

CYCLE OF CARDED COTTON

stage	machine	entry material	delivery material	package form
Opening and cleaning	bale plucker, opener, blender	raw cotton	lap	---
Carding	card	lap	card sliver	can
1st drawing	drawframe	card sliver	drawn sliver	sliver can
2nd drawing	drawframe	drawn sliver	drawn sliver	roving can
Roving	roving frame	drawn sliver	roving	roving bobbin
Spinning	ring spinning frame	roving	ring-spun yarn	bobbin / spool / cheese
Post-spinning processes	winding, doubling, singeing, reeling, twisting, winding-off machines	yarn	yarn	various (skein, bobbin, package)

The cotton arrives at the spinning stage pressed in special *bales* - these come in variable sizes and weights depending on where they come from - and it is put into storage in warehouses immediately following controls and checks on the technical properties requested of the raw part. The most common checks carried out on cotton on its arrival at the spinning mill include:

- determining the *moisture regain* (in order to define the quantity of water present in the material and therefore the commercial weight of the batch);
- analysis and quantification of all the impurities contained in the raw material;
- measurement of the *tensile strength*, the *count* and *length* of the fibre;
- checking the *colour*;
- checking of the *presence of organic substances* in the fibres;
- quantification of the content of *immature and dead fibres*;
- determination of the *stickiness*, *quantity of dust* and *elasticity* of the fibre.

The *conventional process of cotton spinning* can be considered broken down into four processing stages:

a) *opening, blending and cleaning* the fibre, carried out in order to permit the tufts to recovery their natural softness, which is lessened when the cotton is pressed into bales; blending the fibre must be as accurate as possible; a system of staves, batten reels and grids contribute to eliminating most of the natural impurities contained in cotton tufts; then puckers, openers and blenders are used;
b) *disentangling*, achieved by beating and carding, needed for increasing the relative parallelisation of the fibres, obtains a clean product free from fibres that are too short;
c) *doubling*, consists in drawing near and processing similar products (card and drawn sliver) from various machines, in order to improve the homogenous nature of semi-processed goods and consequentially the yarn, permitting any eventual irregular sections to be identified and homogenised;
d) *preparation for spinning and spinning*, this is actually the transformation of the semi-processed product to yarn with the desired properties (count, twist) and it is obtained using roving frames, followed by ring spinning frame;
e) *complementary processing*, supplementary operations necessary only for obtaining a certain packaging or a particular look for the final product; these operations are: doubling, twisting, winding, singeing, reeling and winding-off.

Combed cotton spinning

With the event of the industrial revolution, a need was born in England to diversify conventionally carded cotton yarn, introducing a thinner, but just as resistant, cotton yarn.
Numerous solutions were tried during the period, but the one that proved to have the longest staying power was the innovation introduced by the German Heilmann, who during the 19th Century studied, made and sold the *combing machine*, a machine capable of selecting the semi-processed sliver removing short fibres, permitting, therefore, finer and thinner yarns to be obtained, composed mainly of long fibres.
The notable diffusion of this machine, which over time received mechanical and technological perfecting, determined the birth of a second processing cycle, the *combed cotton cycle*.

CYCLE OF COMBED COTTON

stage	machine	entry material	delivery material	package form
Opening and cleaning	bale plucker, opener, blender	raw cotton	lap	---
Carding	card	lap	card sliver	drawn lap can
Pre-comber drawing	drawframe / lap drawing frame	card sliver	drawn lap	drawn lap can
Combing	combing machine	drawn lap	comb sliver	comb sliver can
Post-comber drawing	drawframe	comb sliver	drawn sliver	roving can
Roving	roving frame	drawn sliver	roving	roving bobbin
Spinning	ring spinning frame	roving	Ring-spun yarn	bobbin / spool / cheese
Post-spinning processes	Winding, doubling, singeing, reeling, twisting, winding-off machines	yarn	yarn	various (skein, bobbin, package)

Open-end cotton spinning

Finally, during the 1960's, technicians in what was then Czechoslovakia studied an original spinning system for cotton yarn, using a single passage going directly from drawn sliver to the yarn. This brought about *open-end spinning frame*, which would from the beginning of the following decade redefine the concept of quality of medium and coarse count yarns, as well as of a large number of fabrics that are today widespread. Below is a schematic representation of *the cycle of open-end cotton yarn*.

CYCLE OF OPEN-END COTTON YARN

stage	machine	entry material	delivery material	Package form
Opening and cleaning	bale plucker, opener, blender	raw cotton	lap	---
Carding	card	lap	card sliver	can
Drawing	drawframe	card sliver	drawn sliver	drawframe can
Spinning	open-end spinning frame	drawn sliver	(O-E) yarn	package