RIETER

Věra Štěpánská
Product Management Air-Jet Spinning
Ústí nad Orlicí, Czech Republic

Marc Schnell
Product Management Air-Jet Spinning
Winterthur, Switzerland

J 10 Air-Jet Spinning Machine

A new dimension in spinning

Editorial

A NEW APPROACH, A NEW YARN, A PROVEN MACHINE CONCEPT

J 10 technology is based on a spinning nozzle newly developed by Rieter. The main advantage of this technology is apparent in the structure of the yarn, which differs from other air-jet-spun yarns. The advantages are visible primarily in downstream processing and in the end product. Air-Jet spinning is the most productive of all known spinning processes. The spinning speed under mill conditions is up to 450 m/min. The machine concept is closely related to that of the R 40 rotor spinning machine – the result of the J 10 robot's superior piecing technology is a perfect piecing. A further priority in the development of the machine was low energy and spare parts consumption in order to keep operating costs low.

Rieter now offers four spinning technologies from a single source: ring spinning, compact spinning, rotor spinning and air-jet spinning. Yarns produced on Rieter machines are familiar under the following brand names: Rieter ring-spun yarn, Com4® and ComfoRo®. The novel yarn produced on the air-jet spinning machine is marketed under the ComforJet® name. The different structures of the four yarns (Fig.1) open up new potential applications for innovative textile companies.

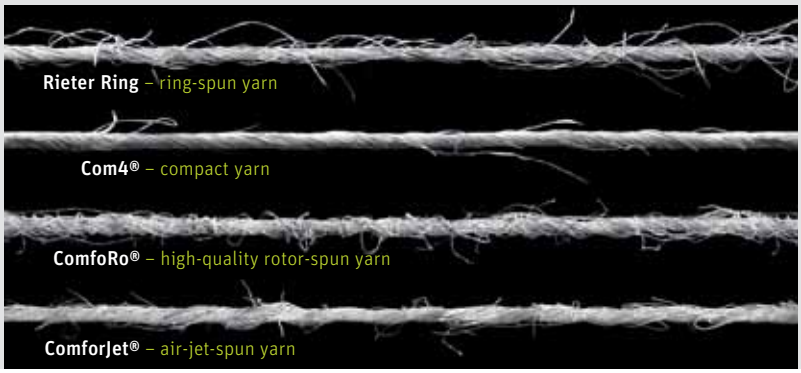

Fig. 1 Which of Rieter's four yarns is suitable for your customers?

DO YOU KNOW WHICH SPINNING SYSTEM IS SUITABLE FOR YOUR SPINNING MILL?

Rieter is the only company worldwide to offer all four spinning technologies and spinning preparation machinery optimized for them – from a single source. From a neutral standpoint Rieter can therefore recommend and supply the spinning system that is most suitable for the required application. The initial installations of the J 10 air-jet spinning machine have shown once again that correct fiber and sliver preparation exert a major influence on yarn quality and productivity. With this knowledge, our sales personnel and technologists support you with advice and assistance in choosing the right spinning system and preparatory process. Our spinning schedules and computations for the spinning mill as a whole enable you to compare the economics of the four different spinning processes.

OPTIMAL OVERALL CONDITIONS FOR AIRJET SPINNING

Mill operations have clearly shown that air conditioning in the spinning mill has a major impact on spinning quality and production stability, especially in air-jet spinning. Rieter's leading role in technological know-how is apparent in the optimization of the process as a whole – from fiber preparation to spinning. Increasing numbers of spinning mills are utilizing Rieter's blowroom lines, combing lines and autoleveler drawframes to produce high-quality fine slivers in order to achieve higher efficiency in air-jet spinning.

Peter Gnägi,
CEO Rieter Textile Systems

Now on the starting line – the new J 10 air-jet spinning machine

The J 10 – a marvel of production in the smallest possible space. With its high speed of up to 450 m/min under mill conditions, the J 10 air-jet spinning machine ranks top of the productivity table. The two-sided machine concept with the cans located immediately under the spinning machine reduces space requirements and operating costs for air conditioning and buildings, and simplifies the integration of the machine in existing spinning mills.

Why launch a new technology? High productivity, low manufacturing costs per kilogram of yarn and novel yarn properties – the development team had all of these targets constantly in its sights during the development of the new air-jet spinning process. These cannot be achieved by small evolutionary steps in existing technologies.

THE CHERRY-PICKER CONCEPT

How did the development team approach this assignment? Development chief Dr. Götz Gresser explains: "We tapped Rieter's wealth of experience, analyzed Rieter's existing machines in detail and chose the best of everything. We adopted the drafting system technology from the G 35 ring spinning machine and adapted it to high speeds. The robots on the J 10 are based on the automation technology of the R 40 rotor spinning machine. Invisible piecings – as on the R 40 – result in high yarn quality. Experience with Plyfil technology – the Suessen air-jet spinning process – was also incorporated in the development of the J 10. We pursued new approaches in the machine concept, without re-inventing everything (Fig. 2). Otherwise it would not have been possible to develop a totally new machine within the space of 6 years."

THE J 10 HAS PASSED THE PRACTICAL TEST

"Our customers set high standards for Rieter machines. This is the benchmark for our developments before we release them for sale", marketing chief Edda Walraf explains. "Exhaustive tests in our development laboratories were followed by a trial phase lasting several years with different types of fiber under practical conditions in spinning mills. The global market launch of air-jet spinning technology has been proceeding in stages since June 2009. We aren't standing still. We're working continuously on expanding its spheres of application."

ALL SPINNING SYSTEMS FROM A SINGLE SOURCE

Peter Gnägi, CEO of Rieter Textile Systems, is proud of what has been achieved. "Rieter is the only company that can offer all spinning processes for short staple spinning from a single source: ring spinning, compact spinning, rotor spinning and the newly developed air-jet spinning (Fig. 3).

Fig. 2 The new J 10 air-jet spinning machine with four robots

Since Rieter supplies machinery and spare parts for the entire spinning mill, we can optimize the spinning process through all process stages. We have this technological expertise for all four spinning systems and you can therefore have confidence in Rieter's recommendations. Our sales personnel and technologists can explain to you in detail the differences between the spinning processes and the yarn and fabric qualities. We can process any conceivable raw material into yarn under mill conditions in our test spinning facilities. We not only develop machines, we also examine the effects of raw materials and yarns through the weaving and knitting processes to the textile end product. This is what distinguishes Rieter from all other suppliers. We are therefore in a position to provide our customers with practical advice going far beyond pure machine-related technology and contribute to their success."

Spinning speed	up to 450 m/min., depending on type of fiber, yarn count and end use
Yarn count	Ne 30 to Ne 50
Spinning units	100 individually driven spinning units, 50 units per side, gauge 260 mm
Number of robots	4 robots, with piecing technology for invisible piecings
Drive	individual drives for each spinning and winding unit, separate machine sides for simultaneous production of 2 different yarns
Drafting system	4-over-4 drafting system with patented traverse mechanism
Yarn clearer	USTER Quantum Clearer 2, optical or capacitive, with or without foreign matter detection
Winding	individually driven winding units for cylindrical packages up to 300 mm in diameter

Table 1 The basic data of the J 10 at a glance

RELIABLE DATA FOR CONFIDENT DECISIONS

"Whenever something quite new appears on the market, customers are initially uncertain. Until they have heard the first reports on experience under mill conditions. Customers then have to be able to rely on what sales personnel tell them," comments Reto Thom, head of Rieter's market organization. "Since we know the requirements of downstream processing from technological studies, we can tell our customers exactly which spinning system is best for their fiber materials and requirements. And our detailed calculations help customers to compare the economics of all four spinning systems. In contrast to our competitors, we can offer this service because

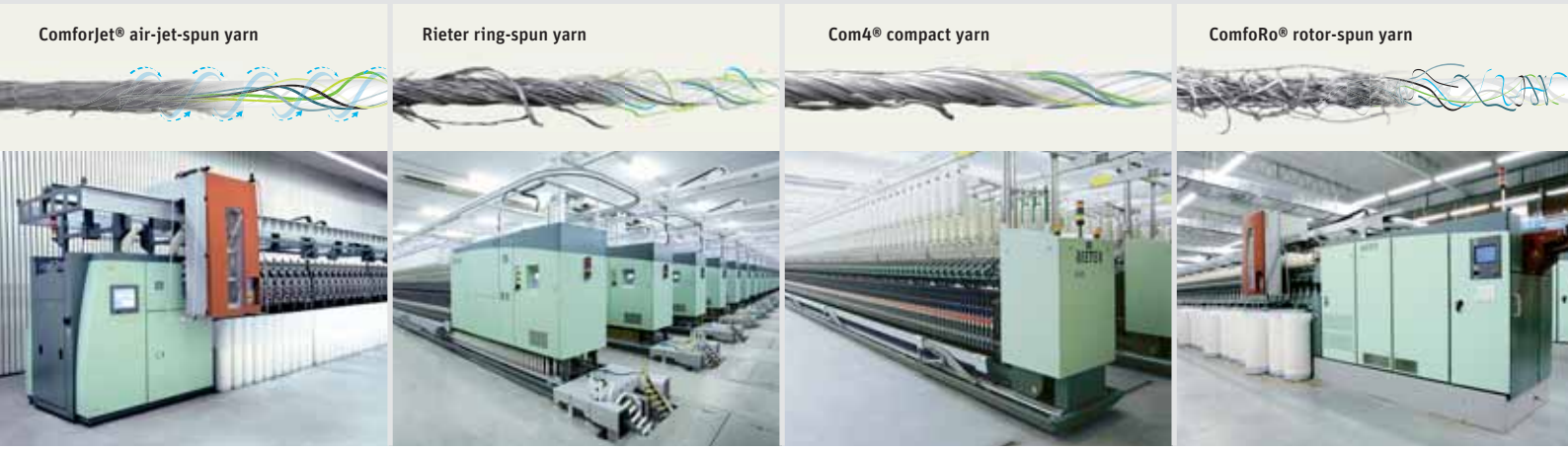

Fig. 3 All four spinning systems from a single source

– as systems suppliers – we have access to all the data necessary for these calculations. With Rieter you decide on the basis of reliable data. Rieter can offer its customers precisely the machines they need, and not just the machines that are available in the product range."

HISTORICAL RETROSPECTIVE

Did you know that the first patents for an air-jet spinning process originate from as long ago as 1955? German inventor Konrad Götzfried was the first to obtain patents on the idea of imparting twist by means of air. Some years passed before an initial prototype emerged on the basis of this idea. A first prototype was shown at the ITMA 1975 in Milan. Rieter commenced fundamental studies on the basis of this development in 1977. Development of the current J 10 air-jet spinning machine started in 2003.

Fig. 4 Perfect package buildup on the J 10

THE MECHANICAL ENGINEERING CONCEPT OF THE J 10

The main requirements in the development process were:

- high productivity
- marketable yarn and package quality
- flexible, easy machine settings
- little downtime for maintenance and batch changes
- novel yarn properties to open up new markets for spinning mills
- adjustable yarn properties
- low manufacturing costs per kilogram of yarn
- space-saving installation / setup for easy integration into existing spinning mills

And these requirements defined the structure of the machine, the automation concept, the individual components and the operating philosophy.

THE HIGH-PERFORMANCE CONCEPT OF THE J 10

Numerous innovations were incorporated in the J 10 air-jet spinning machine in order to achieve delivery speeds of 450 m/min. By comparison: the usual delivery speeds are 15 - 27 m/min. in ring spinning and 130 - 250 m/min. in rotor spinning.

Section layout and machine height have been designed to enable 500 mm (20″) circular cans 1 070 or 1 200 mm in height to be accommodated in 2 rows under the machine. The large can format reduces the number of can changes. In order to keep operator effort and costs as low as possible, an empty tube loader containing 310 tubes is used. The empty tubes are supplied automatically to the robot – just in time – as soon as a package change is performed. The packages can be up to 300 mm in diameter.

A winding system in which two counter-rotating wings systematically guide the yarn is used on the J 10 air-jet spinning machine. This winding system finally makes pattern winding a thing of the past. The angle of intersection can be freely selected between 15° and 46°. Standard packages or soft dyeing packages can be wound on the J 10. The winding system with continuously rotating wings is low-maintenance and offers potential for production increases in the future. (Fig. 4).

MARKETABLE YARN AND PACKAGE QUALITY

Winding tension is kept constant over the entire package on the J 10. Together with the anti-patterning device, this ensures perfect package buildup. J 10 machines are equipped with the latest USTER Quantum Clearer 2 yarn clearer, with or without foreign fiber detection, as requested by the customer, with capacitive or optical sensor. All yarn clearer settings are entered at the J 10 touchscreen. All disturbing yarn defects, neps, thick or thin places and optionally also foreign fibers, are detected and removed – an essential quality prerequisite for downstream processing of the yarn without downtime in the weaving or knitting mill and for uniform fabric appearance.

FLEXIBLE, EASY MACHINE SETTINGS

High production speeds mean that the batches being spun are completed ever faster. The faster a machine spins, the sooner it has to be set up for new orders. The machine concept of the J 10 is therefore designed in such a way that both sides of the machine are completely independent of each other. This enables two different yarns to be manufactured simultaneously, thus enhancing spinning mills' production flexibility. Producing two yarns simultaneously on one machine calls for two package conveyor belts and feeding of empty tubes in different colors. This has been solved by means of a color sensor in the tube loader, enabling the colored empty tubes to be distinguished from one another.

The heart of the J 10 air-jet spinning machine is the spinning unit driven by individual motors. Without a central transmission, without a drive shaft along the entire length of the machine. Following a thread break or a quality cut the individual motors of the spinning position are automatically switched off. The spinning unit no longer consumes any energy or compressed air. The same happens when maintenance personnel are performing servicing work. Switch off only a single spinning position and the rest of the machine continues to produce. Spinning unit settings – such as draft, winding speed or angle of intersection – are adjusted centrally at the machine control panel. This makes product changes fast and flexible. Flexibility is also the primary consideration in analyzing machine data. Separate production and shift reports for each product are a matter of course.

PATENTED TRAVERSE MECHANISM IN THE DRAFTING SYSTEM

Keeping maintenance costs as low as possible is a major challenge at the high production speeds attained by the J 10. The leading drafting system technology on the market stems from the G 35 ring spinning machine. This drafting system has been used for the J 10 and adapted to the machine's high speeds. In order to attain the extremely high drafts the 3-over-3 drafting system was developed further into a 4-over-4 drafting system. This enables fiber-preserving drawing to be performed in 3 stages.

The robust J 10 drafting system is equipped with a unique, patented traversing system. Lateral traverse motion is imparted to the fiber sliver fed in – and thus to the yarn produced. This prolongs the service life of the top roller covers and aprons on the J 10 by two to three-fold. The top rollers therefore have to be ground correspondingly less frequently compared with the competing system. In the long run this enormously reduces maintenance work and parts costs and enables consistent yarn quality to be achieved over long periods.

LOW MANUFACTURING COSTS PER KG OF YARN

Compared with other processes, air-jet technology's energy requirements per kilogram of yarn produced are the lowest for most applications. Rieter's calculations take account of energy consumption for generating compressed air. Intelligent shutdown of the individual spinning units therefore pays off. In the development process care was taken to ensure that the dimensions of the J 10 enable it to be installed in existing spinning premises. The space required for machine installation per kilogram of yarn produced is considerably smaller than for ring spinning. This results in savings on building costs and air conditioning and improves the economics of the air-jet spinning process.

AUTOMATION

A J 10 air-jet spinning machine with 100 spinning positions is equipped with four robots, two on each side of the machine (Fig. 5). The robot fulfills a number of tasks: it cleans the spinning position, produces an automatic piecing after a thread break or a clearer cut, replaces full packages and commences spinning on empty tubes. The robots on the J 10 are based on the automation technology of the R 40 rotor spinning machine. Mill-proven Rieter piecing technology with invisible piecings results in high yarn quality. The piecing process on the J 10 features total electronic monitoring and can be adjusted on the robot. Due to the progressive feeding of new fibers the appearance of the piecing resembles that of yarn. The spinning technology ensures that the fibers at the end of the yarn are perfectly integrated during piecing (Fig. 6). Piecings formed in this way fulfill all requirements in downstream processing.

COMFORJET® YARN – PERCEPTIBLY DIFFERENT

The motto coined by development chief Dr. Götz Gresser was: "We need a new yarn with new yarn properties that opens up new opportunities on the market for spinning mills." The development team has succeeded in fulfilling this requirement. The method of yarn formation – entangling fibers by means of a current of air in a spinning nozzle – results in a novel, perceptibly different yarn structure. This yarn produced on the J 10 machine is marketed under the ComforJet® brand

Fig. 5 Invisible piecing by the robot on the J 10

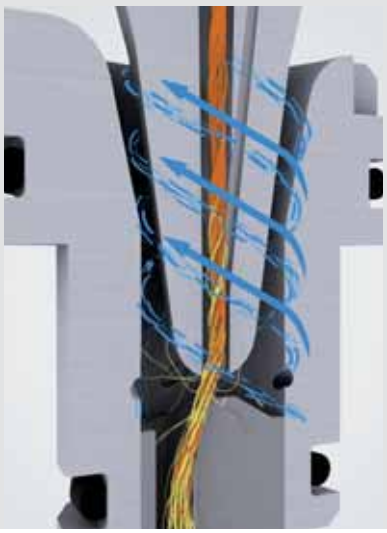

Fig. 6 Diagram of the ComforJet® piecing in the spinning nozzle (yarn – orange; new fibers – yellow; air current – blue)

name. Air is an essential factor influencing yarn structure in the formation of ComforJet® yarn. ComforJet® yarns therefore differ from ring-spun and rotor-spun yarns and have unique properties that display their advantages both in processing and in the end product and the end use (Fig. 7).

Fig. 7 Soft hand and high pile density in knitted fabrics made from ComforJet®.

COMFORJET® YARN WITH DEFINED HAIRINESS

The drawn fibers pass into a spinning nozzle in the non-contact ComforJet® spinning process. The leading end of the fibers forms the core of the yarn. The free fiber ends are wrapped around the parallel yarn core by the vortex of air in the spinning nozzle (Fig. 8). The surface of the yarn is very smooth. The fibers which cause hairiness are very short or form small loops. The hairiness and bulk of ComforJet® yarns can be changed and reproduced on the J 10 air-jet spinning machine via the machine setting. This flexibility is not available to this degree with any other spinning system.

ADVANTAGES IN THE DOWNSTREAM PROCESSING OF COMFORJET® YARN

Low hairiness and good integration of the fibers in the yarn strand reduce dust and fly generation during downstream processing. Excellent pilling resistance is displayed in the washing process. Productivity is increased in weaving and knitting operations. Product quality also benefits from reduced contamination by fly. The typical ComforJet® yarn structure results in high moisture absorption in the downstream processing of the yarn. What is the consequence of this? In the sizing process the concentration of sizing agent can be reduced. In the dyeing process the same color intensity is achieved with less dyestuff.

Fig. 8 Good fiber integration in ComforJet® yarn results in low hairiness

HIGH QUALITY OF THE COMFORJET® END PRODUCT

ComforJet® yarns are very soft and bulky. These properties result in visibly greater pile density and uniformity of the fabric. The fabrics have a soft hand and feel pleasant on the skin. Rieter's unique piecing technology means that ComforJet® piecings are virtually invisible in woven and knitted fabrics, a huge quality enhancement feature. Clearly defined printing contours when printing ComforJet® fabrics are a result of the low hairiness of ComforJet® yarn (Fig. 9 / 10).

Who hasn't been irritated when a new T-shirt lost its shape and was full of fiber knots – so-called pilling – after two or three washes? ComforJet® textiles are longer-lasting. A soft hand, low pilling tendency, high dimensional stability – these are the advantages that consumers and garment manufacturers appreciate about ComforJet® yarn.

The J 10 development project was supported and co-financed by the OPPP program (Operační program Průmysl a podnikání) of the Ministry of Industry and Commerce of the Czech Republic.

"The best way to predict the future is to shape it," Willy Brandt, politician and Nobel Peace Prizewinner, once said. You too can launch yourself into the future with the J 10 air-jet spinning machine.

Vera Stepanska, Marc Schnell
Product Management Air-Jet Spinning

Fig. 9 Woven ComforJet® yarn with low hairiness

Fig. 10 Woven fabric made of ComforJet® yarn

Rieter Machine Works Ltd.
Klosterstrasse 20
CH-8406 Winterthur
T +41 52 208 7171
F +41 52 208 8320
sales.sys@rieter.com
parts.sys@rieter.com
www.rieter.com

Rieter India Private Ltd.
Gat No. 768/2, Village Wing,
Shindewadi-Bhor Road,
Taluka Khandala, District Satara
IN-Maharashtra 412 801
T +91 2169 304141
F +91 2169 304226
www.rieterindia.com

Rieter Textile Systems (Shanghai) Ltd.
12/F, New Town Centre
No. 83 Loushanguan Road
CN-Shanghai 200336
T +86 21 6236 8013
F +86 21 6236 8012
www.rieterchina.com

2279en-v1 2000-1008-42 Printed in CZ

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