



4. Knitting Overview

D. L. Bailey & J. L. Grow

To cite this article: D. L. Bailey & J. L. Grow (2000) 4. Knitting Overview, Textile Progress, 30:1-2, 41-50, DOI: [10.1080/00405160008688883](https://doi.org/10.1080/00405160008688883)

To link to this article: <https://doi.org/10.1080/00405160008688883>



Published online: 28 Nov 2010.



Submit your article to this journal [↗](#)



Article views: 147



View related articles [↗](#)

4. Knitting Overview

D.L. Bailey and J.L. Grow

Cotton Incorporated, Raleigh, NC, USA

4.1 INTRODUCTION

Machinery offerings at the ITMA '99 in Paris were focused primarily on innovations to improve the science of knitting through control of the knitting process. These innovations will result in more flexibility to the knitter, more output in first quality fabrics, higher production efficiencies, higher production speeds, and more profit. Achievement of these goals is a direct result of the machinery manufacturers having engineered into the process the aspects of increased and improved automation, better-built machines, improved and 'next century' electronics, aerospace metals in machine components, and simplified operation. Versatility and the ability to change styles quickly were the main focus of most manufacturers of knitting machinery. In addition to manufacturing better machinery, the commitment to partnerships between the machine manufacturer and the knitter has become a focus of the machinery companies. Custom building of cylinders and dials, take-ups, wider cylinder diameters, on-machine quality monitoring, and precision interchangeable parts are all examples of a commitment to the customer. Because of increased worldwide competition among knitters, it is imperative that the knitter be able to expand productivity, increase efficiency, and become both more versatile and flexible. These necessities for the knitter are more achievable than ever because of the offerings of the machinery manufacturers at ITMA '99.

4.2 CIRCULAR WEFT KNITTING

4.2.1 General

Weft knitting was well represented at ITMA '99, in both the circular and flat bed knitting sciences. Circular weft knitting continues to be the leader in the mass production methods for knitting. Flat bed knitting has controlled the areas of full-fashion, accent fabrics, garment panels, and specialty items. ITMA '99 displayed the latest in both weft sciences, with the exception of sock and hosiery machines. A common feature of both systems is the reliance on electronic computer control. These developments have simplified the entire knitting science by their use, not only in machine monitoring and needle selection for patterning, but also in control of the machine, including style changeover.

4.2.2 Increased Production Rates

To increase production off a knitting machine, one must either increase the number of feeds, the revolutions per minute of the cylinder, the diameter of the cylinder, or the efficiency of the process. Speeds have increased over the years and now have reached a maximum at 45–50 r/min on single knit machines of 30-inch diameter. When expressing speeds in terms of meters per second, the rates have reached 1.8 to 2.0. Higher speeds require a premium on the quality of the yarn package, the quality of the yarn, the heating of the cylinder, and the ability to start and stop the machine, especially those with larger fabric roll capacities.

Realistic speeds for knitting cotton yarns on single knit machines will be in the 30–35 r/min range and up to 40 r/min for 30-inch diameter interlock machines.

Feeder density has appeared to maximize at 4.0 feeders per diameter inch. The density of feeds is related to construction versatility, the type of yarn being knit, and fabric spirality. The range of stitch lengths is greatly reduced when high feed densities are used. This is because the steep cam angles involved put tremendous stress on the yarn and knitting elements. Modification of the needles is also affected. Therefore, the optimum limit in knitting is normally found at 3.0 feeders per diameter inch, especially for spun yarns.

4.2.3 Electronics in Knitting

4.2.3.1 General

Electronics in knitting allow for a true man-to-machine interface. Fabric set-up and style changes have taken on a new level of efficiency due to that interface. Fabric monitoring during knitting is ensured by continuous reports on the state of the machine. Production numbers that are immediately available to the knitter and the management team are maintenance, quality, and defect information. Not only is monitoring possible by the operator, but monitoring can now be performed by the computer on the machine. These smart systems make constant checks on the progress of the process, and they also stop the process when production parameters fall outside of the prescribed limits.

4.2.3.2 Electronic Supervision Systems

Machines of today are now equipped, not only with electronics to monitor basic machine functions, but also with electronics that measure machine parameters and stop the machine if standards are not met. In addition, many fully electronic machines are able to make style changes. Among those machine parameters that are monitored are the operation of needle detectors, the operation of latch openers, course and stitch length, yarn tensions, the operation of quality wheels and tape feeders, take-down tensions, cylinder temperature, oiler pressures and the operation of other machine functions. Fabric parameters that are monitored include defects such as barré and needle lines, among others. Shown at ITMA '99 were integrated monitoring systems for yarn input and yarn tensioning. Coni IN and Coni TM were shown by Mayer & Cie [1]. These systems are integrated to give positive yarn infeed measurements. This data is transmitted directly to the process controller. These systems are used with Mayer's MCTmatic monitoring system, to control the yarn input, the yarn tension, quality wheel settings, stitch formation, and fabric takedown. The result is more consistent fabric quality. Also, when style changes are required, these systems allow for fast and simple resetting of different fabric parameters. By keying or entering one command, all the necessary settings for a given style, such as yarn input tension, stitch length, central adjustment of belt tension, and quality wheel adjustment, are carried out automatically.

These systems are operated by a main process controller. Based on inputted commands, the system will automatically adjust the quality wheel. The belt tension will be adjusted pneumatically. Yarn input tensions are constantly measured and corrected through a positive yarn feeder and stitch cam adjustment. Finally, the fabric takedown is positively driven and adjusted. Central control (MCTmatic) is also part of the quality assurance. Quality data is specified on the screen and is constantly monitored. Deviations out of tolerance will stop the machine automatically, with the error identified for the mechanic to address. As a result, the fabric weight and stitch counts remain constant.

4.2.3.3 Electronic Needle Selection

New machines are being equipped with the latest advances in electronics and computer controls. One of the most exciting features shown at ITMA '99 was the debut of electronic needle selection

on the dial of double knit machines. This choice of independent needle selection, and the use of the three-way technique of needle selection (knit, tuck and welt) at each feed, creates many new design and fabric opportunities. The use of electronic needle selection on the dial allows for fabrics to be produced with full Jacquard patterns on both the technical face and back of the fabric. The electronic dial capabilities include miss, knit, and tuck. Electronic needle selection on the dial is offered by several manufacturers. With the capability of electronic needle selection on the dial as well as the cylinder, every needle can be selected. Not only can double-sided Jacquard fabrics be developed, but Jacquard selection on the dial affects the construction of the technical face, resulting in new design possibilities. These new designs will result in textural and smooth motifs not previously achievable in doubleknits.

Another advantage of electronic needle selection on the dial is the ability to simplify the designing and manufacturing of two-faced constructions. For Jacquard constructions, the electronic needle selection on the cylinder and dial allows for quick and simple style changeovers. Other applications of electronic needle selection are the rapid changeover to and from Jacquard to basic fabrics. For example, when there is no demand for Jacquards, the machine can be easily set to run various ribs – Ponte de Roma (rib-gated), Swiss Pique, and many other rib-grated constructions.

Other advances in electronic Jacquard knitting are the ability to switch colors, change stitch structure, disengage feeders for sampling purposes, and preview patterns on the computer screen at the machine. The ability to switch colors by the selection of needles at each feed, instead of changing the yarn position in the creel, is realized. The ability to change pattern dimensions on the machine by input messages to the computer has been improved so that the pattern may be reversed, inverted, mirrored, stepped, or changed, at the machine. The pattern can then be reviewed on the computer screen at the machine, or a sample can be produced for approval. Also, the number of feeders used on the machine may be reduced electronically for sample work in order to conserve yarn where applicable or accommodate pattern repeats.

4.2.3.4 Electronic Stitch Control

With electronic needle selection on the dial as well as the cylinder, and electronic control of the quality wheel, fabric set-up time has been reduced to a fraction of the conventional time for style changes. Not only are time requirements reduced, but labor requirements are also reduced. Because of this, short runs will be more cost effective.

On-machine sensors measure the course length with every revolution of the cylinder. These are typically mounted at several of the tape feeders on the machine. If the specified course length is not met, the computer will stop the machine and the knitter must address the problem before knitting continues. Some machines are capable of automatically changing the quality wheel when a style change is made.

4.2.3.5 Electronic Transfer and Striping

These technologies have become much more user-friendly by design and function. Efforts have been fruitful in developing more simple and compact electronic striping systems. As a result, these mechanisms are easier to work on and to clean. Up to five selectors can be chosen for each feed.

Yarn threading has been made easier by machine assistance in grabbing the yarn and threading it through to its proper position in the striper feeder. Most of the features developed for basic jersey machines have been applied to electronic striping.

With the ability today of electronically selecting each needle in the cylinder, and with simple

dial cam adjustment from the outside, some manufacturers can offer new pattern designs with very little set-up time. Because of Windows-based computers using pattern design software with transfer capabilities and automatic four finger striping, new areas of fabric constructions can be explored.

4.2.4 Cam Systems

Much effort has been applied to present cam tracks for needles and sinkers that are as closed as possible to outside environments. Tolerances and clearances are as exact as possible to allow for increased speeds, more consistent needle clearing, knockover, and stitch forming. Another result of precision cam tracks is less wear on the needles, jacks, cams and sinkers.

Double-sided stationary exchange cams were shown that allow for simple, quick, and efficient changing of needle selection on the machine. These cams are easily accessible and interchangeable from the outside of the cam section. Each exchange cam system is made into a single unit. Each unit has two choices. There is a choice of a knit end with a miss end, or a tuck end with a support end. To change from knit to miss or the reverse, the unit is simply removed from the cam section, turned around, and inserted back into the cam section. These cams can be chosen for knit, tuck or support. Fabric constructions that include jersey, piques, plain rib, 2×2 rib, rib tuck, half cardigan, thermal, double face, and many other constructions can benefit from the use of these new cams.

Other systems for quick cam changes were shown such as rotary drop cams. Monarch manufactures these systems to allow for quick changing of the cam selection from the outside of the section [2]. In addition, cam sections are now more interchangeable on the same machine and from machine to machine.

Diagonally adjustable stitch cams have been developed by Mayer & Cie, and Vanguard [3]. These cams are implemented to allow for constant needle clearance with the yarn feeder. Therefore, yarn carriers need little or no adjusting. The result is reliable knockover, even on lightweight knit constructions or tightly knit constructions.

Mayer & Cie offer central stitch cam adjustment for maximum simplicity and time savings. The machine is adjusted to the fabric weight, or the desired stitch or course length, with a simple setting action. This can be performed by a single computer input command, or the adjustment of a central mechanical mechanism. The computer input would be to enter a new knitting parameter. The mechanical input would be a simple adjustment of a central bolt that adjusts the cylinder with respect to all the stitch cams at the same time.

Mayer & Cie are utilizing a new cam material called Perunal. This high-tech aerospace metal gives outstanding performance in knitting. It is unique because of dimensional stability at different operating temperatures, non-oxidizing properties, less wear on the cams and the needles, a harder surface, and better dissipation of heat. The result is control of the needles because of positive and constant needle clearance, gentler needle deflection in the cam way, and more consistent stitch forming. By having a consistent needle path, the yarn feeders can be more accurately set in relationship to the needles.

The advent of a twin cam track for sinkers with two butts allows for longer sinker and cam life. Double guidance of the sinker is claimed to give a 100% increase in the life of the sinkers. The effect is better sinker control, more exact loop formation, and better overall machine performance. With more exact loop formation in velour and pile constructions, shearing waste will be greatly reduced, and missed cut loops will become less of a problem.

4.2.5 Automated Style Changes

Mayer & Cie stood out at ITMA '99 by introducing a system to automatically set the dial cams. The dial cam settings are automatically changed by using a switching robot. The robot changes the dial selections at each feed to knit, tuck or welt. Mayer's 'switching robot' allows for rapid and accurate setting of the dial cams when style changes are requested. The three-way technique is of importance for the dial to allow for knit, tuck, or miss. The robot is programmed to go automatically from cam section to cam section to set each cam in sequence. The result is an accurate, technician-free, style changeover in a matter of just a few minutes.

Changes in timing between the cylinder and the dial have become easier with the addition of mechanisms to quickly adjust the timing. The timing can be changed from delayed to synchronized with a simple input at the machine controller.

Adjustment and monitoring of dial height has become much easier with the addition of a central control. When style changes are needed, the dial height will be automatically changed to the specified number. A centrally-located gauge is conveniently located to display the dial height. As with all other machine parameters, the dial height can be seen on the screen with those machines equipped with a computer monitor. Knockover depth can also be easily read from the outside on a scale. This feature will allow for precise and simple reproduction of settings.

Precise and rapid setting of machine gating is also possible on the new technology. This is a big plus in manufacturing because the appearance of rib and interlock constructions is very dependent on the setting of the gating. Also, knitting efficiency is directly related to proper gating.

4.2.6 Quick-change Cylinders and Dials

Quick-change systems for the cylinder and dial are being offered. The design of the machinery allows for machine components such as yarn carriers and fans to be quickly moved or swung out of the way. The cylinder and/or dial may then be removed and replaced with minimal machine disturbance. Some companies allow for the yarn carriers to be placed on a common ring or in sections to form a ring for ease of removal and setting. For single knit applications, the sinker ring can be readily removed with the cylinder. Obviously, quick-change capability will allow mills to change gauges on single and double machines in just hours for body-sized and large diameter machines.

There is a trend to wider diameters in excess of 30 inches, not only for the production of knitted sheets, but also to increase machine production for other end-uses. For body sized fabrics, cylinder sizes range from 8 to 26 inches. Wide cylinder diameters of 38, 40, 42, 48, 54, and 60 inches are offered by several manufacturers. In addition, special orders for cylinder diameters and gauges can be made with most machinery makers.

Cylinders on modern machines have self-centering cylinder bearings that lie in an oil bath, to compensate for cold and warm machine operation conditions. This allows for a consistently and accurately revolving cylinder. Because of the demand for quick-change cylinders, the self-centered cylinder is a must.

Systems to cool the cylinder on jersey machines have progressed since ITMA '95. Savings in metal life (cams, needles, sinkers, etc.), the reduction in frequency of oiling, the amount of oil needed, and increased production, result in savings to the manufacturer. Another benefit is fewer fabric seconds due to oil spots and oil lines. Alandale introduced the FilterFlow 2000 at ITMA '95. This system has been improved and is now offered by Vanguard for most single knit machines. Some companies are offering machines with an extraction system that can remove dust, lint, and sludge from the cylinder, needles, and sinkers. Compressed air is used to dislodge and expel

contaminants, and suction is used remove and collect these items. Closed camming is the key to operating either of these systems to cool the cylinder and keep it clean.

4.2.7 Yarn Control

Mayer & Cie showed their new yarn feeding device, the Coni EP yarn storage feeder with positive feed or storage feed (negative) capabilities. The Coni EP yarn storage feeder offers new capabilities in the control of yarn in knitting. It makes use of a totally new thread wheel with the capability to choose the wheel as a positive yarn feeder or as a Jacquard feeder (negative feed). With combined yarn feeding capabilities, only one unit per feed is required instead of two. This is important where available space above the knitting elements is limited and where both plain and Jacquards are knit on the same machine. With fewer machine components above the knitting elements, there are fewer opportunities for lint and other contaminants to accumulate. Parts costs are reduced because the new units can be used as either positive or negative feeders. Finally, style changes to and from Jacquard and plain are made by the simple turn of a switch, which results in less time and labor.

All surfaces that the yarns must pass over now have high-tech coatings to reduce friction and protect the yarns. On some machines, yarn carriers are mounted on a separate ring, to allow for an exact and consistent setting. Yarn routes have been designed for fewer deflection points, thereby reducing variability in yarn tension, yarn hairiness, and lint generation.

Proper yarn feeding is essential in the knitting of elastomeric yarns, especially in plaiting applications. Plaiting capabilities have been improved on dial feeds to optimize the elasticity of the yarn at each feed. As a result, a more uniform fabric is produced with respect to appearance and stretch characteristics. Yarn carriers are precision manufactured, with multiple holes properly aligned to allow for better plaiting as well as offering flexibility for design and functional effects. Many yarn carriers are designed to swivel outward to simplify threading and service.

4.2.8 Improved Take-up Systems

One of the most improved components of a knitting machine has been the take-up mechanism. ITMA '99 revealed a new generation of systems that wind consistent rolls from start to finish and from doff to doff. Take-ups shown were fully adjustable with positive, motorized drives. Consistent and reproducible take-down tensions are possible by computer control of a potentiometer. Tension can be addressed above the take-up rollers to control the tension of the fabric coming off the needles, and can be addressed below the take-up to control fabric roll tension. The ability to maintain the same tension in the take-up is critical to consistency in knitting, especially for stretch fabrics. Take-up rollers are now being covered with a coating, usually rubber, and have fully adjustable spacers capable of controlling fabrics over the full working width of the knitting machine. Spacers help reduce the distortion of the edge of the knitted tube.

Several companies are manufacturing automated slitting units for fabrics, especially those containing elastomeric yarns. Automated slitters are usually used in conjunction with a take-up that rolls the fabric in either tubular or open form. Terrot [4] presented new technology that opens the tube after slitting, and rolls the fabric in a fully opened width under the take-down rollers. However, some manufacturers offer a system to plait the fabric into a bin. The fabric bin is located just beneath the take-down rollers.

Folding and rolling devices are typically offered on machine diameters of 26 inches and up. In addition to the above technologies, some machines have a special edge device equipped with a roller system, to make sure no sharp folded edges are formed on tubular types of take-up. This

system does not spread the edge of the tube over a fixed wire spreader, but spreads the flat tube over a roller system. These rollers prevent loop distortion and overspreading, and therefore do not pinch the fabric edge. This type of system is designed specifically for stretch and sensitive fabrics, and greatly reduces friction and distortion. All of these systems allow for crease-free edges on stretch and other sensitive fabrics.

Another trend in machine design is to offer the option of extra large rolls. Most machinery manufacturers offer roll sizes up to 920 mm (36 inches) in diameter. This is important to both the knitter and the finisher. In knitting, machine downtime for doffing is reduced, knitting efficiency is increased, and less labor is required. Dyers want long runs with very few seams where rolls are joined together. For jet dyeing, the situation of one roll per fabric strand in the dyeing machine is ideal. For continuous bleaching ranges, the longer the roll, the better for reducing the number of seams required.

4.2.9 Pile Fabrics

The production of full Jacquard pile fabric by means of full electronic sinker selection with high, low, and no loop options at each feed is the latest technology. The design of the loop sinkers and the camming systems allow for ease of application. Sinkers for forming the pile loop have been improved by sinker shape and by sinker activation with double guidance cams. Double guidance of the sinkers allows for more reliable loop height and less waste after shearing for velour fabrics. Also, better control of the sinkers in knitting allows for a smoother surface on the ground or jersey side of the structure. Better tension control in knitting and improved yarn guides allow for a better pile tie-in to give consistent plaiting. The result is a fabric that has a smoother surface for napping on the ground side and nearer perfect shearing on the pile side.

Electronic sinker selection allows for an unlimited pattern area for the pile. As with other improvements in electronic knitting, precise control of the sinkers results in less changeover time and higher knitting efficiencies. When Jacquard patterned pile fabrics are not in demand, the Jacquard selection of sinkers allows for less down-time to change to basic constructions.

Pai-Lung [5] has developed terry machines that have a cylinder and a dial. These machines have an electronic Jacquard-controlled cylinder and a two-track mechanical dial. Another feature is the ability to cut the loops on the machine. The pile loop is formed on the technical face (cylinder) and the ground is formed on the technical back (dial). The ability to form the loops on the Jacquard-controlled cylinder allows for design patterns that contain both cut and uncut loops. Unique and interesting constructions are therefore developed.

4.2.10 Plush or Sliver Knitting

Several machinery companies had offerings of new plush (sliver) knitting machines. The introduction of new technology in the production of high quality sliver knitting was the focus. The FiberKnit system shown by Mayer Industries [6], exhibited a system unlike any sliver knit machine manufactured in the past. The sliver knitting industry has been trying for decades to re-knit the pile back into the structure on successive courses with consistent quality. The new technology, FiberKnit, has achieved this goal and provides the industry with technology that offers to be reliable, simple to operate, and capable of producing fabrics that are innovative with consistent quality.

The economic advantages of FiberKnit are numerous, and stem from re-knitting 95% of the pile back into successive courses. Almost all of the fiber material is retained in the fabric with very little fiber lost in finishing. Pile retention in finishing and consumer use is better because the fiber is

anchored twice into the ground of the fabric. This locking of the fiber into the ground reduces shedding, pilling, and, in most cases, the need for a back-coating. It is claimed that fiber loss during all conventional finishing can be as low as eight to ten percent. Knitting back into the structure will conserve material and reduce finishing costs.

All the plush machines shown, including FiberKnit, are available with Jacquard design capabilities. Constructions may vary from flat, to fleece, to plush, all from the same machine. Pile heights may be varied as a result of design effect. Fabric yields from 180 to 750 gm/m² (5.25 to 22 oz/yd²) are possible. Fiber staple from 25 to 35 mm (1.0 to 1.4 inches) are optimum for knitting. Apparel fabrics, home furnishings, upholstery, automotive, and industrial fabrics are all targeted markets.

Machines shown are available in 10, 12, 14, 16, and 18 gauges, with 18 to 24 feeders. Each feeder has a three-roll carding unit. Two to eight colors are possible on most machines. Manufacturers offer electronic versions that can slit the tube on the machine and doff the fabric into a basket.

4.3 FLAT BED KNITTING

Knitting to shape and full fashion continues to advance in the flat weft knitting sector. Stoll [7] presented touch control technology with their machines. Touch control technology was displayed for complete garments or panels. Symbols serving as icons are used to direct the functions of the machine. This is an effective means of operation since the symbols are multi-national in understanding. Multi-gauge and double-sided fabrics were shown, with multi-width panels. Therefore, full-fashion has been reborn in today's sophistication of the flat knitting industry.

Full-fashioning, loop transferring, rib shaping, integral knitting, and whole garment production are more prevalent today. However, panel production is still the most common form of flat knitting. Whether a panel or a garment is made, it is possible to knit into the fabric pockets, closed pouches, collars, buttonhole panels, facings, overlapping collars, bows, and most any garment component imaginable. Mass production of complete articles such as socks, hats, mittens, and sleeveless shirts are of particular importance.

The revolutionary slide needle was shown, which is patented new technology by Shima Seiki [8]. The slide needle achieves consistently centered loops with minimized yarn tension. This new needle also allows for loop transferring and multiple-gauge designing. Multiple gauge or flexible gauge knitting also offers free adjustment of loop size and wale spacing, to give additional freedom to knit designers. Fine to coarse gauge looks can be achieved in the same pattern.

4.4 WARP KNITTING

4.4.1 General

The new generation of tricot and raschel machines shown at ITMA '99 exhibited an abundance of electronic controls, computer controls, and microprocessors, to enhance quality, efficiency, and production. Machine functions including control of guide bars, take-up mechanisms, and yarn runner lengths are all electronically controlled. This new generation of computer control gives the machines finer tolerances, allowing higher speeds and the capability of producing fabrics up to 6220 mm (245 inches) wide. As a result, tricot and raschel equipment have found new markets and end-uses in building materials, geo-textiles, erosion control and reinforcement fabrics, automotive, medical, as well as home and apparel applications.

Today's warp knitting is not only in the filament nylon and polyester areas, but has expanded to such fibers as carbon, glass, metals, aramide, polypropylene, and polyolefins among the newer fabric fabrications. Unfortunately, with the exception of lace fabrics developed on raschel machines, spun yarn fabrications were not shown. However, weft insertion machines can process spun yarns for the apparel and the home products areas.

Karl Mayer [9] and Liba [10] exhibited the latest developments in the areas of tricot and raschel, stitch-bonding equipment, and warp preparation. A circular loom from Mayer to manufacture bags, containers and tarps made of polypropylene was on display.

4.4.2 Tricot

High-performance tricot machines were shown for the knitting of elastic fabrics at high rates of speed. This has been made possible by making use of high-tech materials in the machine components of the knitting cycle. In addition, the use of electronics to control patterning instead of linked chain systems has also resulted in higher speeds through precise control. The result of these improvements is greater reliability, minimum defects, low energy consumption, low heat emission, low noise levels, a good price: performance ratio, and, of course, higher speeds.

Improvements through innovation have also occurred in the control of yarn from the warp beam through let-off and knitting. Digital control of the yarns during let-off and positive feeding, results in a high degree of consistency and accuracy. Runner lengths can be precisely controlled during the entire run of the warp.

Electronics for control of the yarns for each guide bar, patterning, take-up, and defect analysis have greatly expanded the range of fabrics that can be made on even the most basic of machines. User-friendliness of the process controller on the machine has become a key part of warp knitting.

4.4.3 Raschel

High-performance raschel with weft insertion was shown that can produce wide industrial and technical fabrics. Working widths up to 5410 mm were shown, with magazine weft insertion capabilities. The weft insertion system uses a servo-motor control to guarantee optimum speed and pattern capabilities. Speeds of up to 1400 r/min can be reached with conventional nylon and polyester filament yarns. Lower speeds will be realized with technical yarns such as fiberglass, textile glass, carbon, and graphite.

For raschel knitting, the use of electronic Jacquard control has greatly simplified patterning while at the same time allowing for the creation of more complex constructions. Jacquard laces, ribbons, and constructions that are completely new and different in appearance are possible on this equipment. These new, three-dimensional constructions cannot be made with conventional link-controlled pattern systems. Each individual guide is controlled by the pattern microprocessor. Another advantage may be the ability to change styles and patterns at the touch of a button instead of by the conventional, time-consuming link system.

The CAD systems for design control of tricot and raschel machines allow for the drafting, modifying, simulating, printing, data preparation, data transferring and archiving of designs. Several machines can be networked to a single machine control facility. Patterns can be downloaded from the network, with manipulation of the pattern at the monitor or the machine. Downloading patterns, monitoring production, record keeping, data processing and acquisition, and analysis are all possible immediately at the machine.

REFERENCES

- [1] Mayer & Cie GmbH & Co., Maschinenfabrik, Postfach 1580, D-72438 Albstadt, Germany, Tel: 07432-700-0.
- [2] Monarch Knitting Machinery Corp., PO Box C 268, Flushing, NY 11385-0269, USA, Tel: 718-381-2600.
- [3] Vanguard Supreme Machinery Corp., MacArthur Circle, PO Box 500, Monroe, NC, USA, 28111-0500, Tel: 704-283-8171.
- [4] Terrot Strickmaschinen GmbH, Durrheimer Strasse 12, 70372 Stuttgart, Germany, Tel: 0711 55 31-0.
- [5] P. Lung, Aries International, Ltd, 2833 Top Hill Road, Monroe, NC 28110-2833, USA, Tel: 704-225-9595.
- [6] Mayer Industries Inc., PO Drawer 1466, Orangeburg, SC 29116-1466, USA, Tel: 803-536-3500.
- [7] H Stoll GmbH, Postfach 2544, D-72715 Reutlingen, Germany, Tel: 07121/313-0.
- [8] Shima-Seiki USA Inc., Knitting Division, 22 Abeel Rd., Cranbury, NJ 08512-3705, USA, Tel: 609-655-4788.
- [9] K. Mayer Textilmaschinenfabrik GmbH, PF1120, D-63166 Obertshausen 1, Germany, Tel: 49 6104-4020.