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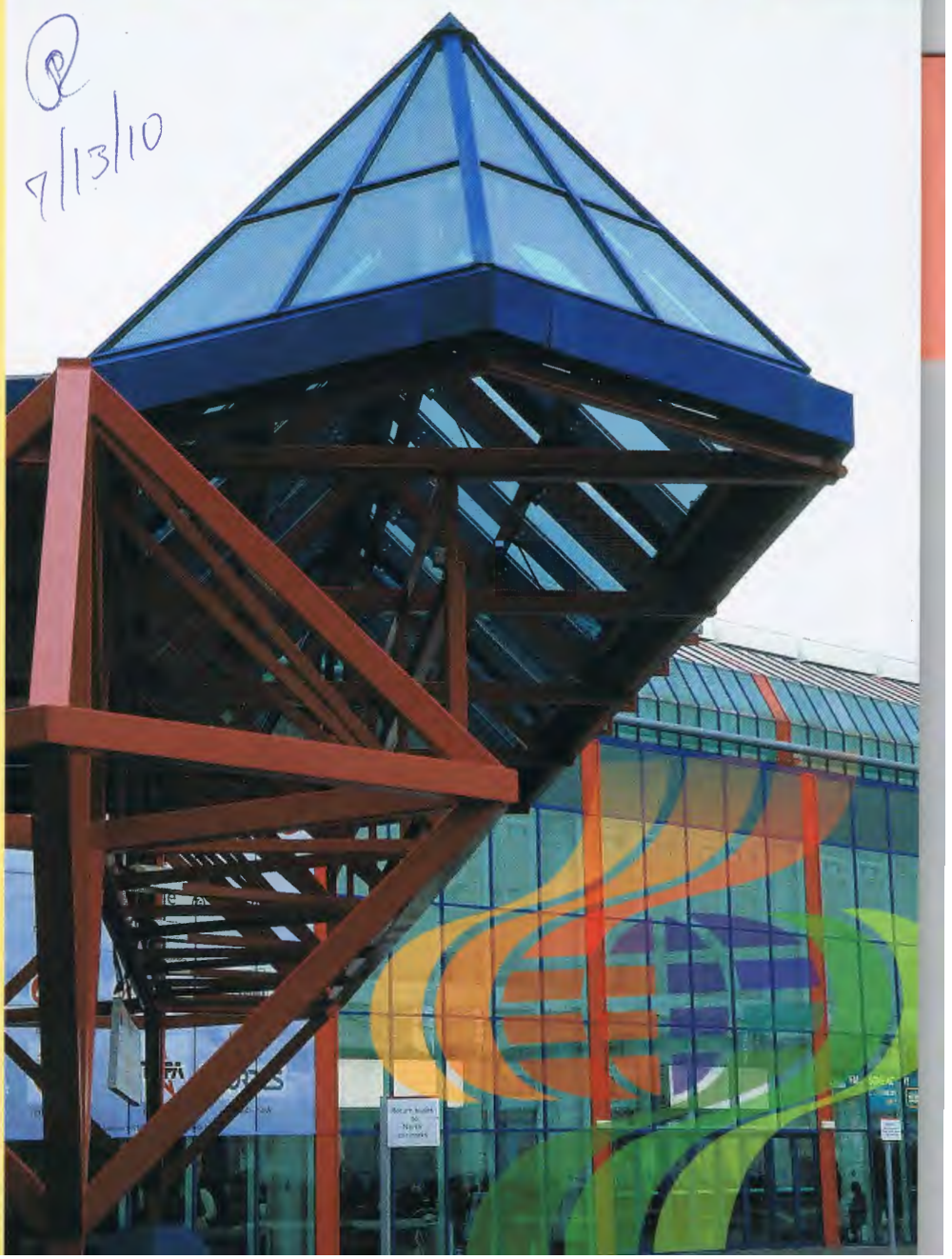

SPECIAL

ITMA '03 TREND REPORTS

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FAST JACQUARD WEAVING MACHINES

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e-mail: its@its-publishing.com

Publisher:
Andreas A. Keller

Editor-in-Chief:
Jürg Rupp

Deputy Editor-in-Chief:
Mac Isaacs
(USA editor)

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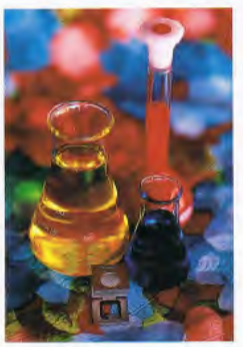

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Flat and circular knitting machine trends

In many respects, ITMA 2003 took place in special conditions for knitting. With the decision of Birmingham (GB) as the ITMA exhibition location, the weft knitting machinery manufacturers developed their own conditions for presenting their products in a place closer to the market pulse, and catering for knitwear tradition and innovation. With Milan (I) as the exhibition site for the newly founded IKME, a location, which assumes an important position for the knitwear industry in particular, was selected. In the end, only the flat knitting machinery manufacturers decided on the IKME.

As one knows, no flat knitting machine manufacturers exhibited at ITMA 2003, as they were at a separate, newly created exhibition in Milan (I). An entire sector of this branch was therefore (practically) unrepresented with the peripheral industry in Birmingham.

The author also attended the Milan exhibition with a view to producing for the reader a comprehensive report on the situation of the knitwear industry.

In terms of a comprehensive report on the situation of the knitwear industry, this information should not be withheld from readers.

The editorial department.

Flat knitting technology was presented at IKME to a striking fashion standard. Great creativity and care was shown by the flat knitting machine producers, both in presenting their machines and in the translation of engineering possibilities into fashion. The machine technology presented discovered new horizons for knitwear creation. The exhibition was therefore one for the eyes, with many colours, shapes and structures, wholly in flat knitter style.

Dipl.-Ing. Oswald Rieder

Head of knitting technology and making-up research, ITV Denkendorf (D)

Complete knitted garments – flat knitting's future

Under this heading, one could sum up the impression that was to be gained from the leading flat knitting machinery manufacturers at IKME - Shima Seiki (J), Stoll (D), Steiger (CH), Universal (D) Protti (I). Completely knitted ("Whole-Garment" knit and wear) or fully fashioned products were running on most machines. From the technological standpoint a new stage has been reached in the production of complete knitted garments.

Yarn material saving

It appears primarily therefore to be no longer a question of yarn material saving and making-up operations. Modern complete products present themselves with a high degree of creativity and knitting technologically integrated details which sometimes cannot be produced in this way by making-up technology. Due to this new creation potential, complete products assume an integral character, i.e. not composed of individual parts, but emerging from a casting process. Flowing transitions produce a harmonic overall impression which allows the completely knitted garment to appear visually as a whole - a new creation dimension for the designer.

Maximum versatility and flexibility in knitwear production

Flat knitters live to a great extent by the creative design of their products. In order to translate structures and shapes, flat knitting machinery manufacturers are therefore constantly developing new functional elements on their machines so as to broaden versatility and flexibility, and consequently the freedom to create. The following compilation will provide a survey on some future-oriented developments.

Additional auxiliary beds

Flat knitting machines with additional auxiliary beds offer the best prerequisite for producing fully fashioned flat knitted products. With sinker-equipped auxiliary beds, normal racking between

front and rear needle beds is complemented by additional racking on to the auxiliary beds. This arrangement makes rational narrowing and extremely sophisticated transfer patterns possible.

Shima Seiki presented its further developed four-needle bed flat knitting machine, which is already familiar from ITMA '95. Four needle beds are the prerequisite for producing complete double jersey garments and complete fine single jersey knits.

Multi-gauge, flexible gauge

These are concepts which describe flat knitting machine flexibility in terms of selectable machine gauge. Patterns can be arranged in a fabric in a number of gauges. Flexible flat knitting machines can basically be employed in different gauges without needle changes and gauge conversion.

Positive yarn feeding

Yarn quantity regulation is now regarded as state of the art at Shima Seiki (DSCS), Stoll (STIXX) and Protti (DSCD). With Shima Seiki, the DSCS has been equipped with positive yarn feeding.

Motor-driven conveyor rollers supply a definite quantity of yarn for each course. Sensors integrated in the unit permanently monitor yarn tension. If this is too high with high yarn consumption or too low with low yarn consumption, the knock-over cam setting is appropriately changed.

Compact construction

Because of the high mass acceleration, flat knitting machine manufacturers are constantly striving to minimise carriage weight and dimensions. Shima Seiki has now achieved a 4.5 inch cam system width on its first machines. It has been made possible by compound needle technology and counter-sinkers. Both shorten the knitting needle stroke.

Interesting detail developments

The innovations presented can be complemented by a series of interesting detail developments. They can basically be emphasised as follows: in the case of flat knitting machine producers, all efforts to that end are directed to developing further versatility and flexibility in order to develop the most comprehensive and creative construction potential for knitters.

Circular knitting machines at ITMA

In the circular knitting sector, ITMA presented itself as an exhibition of machine optimisation, rationalisation, quality improvement, increased efficiency, flexibility, productivity, and, quite particularly, the use of technological innovations from the control technology and data processing fields. The wealth of these makes it clear that there was no focal point development. There were product innovations in the knitting needle, yarn feeding, knitting structure, knitting product, machine control and production monitoring areas.

Quieter machines

Another development stands out: circular knitting machines, above all those from substantial manufacturers, are quieter. This development is an extremely important aspect in health protection at the work station. Furthermore, this has yet another advantage. By harmonising motion cycles, moving parts and those subject to wear are less heavily loaded, ensuring longer working life. Interesting developments, from which stimuli are to be expected for the circular knitting sector in the near future, are described below.

Circular knitted spacer fabrics

The circular knitting sector is increasingly being developed for the versatile and multifunctional textile sectors.

This is shown by machine manufacturers' developments towards producing knitted spacer fabrics, for example by Mayer & Cie (D), Monarch (GB) or Terrot (D). The advantage of these three-layer knitted structures lies in the fact that completely different yarn qualities can be combined with each other to achieve specific functions in material and gauge terms.

Furthermore, the fabric face can be created at will in structural and pattern terms by way of electronic needle selection. Especially for use in the underwear and apparel sector, possibilities are offered in regard to mechanical damping, heat insulation and physiological wear comfort.

Circular knitting spacer machines with electronic needle selection up

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Skechers v Nike

to E32 gauge (Terrot) were presented. A very fine spacer fabric was presented by Monarch in its pattern presentation.

Ultra-fine knitted fabrics for maximum wear comfort

This development was introduced as early as ITMA '99, when SMC (D) presented the highest gauge weft knitting machine cylinder for an interlock machine at that time (E46). Needle thickness is 0.26 mm. This is one of the biggest challenges facing the needle manufacturer. The idea that knitting can still be carried on with such knitting element dimensions as regards yarn loading in the stitch-forming process is astonishing.

Ultra-fine knitted fabrics have very low fabric stiffness, which produces an extremely pleasant feel on the skin when worn. Ultra-fine Mayer & Cie. or Terrot circular knitting machines (E44-E46) are already to be found on the market. Current developments show that the technology for using suitable yarns is well under control.

A high degree of flexibility with motor-controlled yarn feed

In future, modern machines will have central yarn feed servomotor drives. Control will be exercised by the machine control unit and will make it possible to set quality control, which has hitherto been done manually via bevel gears, quickly and reproducibly.

This idea was pioneered by Mayer & Cie, which presented this drive within the framework of the MCT-Matic presentation at ITMA '99.

The number of suppliers – Fukuhara (J), Monarch, Pai lung (ROC) and Terrot (D) – showed that central motorised drive is winning through. Motor-controlled central loop sinking is also finding use now by a number of manufacturers, in fact by Mayer & Cie., Monarch and Pai Lung. The development of individually motor driven positive yarn feeders (Orizio (I) and Terrot) is new.

Improved handling, reduced cleaning expense

As ever, the efforts of machine builders to reduce the manual labour cost on circular knitting machines are endless. Three developments by Mayer & Cie. are interesting examples: the desire of many knitters who have to struggle to hook up the fabric tube after a fine rib fabric press-off has been fulfilled by the development of a double jersey circular knitting machine which automatically starts knitting again. The machine

restarts by itself: sinkers located between the cylinder needles knock over the stitches by means of a horizontal swinging motion.

Plug-in cams, which no longer need to be screwed in, were presented on single jersey circular knitting machines for the first time by Mayer & Cie. The cams are held in place precisely by dowel pins, and can easily be withdrawn and exchanged by hand.

Mayer & Cie. are reducing sinker ring and needle cylinder trick dirt and additive accumulation with the aid of a suction unit. Dirt and superfluous machine oil are constantly extracted by suction. This extends machine cleaning intervals and reduces oil and dirt stripping.

New knitting needles

The further development of the knitting needle as a central element of stitch-forming is currently going in the direction of energy reduction and increased performance. With the "litespeed" needle, Groz Beckert (D) presented a development in which needle thickness is reduced by small amounts in steps along the needle length to the effect that there is less adhesion between needle and trick due to the reduced contact area. Up to 17% less energy was required for needle drive and a lower temperature rise of the same order of size in a series of test bed trials. This development also has an effect on the lubricating process: as compared with traditional needle construction, markedly reduced oil discharge at the top of the needle trick was perceived, indicating more efficient lubricant usage, and reducing fabric oil contamination.

Compound needle gentler stitch formation

Another interesting development is coming from Mayer & Cie.: a compound needle with a hook on the end of the tongue was presented for use in single jersey circular knitting machines. Needle and tongue hooks are aligned counter to one another, corresponding with each other in the stitch-forming operation. Stitches are knocked over by sinkers. The manufacturer talks of gentler stitch formation, as the stitch no longer has to open the latch, and does not have to slide over the latch on clearing. Reduced needle wear and a resultant increased needle service life are quoted as advantages of this development.

Stimuli for the further development of weft knitting technology are expected from the innovations presented. Altogether, weft knitting machine manufacturers are making an absolutely positive impression, particularly in terms of innovation capacity and flexibility. With new and sophisticated technical developments, they are ready for future market demands.

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Warp knitting machines

Flexibility comes before increased speed in the development of warp knitting machines. Increased flexibility is achieved by the wide use of electronically controlled drives and innovative detailed solutions for yarn feeding and patterning control. Important new developments are servo-controlled string bars as patterning bars, carbon guide bars and double-bar warp knitting machines for spacer fabrics up to 65 mm in pitch.

Increasing flexibility by using mechatronic drive systems is in the forefront of development. A trend towards individual motor drives and reducing mechanical transmission is also to be noted in the case of warp knitting machines. Both frequency controlled asynchronous motors and servomotors are employed as drives, increasing the proportion of complex electronic controls. Combined with detailed technical developments, the machines offer significantly higher flexibility in patterning and pattern rearrangement.

Although production output is not the first priority, it has been further increased for many machine models by optimising design details. Noise level and maintenance costs have been markedly reduced by structural optimisation.

Prof. Dr.-Ing. habil. Peter Offermann

Institute director of Dresden University of Technology Textile and Clothing Technology, Dresden (D)

New technical developments

New technical developments are demonstrated on all machines. The innovations relate to individual component groups, which improve individual machine performance parameters.

String bars

The development of string bars is opening up new possibilities and performance fields in warp knitting. Classic guide bars are no longer shogged, but take the form of guide bars which can accommodate eight string bars in all. Each string bar has one or more guides, on which the patterning guides are arranged. The guides are connected to the servomotors and the pneumatic tensioning device, so that 8 patterning guide bars, which operate by wires (strings) on an offset line, are integrated in one guide bar. In addition to drastic space saving, reducing the moving mass offers big advantages. Highly dynamic drives can be used for extremely fast shogging motions and long shogging distances up to 180 mm. Higher performance and new designs are achievable with these machines.

Narrow fabric warp knitting

Narrow fabric warp knitting machines with 24 linear-drive shogging bars, which all operate on their own offset shogging lines, have been increased to 2000 rpm in speed terms. Other innovations include the use of carbon bars, new systems for the guide bar shogging drive and new weft in-lay systems for magazine weft units.

Rib warp knitting

In the rib warp knitting machine sector, machine speeds have been increased, and the range significantly extended by a "High-Distance" rib Raschel machine (see below) and a narrow fabric rib warp knitting machine.

Yarn feed

All machine models are offered with electronic warp let-off transmissions. Yarn feed is very precise, and is also sequentially possible. Electronically controlled yarn delivery units are offered for elastane processing on all warp knitting machines, including narrow fabric warp knitting machines. They improve warp knitted fabric quality, and facilitate yarn break repair. Offered for industrial textiles are special yarn feeders for standing and transverse weft, enabling yarn counts up to 45000 dtex to be processed.

The laying speeds of magazine weft units have been drastically increased by optimisation in the weft layer field. The use of a special shogging comb, which takes over part of the weft layer stroke, offers the biggest performance reserves. These are used to some extent for increasing warp knitting machine performance, and partly for reducing weft waste by narrower lay band widths.

Knitting elements

Knitting element drives and motion cycles are being further optimised, particularly for noise reduction and for extended service life. The use of carbon bars for the knitting elements is a significant milestone. Weight reduction offers new prospects of increasing machine performance and reducing noise. The constant length of

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the carbon bar is an important advantage however, in that there is practically no heat expansion with temperature variation, making this solution of extraordinary interest, particularly for high speed wide working width and fine gauge warp knitting machines.

Knitting element geometry, e.g. the guides, can now be optimally adapted to the technological requirements in conjunction with the sinker and needle manufacturers. It is consequently possible to process sensitive filament yarns and fine staple fibre yarns effectively.

Fabric take-up and batching

Fabric take-up and batching operations are universally electronically controlled or regulated. This makes the machines more flexible, and they produce higher yarn qualities. Modified take-up and batching is offered, depending on the requirements for take-up power, friction, gripping and batch quality.

Product construction

New engineering solutions for producing special products are presented by the new "HighDistance" rib knit Raschel machine. Spacer fabrics can be produced in new dimensions and qualities with a maximum comb plate pitch of 65 mm. Electronic guide bar control provides for flexible guide bar control and the production of large repeat lengths, so that spacer fabrics with pile-free spacing, which are then used for making-up or as "hinges", are possible. The use of two warp let-off positions per bar and quick comb plate spacing adjustment ensures machine effectiveness.

In the narrow fabric warp knitting machine field, warp knitted fabrics with fringing and part weft inlay are used for processing fancy yarns. The part weft ends are cut inside or outside the machine. The fringe then forms the ground fabric, while the part weft ends produce the fancy yarn effect structure.

Quality assurance and monitoring

Regulated warp knitting machine operating temperatures, particularly gear oil temperature, pattern wheel drive oil temperature and bar air-cooling, ensure constant fabric quality. This is especially necessary with wide machine widths, high machine gauges and fast-running machines.

Yarn feed is monitored in the tried and tested method by laser (Protechna/D). Elastane warp knitted fabrics are increasingly monitored by fabric scanners. The systems can be extended for complete fabric monitoring. The problem of monitoring patterned fabric has not yet been comprehensively solved.

All machines can be equipped with on-line monitoring. Quality adjustment is facilitated via stepless electronic machine speed control.

Flexibility

Increased flexibility is in the forefront of warp knitting machine development. Some developments already described significantly increase warp knitting machine flexibility. Here too, universal electronically controlled yarn feeding has a positive effect. Controlling guide bar shogging via chain links is being replaced on a wide front by electronically controlled drives. Pattern wheels will in future be used only on high speed warp knitting machines.

Mechatronic systems

In combination with electronic drives and patterning units, mechatronic warp knitting machine systems offer new possibilities of data recording, pattern control and pattern programming. All machines have prepared interfaces for machine networking in a company network. The pattern preparation software, which permits fast pattern preparation and quick pattern changing, has been considerably extended. Complete network solutions are already on offer for central knitting machine control and monitoring in the mill. Coupling with the internet is therefore possible in every case.

Noise protection

Noise protection is of central interest in warp knitting machine development and in increasing speed. Warp knitting machine builders are completely set, as ever, on reducing noise generation. Machine vibration, and consequently machine noise levels, has been reduced by the targeted design of machine bed and support layout. Noise emission has been markedly reduced on high speed warp knitting machines in this way despite speed increases.

Productivity

It has been possible to increase machine performance further by increasing machine rigidity, reducing the weight of moving parts, and optimising drives. High speed warp knitting machines attain speeds up to 3500 rpm. The increased speed of warp knitting machines with higher guide bar numbers, with patterning units and magazine weft units, is striking, amounting to 60%.

Thus, 5-bar warp knitting machines with electronic guide bar drive for example operate up to 1800 rpm, while narrow fabric warp knitting machines with 24 linear-drive guide bars attain speeds up to 2000 rpm.

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