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The leading technical and  
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### Front Cover:

#### Santoni SpA

Santoni has guided seamless apparel into a new era through design, technology and promotion. It's 3D technology gives a new dimension to seamless style and comfort.

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If ITMA 1995 in Paris witnessed the dawn of commercial complete garment knitting, then IKME 2003, held during October in Milan was the venue where this exciting technology really did come of age.

All of the main builders of flat knitting machines offered solutions for the knitting of complete garments and the range of gauges, knitting widths and configurations on show were ever wider.

We refer to them as ready to wear, seamless, knit and wear, 'wholegarments', one-piece garments, integral garments and complete garments, but whatever we call them they are essentially garments, which are knitted in one piece, which require little or no seaming when they leave the knitting machine.

Although other techniques are used, today's flat knitted complete garments are produced in tubular form, knitting one wide tube for the body and two narrower tubes for the sleeves. Knitting tubes on flat knitting machines is not new, but the challenge with complete garment knitting lies in connecting the three tubes together at the neck and shoulders and under the arms, to make a sweater.

An even greater challenge has been to create a commercially viable product, which equals or surpasses conventional knitwear. IKME showed that the world's flat knitting machine builders are meeting this challenge head-on and the range of enhanced equipment on show confirmed that the technology is now beginning to mature.

Shima Seiki, a pioneer in this field showed no fewer than five different machine types, which had some sort of complete garment capability. The Japanese manufacturer exhibited its trademark WholeGarment machines in four different needlebed configurations utilising three different needle types, namely latch, compound and slide needles.

Shima has been steadily expanding and improving upon its complete garment technology since 1995 and its flagship 'First' machine is without doubt one of the most sophisticated



A garment from Shima Seiki's NewSES-CWG equipped with 5G compound needles to give a 3G look.

## TECHNOLOGY TRANSFER

Has complete garment knitting really come of age? And can it grab even more market share? Billy Hunter reports on the very latest knitwear machinery.

flat knitting machines to date. 'First' features Shima's slide needle instead of the conventional latch needle.

A new addition to the 'First' line-up at IKME was the SWG-FIRST184L12S. This model adds a spring-loaded sinker to the SWG-FIRST184L model, expanding its patterning range even further.

The jewel in Shima's crown however seems to be the SWG-X and

IKME saw the addition of the 80 ins wide SWG-X 15G machine for knitting elegant, high quality fine gauge knitwear including wide ribs that require a wide knitting width. Previously the SWG-X was available only in 12G and in 68 ins working width. Like the well-established 12G machine, the 15G SWG-X features four needlebeds for knitting, as well as Shima's slide needle and pull-

Right: This brand new 10 ins machine from Shima caused a stir. Dubbed the 'SWG-Mini' it uses WholeGarment slide needle technology for knitting gloves and accessories.

down device from its flagship 'First' machine.

At IKME, the new 15G SWG-X machine was producing a very elegant body contoured ladies fine 2 x 2 rib garment with integrally knitted v-neck and internal fashioning. This machine was also fitted with Shima's new i-DSCS, an improvement on the original Digital Stitch Control System (DSCS). Whereas its forerunner DSCS was a passive system, which controlled stitch length and yarn tension by limited yarn-feed, the new i-DSCS now has the capability to actively control yarn-feed in both feeding and retrieval directions. Shima says this results in higher quality and greater productivity using a wider variety of yarns. i-DSCS will initially be offered on WholeGarment capable machines where its potential is more critical.

At the other end of the gauge spectrum Shima exhibited the NewSES-C•WG coarse gauge machine featuring 5G compound needles, capable of producing 3G fabric texture. The machine is capable of knitting both shaped pieces and complete garments and features compound needles like those found on its SES-CS type machines, as well as the First-inspired fabric takedown system with Shima's pull-down device.

Two machines were exhibited. One of which was equipped with two carriages, each with one knit, and

one transfer system. These were coupled together to knit a slip-stitch 3G look complete garment with cable. The machine also comes with four sets of the company's standard Knitran cam systems for retrofitting, allowing the machine to be converted for use as a standard machine for knitting shaped panels.

The second NewSES-C•WG machine was knitting a 3G waistcoat which was knitted open, with the shoulders being closed on the machine. Other features include optional yarn carrier kickback for efficient production of intarsia and integral knits, and adjustable 'second stitch' facility for knitting loose and tight stitches. This is especially applicable when knitting garments with complex transfers.

Shima says the NewSES-C•WG is ideal for coarse gauge complete garments. Yet it is also flexible enough to support varying market demands.

All of Shima's WholeGarment

machines now feature twice as much memory capacity in their new control units for supporting large knitting data.

## 'Mini' seamless machine

A brand new prototype 3-D shaping and fashion-knitting machine attracted a lot of interest at the Shima stand. This was a novel compact machine with a working width of just 10 inches.

The machine, which

has tentatively been dubbed, 'SWG-Mini', was displayed in the glove/sock knitting machine section and is based on a completely new concept.

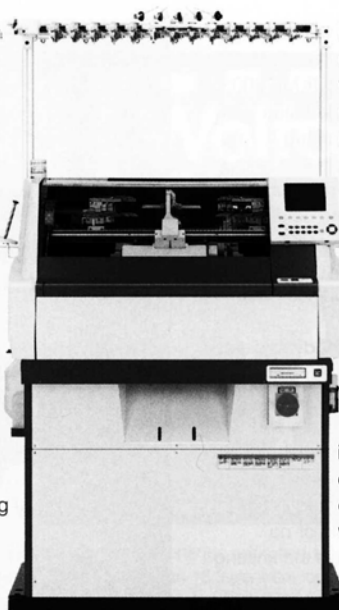
Mainly for use as a fashion glove knitting machine, the 'SWG-Mini' features slide needles such as those found on First and SWG-X machines. This gives it the transfer capability to knit 3-dimensional gloves with improved fit and comfort. According to Shima, the most notable feature of

this machine is that it can knit 3-dimensional gloves with the thumb offset to the inside of the palm so that it imitates the actual shape of the hand. Previously, Shima's glove machines such as the SFG plain glove and SJF jacquard glove machines did not incorporate stitch transfer and thus all gloves were knitted with an outset thumb.

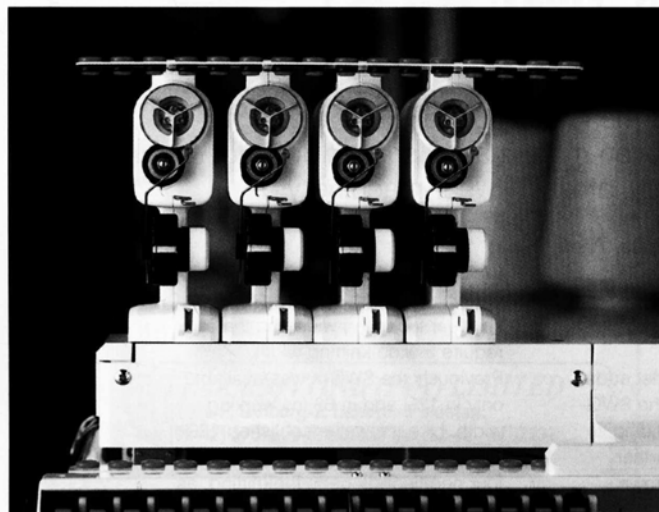
Additionally, because gloves are knitted on all needles in tubular form, stitch transfer with latch needles would have been difficult without empty receiving needles. But because the slide needle can transfer a stitch to the slider of an opposite loop holding needle, new patterns as well as the inset thumb can be knitted.

The 'SWG-Mini' uses this transfer facility to knit complete gloves with shaping in the area of the thumb and a lace pattern in the palm area. The machine also has the capability to knit seamless hats, mufflers, socks, leg warmers and other fashion accessories. It will be interesting to monitor the progress of this machine as its capabilities may also render it suitable for non-fashion glove applications. For example, in technical and medical products both in gloves and other items.

The combination of the slide needle and the machine's small lightweight



Below: Shima's intelligent digital stitch control system (i-DSCS) allows greater production with very delicate yarns.



carriage, which make it very productive, opens up a variety of new possibilities for knitters. Shima Seiki built the foundations of its business on glove knitting technology with the first seamless glove knitting machine appearing in the early 1960's. Some of the early technology such as loop holding sinkers were developed on the glove machines and it is fascinating to see that new technologies such as the slide needle developed on Shima's FIRST flat knitting machine now being applied to the glove knitting machines giving them a potential new lease of life.

Another interesting innovation in the glove machine section was a six colour-knotting device which was mounted onto a Shima SPF five toe sock machine. The device automatically splices yarns, controlling up to six colours and is used in the production of multi colour fashion gloves.

## Stoll machines for all seasons

Remaining true to its philosophy of producing knitting machines which can knit almost anything flexibly and economically, Reutlingen based Stoll showcased a well-rounded machine product line with interesting new enhancements to their top class, compact class, special class and basic class models.

New from Stoll at IKME was the CMS 330 TC Knit & Wear machine. With its 72 ins working width, three systems, and availability in gauge ranges from E2,5.2 to E7.2, the machine is suited to the knitting of complete garments with the appearance of 2.5 – 7G, respectively. Like its well-known four-system counter part, this machine can also be used for fully-fashioned, multi-gauge and intarsia applications. A gauge conversion from E2,5.2 to E7.2 is possible with this machine.

Also new in Milan was the CMS 330 TC-T Knit & Wear whose versatility Stoll was keen to emphasise. This 72 ins wide 3-system model incorporates four-bed technology, i.e. two lower needlebeds and two upper transfer beds, such as those found on the



CMS 330 TC-T compact machine.

The two external systems are used for stitch transfer from lower to upper beds and vice versa. The machine is available in gauges E6.2 and E7.2, and using its three systems and the additional beds, plain complete garments comparable to those produced on fully-fashioned frames can be knitted in 12 and 14G. The machine can also produce complete garments, which incorporate multi-gauge effects. This creates an interesting interplay between finely-knit areas knitted with all needles

and coarser areas knitted on every second needle.

As with other Stoll Knit & Wear machines, complete garments with front and back needlebed knitting in 7 and 8G can be produced. When knitting fine gauge garments the use of additional transfer beds saves a considerable amount of production time. As with all other Stoll Knit & Wear machines, this model can also be used for fully-fashioned, multi-gauge and intarsia fabrics. At IKME this machine was knitting on all needles and producing a men's plain-knit raglan-sleeved sweater with integral crew neck, in 14G.

By introducing a new extra long working width of 84 ins, Stoll now offers knitters improved options for producing extra-large sizes, which are especially important in the men's knitwear market. Two new four-system models are now available.

The first is the CMS 340 TC-M, a machine available in gauges E5 to E14 for knitting fully-fashioned panels. The enlarged working width enables the knitting of even larger pieces side by side. If necessary, this model can also be quickly and economically converted to a knit and wear machine.

The second new four-

Above: Stoll's CMS 330-TC-T Knit & Wear machine is the new 4-bed machine which is a versatile all-rounder. It's designed to compete with fully fashioned frames in the plain 12 – 14G knitwear market.



Left: New sinker technology on the Stoll 340 TC-M Knit & Wear allows manufacturers to knit this 'French' or 'off-set' shoulder. A feature normally associated with high quality fully fashioned garments.

system model is the CMS 340 TC-M Knit & Wear, which features a gauge range from E2,5.2 to E7.2 and is also capable of gauge conversion. As well as Knit and Wear capability this machine also enables the knitting of complete garments in sizes not previously possible, in all knitting modes. Stoll says that in this category, the new machine has the largest working width on the market. This model can also be used for fully-fashioned, multi-gauge and intarsia fabrics.

At IKME, the CMS 340 TC-M Knit & Wear was knitting a classic men's complete garment in 7G with integrally knitted crew neck featuring a fashioned or French shoulder with the shoulder "seam" also set-in at the back. The fashioned shoulder technique is traditionally used in the manufacture of high quality fully fashioned garments to give superior fit, and has become known as a mark of quality. Some complete garment knitting machines are now able to imitate this feature. As far as Stoll Knit & Wear technology is concerned, the introduction of a new-patented spring controlled holding-down sinkers on this model now makes the knitting of this shoulder feature possible. The new sinkers also make it possible to knit the integral crew neck with a lower "neck drop" which makes the garment fit and appear more like a conventionally produced fully fashioned garment where the body is cut to shape to receive the neck trim and then attached by linking.

The CMS 340 TC-C also created a lot of interest amongst visitors. This new machine can produce ultra-coarse ready-to-wear garments with a fabric appearance of 2G. It also has a new extra wide working width of 84 ins for extra large sized garments, and has the new spring-controlled holding down sinker technology.

Three systems and a working width of 84 ins enable the new CMS 330 TC-C Knit & Wear E2,5.2 to easily produce ultra-coarse complete garments even in extra-large sizes. The gauge E2,5.2, in conjunction with knitting/transferring systems and a new type of holding-down technology, makes the production of ready-to-

wear articles with the often asked "handmade look" possible. Yarn usage is the same as with gauge E2 and coarser. The new spring-controlled and adjustable holding-down sinkers provide a high degree of performance. The ultra-coarse stitch look is also demonstrated by the Stoll-knit and wear men's pullover, which exhibits a fabric look of E2 and was knitted in sequence in size M and also in the largest possible ultra-large size, shown at the exhibition.

## Steiger bullish about Taurus

Swiss machine builder Steiger showed a typically interesting range of machines at IKME. This included its Taurus 3 model with compound needles and integrated fashioning points. This compact machine exhibited was a 12G, 51 ins wide 3-system machine with 12 independently motorised yarn carriers.

The upper takedown which is active close to the loop formation area is combined with a takedown comb. According to Rene Schenk of Steiger, "The use of compound needles provides a wide variety of new knitting opportunities and new fashioning procedures with only two needlebeds." He also claims that new structural designs are simple to produce, since they do not require the use of additional or auxiliary needlebeds with fashioning points. Taurus is designed to knit both shaped pieces and complete

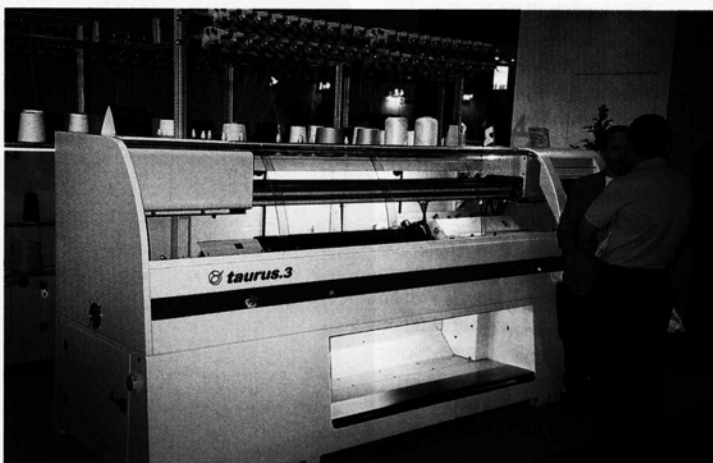
garments. The compound needle incorporates a sliding latch with has an opening through which it receives stitches from transferring needles.

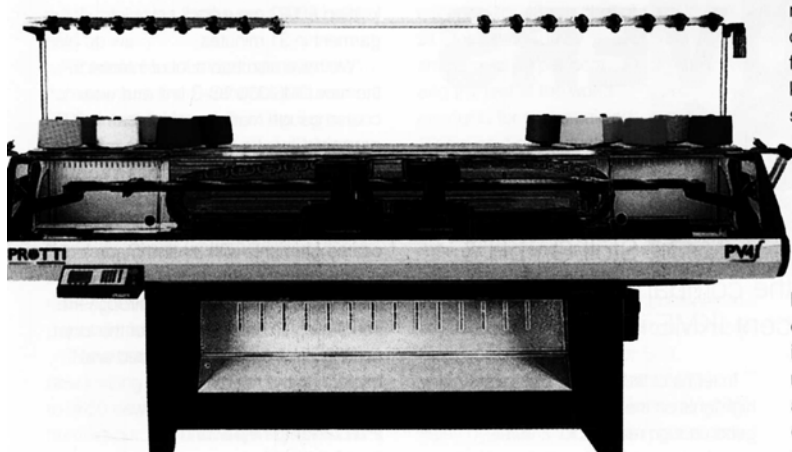
Steiger emphasises how these new machines no longer operate with a traditional cam-carriage. Both its Vesta Multi and the Aries ranges use front and rear cam plates, which are driven separately, thus eliminating the conventional cam-carriage bow which makes it possible to have direct yarn feed from above. The front and rear cam plates are driven independently but are synchronised. This technology has an important advantage, in that the direct yarn feed to the knitting area has eliminated the unnecessary diversion of the yarn as on traditional flat knitting machines. It allows the machine to work with the same yarn tension in both cam-carriage directions, enabling knitting at increased speeds and higher productivity without loss of fabric quality.



This shoulder and neck detail illustrates how Steiger's innovative Taurus 3 machine can knit a high quality complete garment with just two needlebeds.

Right: Steiger's Taurus 3 machine was shown as a 12G, 15ins wide 3-system model with 12 independent yarn carriers.





## Protti's integral solution

Protti showed its PV4i twin carriage machine with a 190cm (76 ins) working width which allows the production of complete garments in large sizes by joining the carriages. Separating the carriages allows the knitting of two shaped fabrics at the same time, each up to 91.5cm (36.5 ins) wide. The machine which can also be used for intarsia knitting is available in gauges 5, 10 and 12. As it uses the half-gauge tubular method for knitting complete garments, the PV4i is available in configurations suitable for producing complete garments in 2.5, 5 and 6 gauge and shaped panels from 2.5 to 12 gauge.

The machine is equipped with sinkers and stitch pressers to assist secure knitting, and Protti were keen to emphasise the importance of their innovative take-down system, which works close to the knitting area and their

DSCD yarn feed system, which allows shorter and longer stitches on the same row needle by needle.

At IKME there were two PV4i machines on Protti's stand. One was one set up with the two carriages in tandem knitting a complete coarse 3G cardigan in 30 minutes. The other machine was set-up with separate carriages knitting two 5G sleeveless polo neck garments in 25 minutes.

The Italian company also showed a range of compact and tandem machines which are available in 2.5 – 18G, a range of high production trimming machines and its well known

rib bar knitting machine for knitting ribs for 30 gauge fully-fashioned frames. Protti have always been best known for their excellent range of rib bar loading machines and trimming machines that knit trims and accessories, which are then later attached to body panels. It is interesting to note that even Protti are now committed to building complete garment machines, which require no separate trims to be knitted.

## Integral Universal knitwear

Other new developments in Milan included the new MC-844 RTW 4-system machine from German flat knitting machine builder Universal. With a working width of 80 ins, the interesting thing about this machine is that the needlebed gap can be widened so that coarser gauges can be knitted. This is achieved with a moveable and exchangeable knockover section of the needlebed. The machine is equipped with needles that have a 10G shank but have a 7G hook that allows garments in both these gauges to be produced with minor adjustments to the needlebed.

At IKME the MC-844 RTW was producing a short-sleeved complete garment on a 12-gauge needlebed. The machine is equipped with a controlled takedown comb for fabric set-up without the need for a special set-up yarn. The comb has a moveable cover plate and the hooks are only uncovered when they reach their upper position. Using this mechanism, the comb is securely

raised once for the body set-up at commencement of knitting and later for the sleeve set-up. No waste yarn knitting is required for the knitting of short-sleeved garments.

## Conclusion

So, has complete garment knitting really come of age and can it really grab more market share?

According to the larger machine builders, around 15 per cent of their current annual manufacturing output is complete garment knitting machines. Both Stoll and Shima have, at different times, indicated that they expect the number of complete garment knitting machines which they manufacture to steadily grow until the technology dominates. Well, we would expect the machine builders to say that, wouldn't we? However, even the smaller machine builders such as Protti and Universal have now entered the complete garment arena and we even saw an Italian company exhibit a complete garment conversion for 1980's technology Shima machines, at IKME.

The early complete garments shown at ITMA '95 and later exhibitions, generally lacked finesse and were produced mainly in the middle gauges thereby limiting market penetration. Indeed, many of the complete garments which appeared in the market place in the early years were not terribly inspiring in terms of quality and design content.

However, the level of sophistication now evident in both the garments shown at IKME and in today's market place is a tribute to the machine builders and their customers, and is also a very good indicator of just how far the technology has advanced.

Garment quality has also improved dramatically and designers now seem to be inspired by the possibilities of the new technology.

The range of gauges in which complete garments can now be knitted together with the new technical possibilities enabled by the machine enhancements shown at IKME, is a clear indicator that complete garment knitting is indeed set to take more and more market share. ■

Left: Protti, famed for trimmings machines has also taken the complete garment route with its PV4i which received good interest.