



Automation makes footwear manufacture possible in industrially developed countries.

CREDIT: HEINRICH KLUMPEN SONS

Turning full circle

As the Chinese would say, we live in interesting times and, as far as the global economy is concerned, extremely uncertain ones. The footwear industry is not immune from this and many major brands faced with ever higher factory gate prices from their principal supplier China, coupled to greatly increased freight costs and a general air of uncertainty as to what the future might hold, are being forced to rethink their sourcing policy. One alternative is to look at manufacturing in low cost countries nearer to home such as in Africa or South America depending on where their main market lies. The other is to turn full circle and use robotics and advanced production techniques in order to actually manufacture within it.

US sports shoe brand New Balance is a striking example of how successful the latter can be. It uses advanced manufacturing systems and a highly flexible work force to produce a pair of shoes in 24 minutes compared to around three hours in Asia. Labour cost per pair is correspondingly low and, with savings on logistics and work in

progress, the final cost differential is only a few percent on a typical mid range shoe which is offset by being able to make faster deliveries and quicker style changes than competitors. Furthermore, New Balance has been doing this for years.

But, while low cost and good quality footwear has been so easily obtainable from China, most others have not seen any reason to go down this road. Times are changing however and some of them are beginning to seriously consider this option. And, seeing where this could lead, their Chinese suppliers are beginning to switch more and more output to the domestic market just in case. This in turn creates more pressure on Western importers who will now really have to make up their minds as to where their shoes are to come from in the future.

FUTURISTIC MANUFACTURING

New Balance has shown that the cost of the upper can be made competitively in Western factories; if the remainder of the manufacturing process could

achieve the same result, then we might see a sea-change in the footwear industry. Force lasting followed by direct sole moulding on an automated conveyor with a combination of human operators and robotic work stations linked to a rotary moulding machine is one way. Pioneered by Ecco in Denmark, it has been used as a reference point by many other companies moving in a similar direction.

Desma is a major supplier in this field and its amir System based around one of its rotary moulding machines is both well established and recognised as being highly efficient. Even so, the quest for even greater automation has continued and the company's latest development, laser roughing, has taken preparation of the lasted upper prior to sole moulding to new heights (*World Footwear* May/June issue). Working as it does with a fixed laser and the shoe moved by a robotic arm, it fits in perfectly with the amir System where it can be programmed to work on any last shape or combination of materials.

Christian Decker, managing director

of Desma, explains: "The more manual steps performed, the more chances there are for inaccuracies and, in the footwear world, inaccuracy sooner or later leads to a drop in reliable quality." The concept is already proving itself in everyday manufacture. HKS (Heinrich Klumpen Sons) produces premium safety shoes. This market sector in Europe is tough and demanding, so its 80-strong workforce at Nettetal in Germany has to develop and manufacture footwear which is consistently able to meet these demands. The company regards its new Laser Cell as a valuable investment which will help it to meet that goal in terms of both output and quality.

SMALL AUTOMATION

Italian machinery company Main Group has also developed automated systems to save on labour costs while at the same time improving end product quality on its injection moulding machines. It refers to these as 'small automation'. For instance, an injection moulding machine cannot be considered an end in itself but must be seen as an integral part of a complete production process. In this way, the adoption of automated systems, however small, can contribute significantly. Small but important tasks carried out manually can be performed better by automated equipment.

A good example is sprue-pulling on the Delta 900 machine for the production of TPR boots. It is a simple repetitive task which nevertheless costs a remarkable amount of lost time and is easily replaced by a robotic arm. The moulding machine's software program is able to accurately monitor the position and time when the robot needs to perform the task. This is normally just after the injection phase due to the cooling and solidification of the material located in the injection gate inside the mould.

Another simple repetitive task on the same machine is slipping the boots at the end of the moulding cycle. In this instance, timing is particularly crucial as they must be removed as soon as possible once the mould has opened. This is where a robot really scores over a human operator liable to fatigue in the course of a long working shift as the program activates it to the very second, time after time. Other associated applications include general handling, mould release spraying and component insertion. All these minor operations as well as the major ones of the moulding machine itself are managed by a 'single thinking head' from which the efficiency of the whole plant results.

The special software used not only controls actual functions but constantly detects and monitors any irregularities allowing a clear overall picture to be seen of everything occurring during each working shift. For example, machine speed and output reports reveal the actual time the machine has been working and how many rejects it has produced by type so that corrections can be made with a minimum of delay. The 'moulding plant' can in fact operate and produce complete boots without any manual intervention by the operator.

Like Desma, Main Group also sees automation as the way to save manpower which, in Western economies, greatly affects the price of the finished product. The company says that the advances it has made in this area in regard to machines such as the Delta 900 has enabled some major brands to bring production of TPR boots back to Europe from



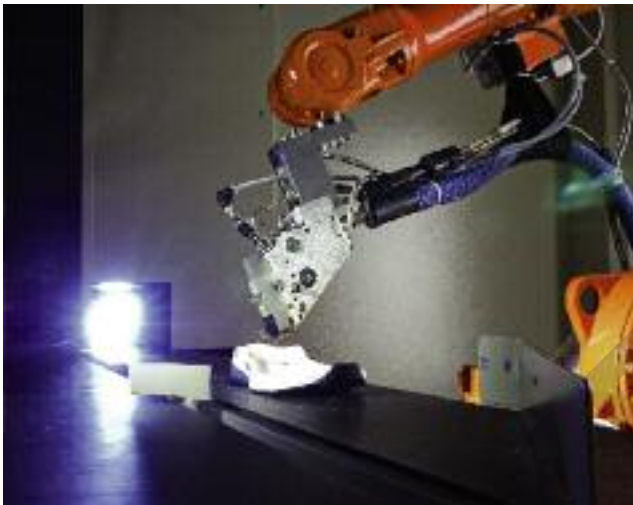
Automated boot removal on the DELTA 900 rotary machine.

CREDIT: MAIN GROUP TECHNOLOGIES

Asia. While these are relatively easy footwear products to automate, it is nevertheless a pointer to what may begin to happen on a wider scale.

CONVENTIONAL FOOTWEAR

The developments we have looked at so far suffer from limitations as to the type footwear that can be produced. These are essentially industrial and safety shoes, some types of sports and comfort shoes and complete moulded boots in



The Sole Cell automatically prepares and cements soles ready for reactivation and attaching.

CREDIT: KLÖCKNER DESMA

either PU or TPU. Up to 90% of the footwear produced in the world, however, still uses more traditional construction with flat lasting and cement sole attaching by far the most popular. Here it is more difficult to make the major labour savings needed to make Western footwear manufacture truly cost effective.

So, where could you save money? Modern NC-controlled lasting machines such as those supplied by Cerim and Molina e Bianchi have probably already reached the limit of their

development in terms of both what they can do and their output. They can also be robotically linked to downstream operations such that only one operator is needed to load the pulling and lasting machine at the beginning of the sequence. There is clearly little room for improvement here.

As we saw in *World Footwear* May/June issue, automatic roughing and cementing machines are also available that can again be robotically linked and are therefore extremely time and labour efficient. When Desma was asked by customers to look at this area, it came up with two solutions. One is the Laser Cell as already mentioned and the other is to lower the actual material cost of the cementing operation and, central to this, is the Sole Cell.

This can be used as a stand-alone fixture or combined into an automated production line. Soles fed in one end emerge prepared and cemented at the other ready for activation and sole attaching. Adhesive is applied by spray with total accuracy and maximum economy. It can also apply all types of adhesive including reactive hot melt and this is where some real savings can be made. Desma says that using a Sole Cell in conjunction with a reactive hot melt adhesive produces 18% more output per person than is possible with alternative systems.

Experience has shown that a simple ribbon around the periphery of the sole provides the required bond strength with a minimum usage of adhesive. It is also fast and a Continental size 43 (UK size 8) sole can be treated in less than eight seconds and needs only around 1.5 grams of hot melt adhesive. Combined to a laser treated lasted margin which, depending on the upper material involved, will at the most only need priming, there are substantial savings to be made. A conventional brush-applied water-based adhesive on the other hand will need anything between 10 and 15 grams of adhesive per shoe.

TURNING FULL CIRCLE

The concepts we have looked at here are not totally new but they have been carefully refined, such that the almost entirely automated shoe production line is no longer a pipe dream. There have however been relatively few takers so far, other than one or two highly specialist manufacturers, prepared to invest the substantial capital required as, up to now, there has been no shortage of suitable low cost suppliers in Asia. But, as remarked at the beginning of the article, we live in interesting times. We also live in potentially exciting ones as the current economic problems may well provide the impetus for a change of direction.

Christian Decker goes on to say that: "The calls are becoming more frequent from the conventional footwear sector. They know that manual production often brings many challenges, especially in quality and want to follow the automation trend. The challenge has been finding appropriate automation methods to fit into their current production schemes." The fact that machinery manufacturers have been able to combine the strengths of electronic NC control with sophisticated engineering may well have sounded the death knell for the traditional labour force everywhere and, with it, the inherent advantages of low cost economies. On a more level automated global playing field, could the industry be about to turn full circle and Western countries bring footwear manufacture back home? 📍