



CREDIT: PFAFF INDUSTRIE MACHINEN AG

Hidden changes

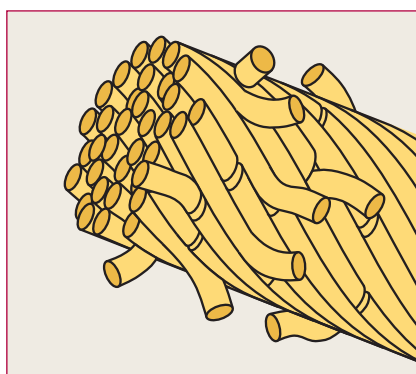
The past quarter of a century has seen great change in the footwear industry as highlighted in this special 25th Anniversary Issue of *World Footwear*. As far as the manufacturing side is concerned, these have often been radical and far reaching, such that shoe factories now look and operate very differently than they did in the past. However, the actual way in which the shoe itself is constructed remains essentially the same and nowhere more so than in the way upper components continue to be stitched together using sewing machines and thread just as they have been ever since Isaac Singer founded the Singer Sewing Machine Company in 1862.

Up until the development of nylon fibres in the late 1930s followed by polyester in the early 1940s, upper stitching threads were made from natural fibres. These were primarily cotton, with some silk, linen and hemp

used for specialist applications. The advent of the new synthetic fibres created a stitching revolution as they were stronger and had better elasticity. They also had greater resistance to needle fray which meant they were much easier to use. This improved 'sewability' in turn led to improvements in needle design as lighter weight and less bulky threads could be used and the speed of the sewing machines

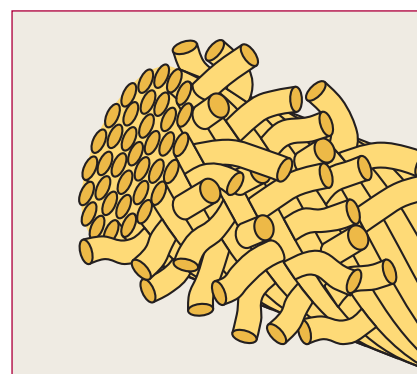
themselves increased.

The original synthetic threads were simply twisted and lubricated but, as sewing machines became faster and new upper materials began to be used, greater demands were placed on thread performance. By the early 1960s, speeds on automatic sewing machines were up to 5,000 stitches per minute and the basic twist-spun type of thread could no longer cope.



Spun thread

CREDIT: AMANN GROUP



Core-spun thread



sabaC polyester core-spun thread

CREDIT: AMANN GROUP

CORE-SPUN THREADS

The solution lay in the development of core-spun threads that could withstand the extra heat and friction created by the needle moving at the higher stitching speeds involved. Early examples used a combination of polyester/cotton to create a more efficient thread construction. This was followed at the end of the 1970s by a significant advance with the appearance of polyester/polyester core-spun threads, which are still widely used today.

Core-spun threads differ from conventional spun threads. Spun threads have single yarns consisting of short, cut staples joined by twisting. Core-spun threads, on the other hand, have yarns consisting of a multifilament core surrounded by fine fibres which combine the strength of multifilament threads with the good sewability and surface appearance of those made from spun yarn. The core usually comprises two-thirds of the thread and the cover one third, with the core sheathed but not fully covered. As with those made from fibre yarns, core-spun threads have a smooth grip and textile surface but, due to the combination of multifilament and spun fibres, both strength and abrasion resistance are far higher.

These threads also have outstanding sewability even in difficult applications such as multi-directional sewing operations. Amann Group from Germany has been producing sewing threads for more than 150 years and is a major supplier of core-spun threads. Its sabaC 100% polyester core-spun thread runs very well in all sewing applications and on all types of machine from standard high speed through to high-tech automated systems.

Most footwear uppers, however, are now stitched using threads made from continuous polyamide or polyester filaments. Amann's Serafil is an all-purpose 100% polyester thread noted for its outstanding breaking strength, high abrasion and thermal resistance, well-balanced elongation and good light and weather fastness properties. Having said that, core-spun sabaC with its textile structure nevertheless remains a viable alternative to smooth continuous filament threads.



Serafil polyester continuous filament thread produces a neat seam

CREDIT: AMANN GROUP

BONDED NYLON THREADS

There are, however, many applications where greater tensile strength is needed and this is where nylon, or to give it its correct name, polyamide fibres score as they can be anything up to 25% stronger. Core-spun nylon threads also have better abrasion resistance and this made them ideal for use in sports shoes. The past 25 years has seen phenomenal growth in the sports and outdoor footwear sectors and the quest for ever better performance in turn led to the use of new high performance upper materials that sometimes proved difficult to stitch on high speed automatic machines. Furthermore, this type of footwear is often exposed to adverse or wet conditions, so the thread must also be extremely strong, able to withstand abrasion and be water resistant.

The thread manufacturers responded and invented 'bonded' nylon threads with a special coating that allowed for even higher speed sewing and a wider variety of footwear materials to be used. Netbond from Italian thread manufacturer CT Point is one of these. A conventional twist construction thread, made up from continuous polyamide filaments, it has then been impregnated with a urethane resin to bond them together. The filaments are in effect 'welded' to each other so that there can be no untwisting or opening during stitching and no frayed ends when cut. The thread can be used at high speed on even the most difficult materials used in snowboarding boots and other advanced types of sports orientated footwear due to a double coating of lubricant which stops the needle overheating and prevents the thread melting.

VERY SPECIAL THREADS

US thread producer American & Efird, among the largest producers of industrial sewing threads in the world, has long been regarded as a technological innovator. Its huge range now includes not only all the regular types of core-spun and continuous filament threads, which it supplies in substantial volume to footwear producers, but also highly specialist products such as Anefil Nylon DRY, a proprietary



The filaments of Netbond are welded together to prevent untwisting or opening during stitching

CREDIT: CT POINT

product certified by W.L. Gore and specified for use in branded waterproof shoes and boots utilising Gore-Tex to achieve the ultimate in moisture wicking prevention.

Another footwear sector imposes even greater requirements on the threads used: firefighters' boots and work boots, to resist molten metal in the steel industry as well as other areas where heat, fire, or extreme exposures pose extreme risks. The fibres used to produce these threads are Meta and Para-Aramids such as Dupont's Nomex and Kevlar or Teijin's Twaron. Only technologically advanced materials such as these are capable of producing seams able to survive in even the worst environments and where the footwear requires the strongest possible seam strength.

A&E's newest product is its Vectran footwear thread aimed at boots for the mining industry and similar sectors where strength and durability are pushed to the limit in conditions where high abrasion, variable temperatures and chemical and acidic/caustic environments are all possible. Mark Hatton, director marketing and sales, says: "We are particularly excited by this new product. Vectran is a high-performance multifilament yarn spun from liquid crystal polymer (LCP) by Kuraray in Japan and is the only commercially available melt spun LCP fibre in the world. It exhibits exceptional strength and rigidity being pound for pound five times stronger than steel and ten times stronger than aluminum. It is the toughest footwear thread yet."

CHANGING FUNCTIONS

In the past, sewing was regarded as just a basic but

essential process in producing clothing and footwear. Seams were kept to a minimum and designed to be as least visible as possible. A minimum of colours was used, with brown, tan and white predominating in the footwear industry. The arrival of stronger threads made from synthetic fibres allowed thread sizes to be reduced and a wider palette of colours to be created.

Now, as well as forming a functional part of a shoe's construction, upper stitching thread has also become an important visual element of its design. Whether in unique top stitching patterns, heavier than required threads or merely contrasting colours, threads are used to emphasise shape and function as well as visual appeal. The variety of shades now available is almost limitless due to the development of computerised colour matching and threads are now used in a much wider range of sizes than ever before.

Some would argue that the evolution of sewing machines has been made possible through the development of higher performance threads. But, as machine technology was developed and refined, the reverse occurred and created a need for higher performance thread. But this is how progress is always made. A&E's introduction of its Vectran thread clearly illustrates that as fibre developments advance, so will the opportunities to use them in footwear.

While sewing machines are now more sophisticated and thread is made from synthetic rather than natural fibres, the actual method of creating the seam remains the same simply because a more efficient and effective way to achieve the same end result is yet to be found. Indeed, unlike the cutting and making departments in a modern shoe factory, a glance into the stitching department does not reveal many apparent differences compared with 25 years ago.

There has been change, nevertheless, not in the way things are done but in the threads that are now available. Back then, it was a simple choice between nylon and polyester. Now, new generations of synthetic fibres have enabled thread manufacturers to create a step change in the way stitching threads perform. While we may still be using stitched seams to create shoe uppers, we are producing much better ones than ever before. 



Vectran is the strongest thread for footwear produced so far

CREDIT: AMERICAN & EFIRD