



Clarks Desert Boot – a style classic simply constructed.

CREDIT: CLARK'S ORIGINALS

Footwear Fundamentals: Part 1

WHICH CONSTRUCTION?

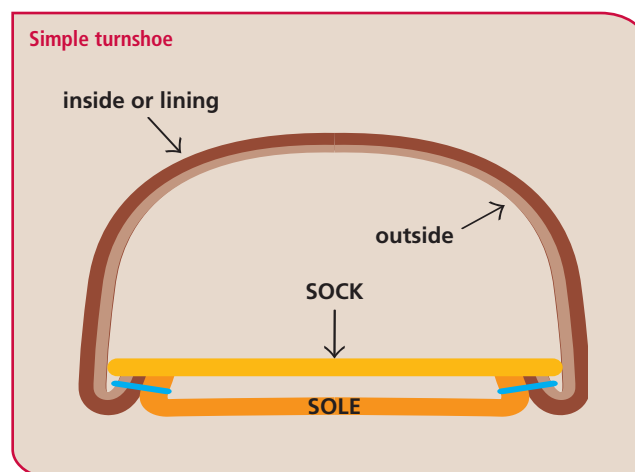
Until quite recently, man used natural materials and techniques for his shoes. At first, uppers and soles were cut from the hides of the animals he ate and their sinews bound them together. He then gradually learnt how to tan these hides for greater strength and longevity, to spin natural fibres into sewing threads and to produce sewing needles from a succession of ever more refined materials. He also made them purely for himself and his immediate family. When specialist shoemakers finally appeared, they also worked alone or perhaps with one or two apprentices, right up to the early 19th century.

The only successful attempt to industrialise the manufacture of footwear prior to that time in fact came with the Roman army boot, which was mass produced to a standardised pattern and used iron rivets to secure the sole to the upper and to resist the many miles of marching they were subjected to across the vast Roman Empire. Other armies down the years were shod with whatever the government of the time could buy from a mass of individual shoemakers, so both quality and reliability varied greatly. The individual citizen – if he or she could afford shoes – also went to the local shoemaker.

Footwear remained fundamentally unchanged for centuries and followed two basic constructions, the simple force lasted turnshoe and, from the late Middle Ages on, a

more complex process where the upper was pulled down to a wooden last before the sole was attached via a strip of leather called a welt. Modern shoe constructions are all descended in one way or another from these two original techniques.

The turnshoe was simple and flexible but did not stand up to hard wear and could not be repaired easily. The hand welted construction, on the other hand, was durable and could be repaired simply by sewing a fresh sole on. A division soon appeared whereby hand welting became the standard for men's and all other heavier boots and shoes,



while turnshoe was confined to lighter footwear for women and children. This split approach has broadly continued to the present day even though the actual constructions may have changed.

The mass industrialisation that dominated the 19th century led to rapid change in the way footwear was made and the welted process became almost universally adopted for both genders and almost all ages through variations on the machine welted process developed in America by Charles Goodyear during the course of the 1870s. The cost of shoes fell dramatically, quality improved and footwear sales boomed. Turnshoes, however, did not lend themselves to mechanisation, remained expensive and soon fell into decline. This drive to lower the cost per pair has been behind most constructional innovations ever since.

SPOILT FOR CHOICE

Today we have access to a greater variety of footwear constructions than ever before and choosing the right one is not always easy as there are so many considerations depending on your starting point. If you have inherited a Goodyear welted factory, high quality welted shoes are your only real option. If it is a factory equipped for direct vulcanisation, you are equally restricted in what you can produce. If you are starting from scratch, then you will be wise to look for the most cost-effective construction which at the same time offers the greatest flexibility in the market sector you are aiming for and your capital budget can support. If, on the other hand, you are sourcing complete footwear, then it is a case of choosing a supplier who has the construction you have decided you need and who offers the best price, quality and supply package.

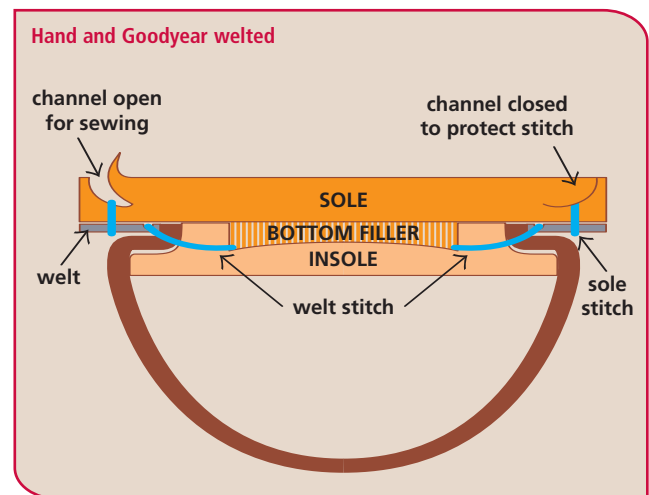
In either instance it is helpful to understand the basic strengths, weaknesses and possibilities of these constructions. If we ignore turnshoe, we can see that the others always combine two out of four basic criteria.

1. Pulling an upper over a last and securing it to an insole before attaching a sole either directly or indirectly.
2. Forcing a last into an upper 'bag' or forcing the bag over the foot form of a moulding machine.
3. Attaching a sole directly by stitching, cementing or direct moulding.
4. Attaching a sole indirectly and usually by sewing and stitching.

WELTED

Combining one and four, this is the construction of choice for high-grade men's shoes. Shoes made this way are repairable, flexible, keep their shape and once, bedded in to the wearer's foot shape, are very comfortable.

Hand Sewn – a very few, very exclusive shoes are still made in the welted construction entirely by hand. They are usually made to measure with most customers having their own lasts kept with the shoemaker. The method has changed little since Medieval times and is used in a modified form by Bespoke Western boot makers in the US.



Goodyear or machine welted – the construction closely mirrors hand sewn and retains its excellent characteristics. The upper is lasted on to an insole with a rib cut into the underside (hand) a little way in from the edge and finishing just above the heel each side, or a strong fabric and board rib similarly placed, but attached with adhesive (machine). Surplus upper material above the rib is trimmed off and a narrow strip of leather (the welt) is wetted and sewn in with a chain-stitch through the upper and on to the rib. This 'inseam' is trimmed as flat as possible and the welt beaten flat and horizontal to the shoe bottom. The ends of the welt are bevelled to receive a seat lift, a wooden shank is stuck to the waist and the cavity inside the rib, filled with cork compound bottom filler. The sole is now temporarily attached with adhesive and rough rounded to shape by a machine which also cuts a channel or groove to take the sole stitching. A lock-stitch seam finally attaches the sole to the welt, a heel is nailed on and a range of trimming and finishing operations are used to finish the shoe.

The end result is an aesthetically pleasing and, if well looked after, shoe that will provide long service for the wearer. Each of these numerous operations however, requires great craft skill and the whole process is both labour-intensive and expensive. Goodyear welted was virtually wiped out in the second part of the last century as cheaper alternatives were developed and, although the surviving factories have a steady business, it remains a niche product as manufacturers rely on a degree of exclusiveness when marketing their products.

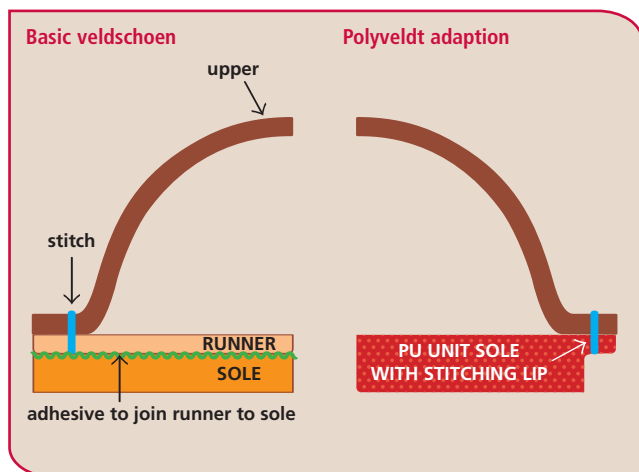
Doctor Martens – there are many variants of the welted process with 'Doc' Martens perhaps the best known having been a fashion icon for so many years. In this construction, an extruded PVC welt is sewn to the lasted upper to which a moulded PVC sole with an inserted foam filler is welded rather than stitched. The edge only needs light trimming as the sole is shaped to match the outline of the welt. It is cheaper to produce than conventional Goodyear welted and extremely simple to repair. It also offers exceptional comfort for people such as policemen who spend a great deal of time on their feet.

VELDTSCHOEN

Again combining one and four, this is a simple stitched construction that is capable of producing extremely flexible footwear. Probably the most famous example is the immortal Clarks Desert developed during World War II for use in the desert and which has since become a style classic. The upper is lasted down and out to an insole or runner that has an extended lasting margin all round the feather edge of the last. This is then lock-stitched through and a sole and heel unit stuck on. The edge is then trimmed close to the stitching and finished if thought necessary. The potential combinations of upper and soling materials are immense and the construction is ideal for simple casual footwear for both genders and all ages.

Conventional looking veldtschoens can also be similarly produced by stitching the upper to an oversize insole or runner using a specialist machine such as those made by Ciucani in Italy. A last is then forced in, the upper heat set and a sole unit stuck on. While not quite as economical as the Polyveldt system, it is ideal for small low-cost enterprises as lasting machines have been eliminated.

The construction can be further simplified as in the case of the various developments of the original Clarks Polyveldt. The upper is stitched directly to the edge of a specially moulded PU sole unit again using a Ciucani type lock-stitch machine. A last is then forced in, the upper heat set and a sock added to complete. No finishing is necessary as there is no surplus upper material to remove, which also means a considerable saving in upper material. A highly comfortable construction and simple to produce as once again no lasting machines are involved



CEMENTED OR STUCK-ON

Combining one and three, this is the most flexible and adaptable construction currently available. It allows almost any type of sole to be attached to almost any type of upper and in almost any shape or size using heat reactivated adhesives. The flat lasting aspect involves pulling an upper over a last and securing it all around with tacks, hot-melt adhesive or a combination of the two as is frequently used on the waists and seats of high-heeled women's shoes for extra strength and rigidity. Highly sophisticated CAD-

controlled lasting machines now make this all very easy as they can accommodate almost any type of shoe or toe shape and combine high output with excellent quality. Only two machines are usually necessary, one for the forepart and one for the waist and seat. They are, however, extremely expensive.

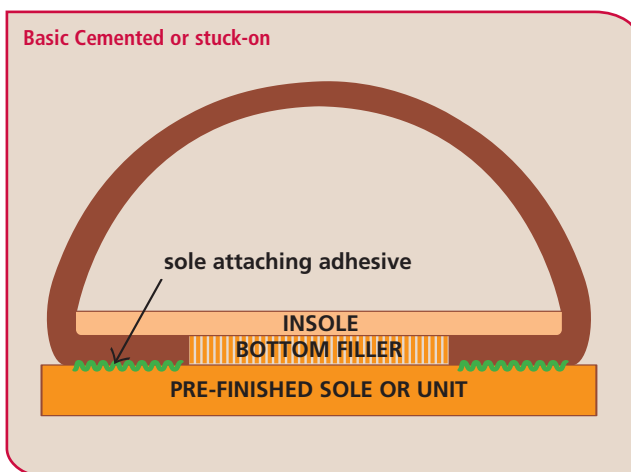
Attaching soles by adhesive only became really practical in the early 1950s with the development of polychloroprene (neoprene) and then polyurethane. These synthetic polymers were originally dissolved in volatile hydrocarbon solvents and the system still works well. More recently, environmental and health considerations have led to the introduction of water-based adhesives using these same highly effective base polymers. These have in turn led to the adoption of drying tunnels or chambers to ensure adequate drying of the adhesive.

Introduction of this process was a major breakthrough as up to that point, soles had to be riveted or stitched to the shoe bottom and then finished in the same way as a welted shoe. Soles could now be pre-finished before attaching and unit soles could be moulded or fabricated in a wide range of materials and styles. The reliability of modern adhesives and the development of ever more complex and sophisticated moulded sole units have made cemented the number one construction for the industry.

There are, however, five points to watch out for as a cemented shoe stands or falls on the quality of its sole bond.

1. Adhesives must be performance tested with all materials involved.
2. Lasted margins must be as flat as possible and adequately prepared, according to the material involved.
3. Soles must be similarly prepared according to their type.
4. Adhesive supplier recommendations must be followed in every respect.
5. Activation temperatures and sole press times must be regularly monitored.

This completes the first part of the fundamentals of footwear constructions. The second part appears in the Jan-Feb 2009 issue of World Footwear and will cover vulcanising, injection moulding and the application of robotics, plus constructions that do not need lasting machines.



“...and it should be noted...”

SHOEMAKER'S DRAFTING SEQUENCE

Modern shoe making is a mix of high-tech machines and ancient craft principles, so when looking at fundamentals it is also appropriate to consider old techniques and learn from them. This diagram shows the hand shoemaker's drafting sequence used for centuries to pull the upper down to the last and followed by its modern counterparts.

