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Further Advances in Special Footwear and Moulded Soles

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Until recently boots for badly deformed feet of leprosy patients have tended to be very clumsy, broad and heavy looking. In many cases this has been a deterrent to the patient to wear the shoes. The use of tailor-made plastic lasts (Girling *et al.*) has helped to reduce some of this bulk but we were still left with boots that have the typical broad heavy welt that is associated with hand-made footwear. To overcome this a non-welt method of construction has been developed using an applied sole process that is similar to modern methods of shoe construction. With this modern method a high quality of adhesive is used along with special presses both of which are expensive. To reduce the cost we have used an open toe design of upper which allows us to stitch right round the inside of the sole through to the bottom sole with a strong locking stitch. This makes the construction strong enough and eliminates the need for the strong adhesive and special press.

METHOD

The upper of the boot is made in the usual way using an open toe design. In order to hold the foot firmly in place on the moulded sole and to act as a supporting edge to the plastic mould, a heavy bark tan leather heel counter is used. This stiffener extends to just behind the metatarsal heads. It is placed between the lining material and the upper leather and is blocked on to the last while it is wet so that it takes the exact shape of the last. This method of heel counter is only used when a plastic tailor-made last is used, as only then does one have the exact shape of the foot to work with.

The insole is positioned on to the bottom of the last in the usual way and the upper is lasted in place and held with nails. Normally the welt would now be stitched in place; instead the edge of the upper is trimmed to not less than 6 mm. from the edge. The upper is stitched to the insole and the nails removed (Fig. 1). A metal shank piece is placed from the heel to just behind the metatarsal heads (Fig. 2). To prevent the moulded sole from cracking and also to prevent extension of the metatarsal-phalangeal joints at toeing off the fore part of the boot is also made ridged. This is done by incorporating a cork roll in the sole. A piece of cork 15 mm. thick is positioned on the sole and rasped to the required shape. The edges of the cork are then covered with leather (Fig. 3). The rubber sole is stuck into position using a medium grade

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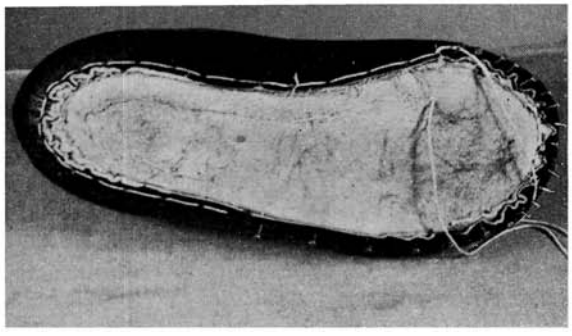

FIG. 1
Showing the stitching of the upper direct to the inner sole.

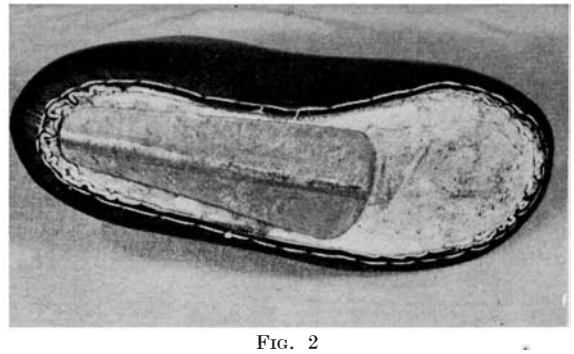

FIG. 2
The metal shank piece in place made from 16 gauge mild steel sheeting, with a ridge down the centre for strength.

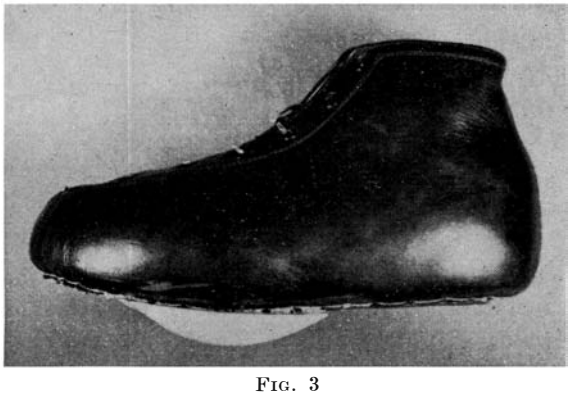

FIG. 3
The cork roll after the cork has been rasped down to shape and the edges covered with sheepskin.

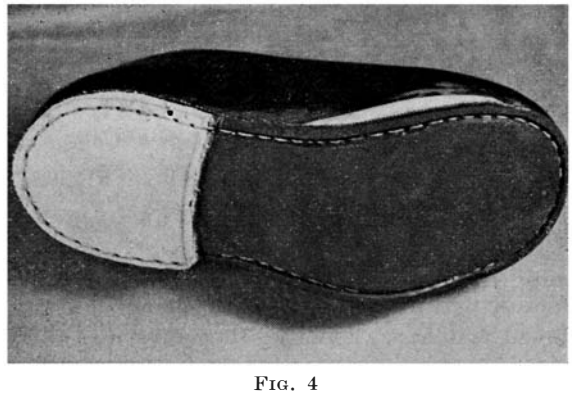

FIG. 4
The sole of the boot showing the locking stitch that passes right through to the inner sole. The heel has yet to have further pieces glued and nailed in place so as to bring it up to the same height as the roll.

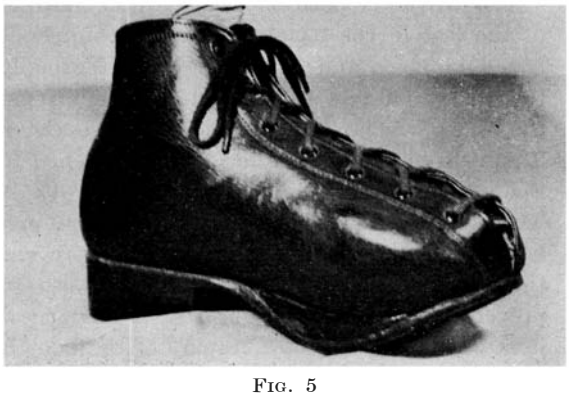

FIG. 5
The finished boot showing the open toe design and the roll. The improved lines and neatness can be compared with Fig. IX of the previous paper, 'Experimental Moulded Soles and Shoe Lasts'.

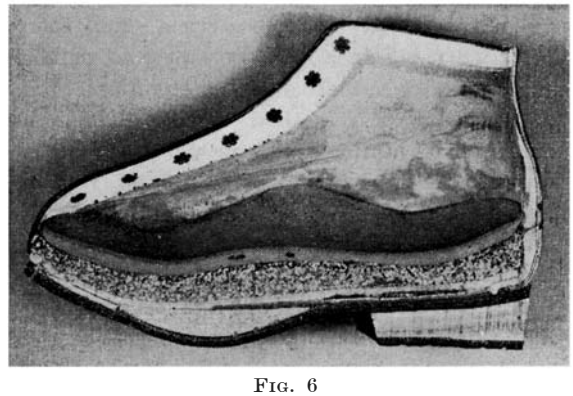

FIG. 6
The same boot cut in half to show the microcellular rubber insole, the cork and polyester planned distribution of pressure mould; good pressure is being taken under the medial arch and reduced pressure under the scarred head of the first metatarsal head. At the toes the locking stitch can be seen, also the shape of the cork roll and the length of the metal shank. At the heel the heavy bark tan heel counter can be seen.

adhesive. Two layers of the heel leather are stuck in place on the sole. The last is removed and the locking stitch using a strong thread is done right round the inside of the boot through to a stitching channel that has been cut in the bottom sole (Fig. 4). The rest of the heel is stuck and nailed in place so that it is the same height as the roll (Fig. 5).

MOULDED SOLES

The success of moulded soles for the prevention of ulcers in deformed feet has now been realized. Various materials for making the moulds have been tried out and it was thought that the answer had been found by using rubber latex and cork granules (Girling *et al.*). Over a period of time it was found that the cork and latex even though protected by a layer of microcellular rubber did not have the lasting qualities needed. The soles disintegrated and the patient was left with a thin sheet of microcellular rubber as the only protection between him and the sole of the boot. Further studies were carried out and it was found that polyester resin and cork granules have the initial moulding qualities as well as the necessary durability.

METHOD

Polyester resin and cork granules are used to make the mould. The polyester resin is mixed in the standard way (Polyester Hand Book). About 50 to 70 grams of resin are needed for each boot. The cork granules are mixed into it to a consistency so that the granules are wetted and stick to each other.

There are two ways of forming the mould. In the first method the aim is to produce a mould that is the same shape as the walking foot. The second method is to make a mould that will distribute greater weight on to parts of the foot that are not scarred and substantially reduce the pressure taken on the scarred areas.

To make the first type of mould the cork and polyester mixture is distributed in the boot nearly evenly with only a little more in the areas of the arch and a little less in the areas where the foot is prominent. The microcellular rubber insole is placed over it and the boot is put on the patient's foot. The patient stands and then walks about gently for a minute, he then sits while the polyester resin sets.

To make the second type of mould that has the planned distribution of pressures, the sole of the foot is studied and its exact position in the boot is observed before the cork and polyester is mixed. The cork and polyester is mixed and distributed in the boot so that there is a substantially greater quantity in the areas where the non-scarred parts of the foot are going to be and very little under the scarred areas (Fig. 6). The microcellular rubber insole is placed over it. The patient stands and takes 3 or 4 steps only. He then sits while the polyester resin sets. The boot is removed and the positioning of the mould is checked by eye; a method of accurately checking the mould is still to be developed. When the planned distribution of pressure mould is used the patient should be kept under observation for at least a week. In the event of the mould giving too high a pressure in any one place, the microcellular rubber insole is removed and that area of the mould is rasped down.

MICROCELLULAR RUBBER INSOLE

This insole which is placed over the cork and polyester should be made from 15 shore microcellular rubber 7 mm. thick. The rubber is cut out so that it is 5 mm. wider than the last all the way around except in the front where it is the same size and in the area of the medial arch where it is 10 mm. wider. The underside of this extra width of rubber is skived so that it will easily curve up around the foot and help encase it snugly in place on the mould.

This special type of footwear is expensive. So special care should be taken when prescribing such footwear that the patient is a suitable type. The best designed and made footwear is not sufficient alone to keep a patient free of ulcers. The patient himself must have a determination and incentive to be ulcer free. These complicated and costly boots will not work when used for the deformed feet of beggars and other patients who lack the necessary incentive. But they will work very successfully on patients who have been

truly rehabilitated and who realize the dangers and horrors of ulcers as well as the financial implications when an ulcer means loss of working hours. For the patient with deformed feet who is to be rehabilitated a well planned and made boot is a necessary part of his rehabilitation.

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