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FOOTWEAR AND THE MANUFACTURE THEREOF

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My invention relates to improvements in footwear such as a boot, shoe, etc., and the manufacture thereof and more particularly to the insole construction as affected by the use or employment therein of sponge rubber, and, again, particularly sponge rubber of the type in which the pores or cells constituting the sponge are interconnected.

In the manufacture of footwear in general, it is well known that the surface of the insole portion of the footwear is, for convenience in manufacturing, virtually flat, whereas the bottom of the human foot is contoured in accordance with the disposition of the bone structure and the flesh pads covering these bones.

In general, the weight of the body is normally borne by three points in the foot, namely the os calcis, or heel bone, and the first and fifth metatarsals, or large and small toe bones.

These three points are normally in direct contact with the insole of the shoe, and are so to speak, supported by the shoe.

Other parts of the foot are not normally in direct pressure contact with the insole and are not supported to the same extent.

Due to this lack of support, and other reasons, there is a tendency for the muscles of the foot to collapse, in varying degrees causing other portions of the foot to strive to get in contact with the insole, to gain support, or relieve pressure on the primary supporting points.

Hitherto it has not been considered practicable to manufacture footwear with an insole surface more nearly approximating in contour to the sole of the foot, for many obvious reasons.

Considerable ingenuity has, however, been displayed in developing corrective insoles and supports to correct muscle collapse which has already taken place, or which is imminent.

In the main, such supports have been rigid, or semi-rigid, and whilst they correct collapse, they do not normally cure collapse by reason of the fact that such supported muscles are not called upon to do any exercise.

In the provision of resilient insoles in footwear, such as, for example, the types known as sponge insoles, (usually sponge rubber) there is a certain amount of massaging action on the bottom of the foot which is beneficial in its effect on the muscles, in addition to its cushion insulation effect from the point of view of shock reduction.

Such insoles, however, are usually made flat, so that their extra supporting action is limited to a region around the points of greatest pressure.

The absence of contouring in such insoles prevents that beneficial massaging and supporting action being given to regions of low pressure, such as the arch.

Whilst it would be impracticable to produce a fully moulded contoured sponge insole to suit all types of feet, owing to the diversity factor, it is feasible and is the object of this invention to produce a sponge type insole in the flat form of such a nature and composition that it can become self-moulded in situ by the wearer, thus assuming a contour which more nearly approximates the sole of the foot and giving permanent but resilient support to the low pressure areas of the foot, in addition to acting as a shock insulator to the high pressure points.

According to this invention, in footwear such as a boot, shoe, etc., the insole comprises a basic layer of reinforced vulcanised sponge rubber upon which is superimposed a layer of sponge rubber which is more resilient and has less reinforcing than the basic layer, and has its vulcanisation characteristics so adjusted that it is capable of initial, partial, local deformation and which has its permanent set characteristics so adjusted that such initial deformation ultimately becomes permanent through vulcanisation in situ.

The basic layer is fully vulcanised and resilient and is by reason of its degree of vulcanisation, low in permanent set.

This layer can be of the order of one-eighth of an inch in thickness and functions as the permanent shock-absorbing layer with low deformation characteristics.

Such an insole when placed in a shoe, and prior to use would be of a uniform thickness and after the shoe had been worn for a period the insole would assume contours approximating and complementary to those of the foot parts contacting therewith and in due course this shape would become permanent through vulcanisation in situ.

This displacement of material of the upper layer from the pressure regions to the non-pressure regions, during the initial deformation readjusts the support over the whole foot and becomes permanent.

The basic lower layer remains unchanged and acts as a shock absorbing layer whose only deformation is that occasioned by local pressure and is non-permanent.

The upper layer still retains a certain amount of porosity and resilience after its deformation and after it has become fixed.

An example of the two types of sponge rubber compositions from which the adjustment of vul-

canisation characteristics can be appreciated is as follows:

For the basic layer of low permanent set and non-deformable—

(1)	Rubber	100
	Sulphur	5
	Reinforcing fillers	30
	Softeners	26
	Antioxidants	1
	Zinc oxide	2
	Mercaptobenzothiazole	0.54
	Zinc diethyldithiocarbamate	0.4

This is inflated to twice its volume.

For the upper, deformable layer of high permanent set—

(2)	Rubber	100
	Sulphur	2.64
	Colour	1.0
	Softener	3.0
	Antioxidant	0.5
	Zinc oxide	2.0
	Mercaptobenzothiazole	1.5

This is inflated to two and one-half times its volume.

The two layers may be coincidently vulcanised at a temperature approximating that at which the vulcanisation accelerator combination in the No. 1 mixing reacts (which is lower than the temperature at which the vulcanisation accelerator in the No. 2 mixing reacts) and the basic layer will develop full physical characteristics whereas the upper layer will not.

An approximate temperature of vulcanisation can be 105° C.

The physical characteristics of the upper layer will develop over a long period of time (that is, during wear) after the desired deformation has taken place, consequent upon the initial pressure during wear.

It will be understood that rubber is used generally or in a descriptive sense in the specification and claims and will include not only compositions comprising natural and artificial rubber but all compositions having the necessary physical characteristics, such as resilience.

Having now particularly described my invention, I claim:

1. A method of making an article having a lower layer resistant to permanent deformation and an upper layer less resistant to permanent deformation but capable of taking a permanent set which comprises incorporating in a vulcanisable composition for said lower layer an accelerator effective at a low temperature, incorporating in a vulcanisable composition for said upper layer an accelerator effective at a relatively higher temperature and vulcanising said compositions between said temperatures.

2. A method of forming cellular rubber articles having a layer more resistant to permanent deformation and a layer less resistant to permanent deformation which comprises vulcanising a foamed rubber composition for said more resistant layer at a temperature at or above its vulcanising temperature and vulcanising a foamed rubber composition for said less resistant layer at a temperature below its vulcanisation temperature.

3. An insole for footwear which comprises a lower basic layer of reinforced spong rubber and an upper layer of sponge rubber superimposed on said lower basic layer, said lower basic layer being vulcanized to substantial completeness and resistant to any substantial permanent set, said upper layer being more easily deformable than said lower basic layer and incompletely vulcanized and capable of initial, partial local deformation and ultimately of permanent set through completeness of vulcanization in situ.

4. An insole for footwear which comprises a lower basic layer of reinforced spong rubber and an upper layer of sponge rubber superimposed on said lower basic layer, said lower basic layer being vulcanized to substantial completeness and resistant to any substantial permanent set, said upper layer being more easily deformable than said lower basic layer and incompletely vulcanized and capable of initial, partial local deformation and ultimately of permanent set through completeness of vulcanization in situ, the composition of the lower basic layer comprising the following ingredients:

Rubber	100
Sulphur	5
Reinforcing fillers	30
Softener	26
Antioxidant	1
Zinc oxide	2
Mercaptobenzothiazole	0.54
Zinc diethyldithiocarbamate	0.4

and this composition is inflated to twice its volume.

5. An insole for footwear which comprises a lower basic layer of reinforced sponge rubber and an upper layer of sponge rubber superimposed on said lower basic layer, said lower basic layer being vulcanized to substantial completeness and resistant to any substantial permanent set, said upper layer being more easily deformable than said lower basic layer and incompletely vulcanized and capable of initial, partial local deformation and ultimately of permanent set through completeness of vulcanization in situ, the composition of said superimposed layer comprising the following ingredients:

Rubber	100
Sulphur	2.64
Colour	1.0
Softener	3.0
Antioxidant	0.5
Zinc oxide	2.0
Mercaptobenzothiazole	1.5

and this composition is inflated to two and one-half times its volume.

6. An insole for footwear which comprises a lower basic layer of reinforced sponge rubber and an upper layer of sponge rubber superimposed on said lower basic layer, said lower basic layer being vulcanised to substantial completeness and resistant to any substantial permanent set, said upper layer being incompletely vulcanised and capable of initial, partial local deformation and ultimately of permanent set through completeness of vulcanization in situ.

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