TITLE: ELEMENT SUITABLE FOR USE IN RETAINING THE SHAPE OF PART OF A SHOE UPPER, SHOE COMPRISING SUCH AN ELEMENT AND A METHOD OF MAKING THE SHOE

Abstract: A shoe shape-retaining element (14) is of generally U-shape to correspond with the top-line (22) of a shoe upper (12) around the heel region of the upper and is made of a shape memory alloy.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
ELEMENT SUITABLE FOR USE IN RETAINING THE SHAPE OF
PART OF A SHOE UPPER, SHOE COMPRISING SUCH AN
ELEMENT AND A METHOD OF MAKING THE SHOE

This invention is concerned with an element suitable for use in
retaining the shape of part of a shoe upper (for example the top-line of a
shoe upper around the heel region), a shoe comprising such an element
and a method of making the shoe.

The term “shoe” where used herein is to be understood as denoting
outer footwear generally whether ready for wear or in the course of
manufacture.

In many shoes the shape of the heel region of the shoe is achieved
and maintained by incorporating a heel end stiffener (commonly referred
to as a counter) between a lining of the shoe and an outer integument of a
shoe upper. In such shoes the top-line of the shoe upper around the ankle
at the heel is maintained by the upper edge portion of the counter. In
order to maintain adequate definition of the upper, and to give the top-line
sufficient shape and to give the required styling, the counter material
needs to be quite stiff. This stiffness can lead to discomfort to the wearer
in the region above the ankle of the wearer around the heel - the shoe may
be said to pinch. As shoes wear, the materials in the shoe relax to a
certain extent and the shoes are then said to be “broken in”. However,
this breaking in of the shoes also can result in a loss of clear definition of
the top-line of the shoe upper and of the general styling as the top-line
tends to bow outwardly. This is especially noticeable in ladies fashion
shoes but may also be a problem in other types of shoe.
One of the various objects of the present invention is to provide an improved element suitable for use in retaining the shape of part of a shoe upper.

Another object of the present invention is to reduce the tendency to discomfort associated with tight-fitting new shoes.

Another of the various objects of the present invention is to provide an element suitable for use in retaining the shape of part of a shoe upper for example the top-line, over a substantial period of time.

In one aspect the invention may be considered to provide an element suitable for use in retaining the shape of part of a shoe upper, the element being made of shape memory alloy, and the element having a shape corresponding with the desired shape of part of the shoe upper.

One preferred shoe shape-retaining element in accordance with the invention is of a generally U-shape to correspond with the top-line of a shoe upper around the heel region of a shoe upper and is made of shape memory alloy. Conveniently, a shape-retaining element intended for use at the top-line of a shoe upper is provided by a strip of shape memory alloy formed precisely into the desired U-shape of the top-line of the shoe in which the element is to be incorporated. Suitably, the element has a cross-sectional area of between 0.3 and 5.0 square millimetres and conveniently comprises a strip which has a width between 1mm and 5mm, and a thickness between 0.3mm and 1mm.

A preferred element in accordance with the invention is formed from a nickel-titanium shape memory alloy.
Alloys, now called shape memory alloys, having a shape memory effect have been known for over sixty years and may be provided by alloys of various metals known to those skilled in the art. Some shape memory alloys are available commercially and of these, nickel/titanium alloys are used commonly. Amongst the properties of known nickel/titanium shape memory alloys are their pseudo elasticity (or super elasticity). Such shape memory alloys resist permanent deformation even if bent severely and have a very high limit of elasticity; they also have a low modulus up to this elastic limit. Furthermore, they can be formed to a desired shape and thermally treated to set them into this desired shape.

Figure 1 shows the load extension curve for a standard material (for example mild steel) and the equivalent curve for a shape memory alloy suitable for use in making an element in accordance with the invention. The slope of the curve indicates the effective stiffness of the material. With the standard material eg mild steel, as strain increases the force increases; in contrast, with the shape memory alloy material the slope of the load extension curve is practically flat over a large range of deformation and thus increasing strain leads to minimal increase in the effective stiffness. This property is beneficial in an element in accordance with the invention. For example in the preferred shape-retaining element distortion in the top-line of a shoe upper which includes a shape-retaining element, in accordance with the invention leads to minimal increase in the loading on the ankle of the wearer. Effectively the ankle experiences a relatively small substantially constant force which tends to reduce discomfort experienced in shoes of previously known constructions.
Not only does the use of a shape-retaining element in accordance with the invention tend to reduce the level of discomfort which can be associated with a new shoe but also the supplementary reinforcement of the shoe upper provided by the element (for example in the top-line region reinforced by the preferred shape-retaining element) reduces the requirements for the counter itself; thus savings may be made in material in the counter region and as a lower performance counter may be used, costs of the counter may be reduced, thus compensating at least to some extent for the additional cost of the shape-retaining element.

In another aspect the invention may be considered to provide a shoe comprising an element in accordance with the invention secured to an appropriate region of a shoe upper.

In yet another aspect the invention may be considered to provide a method of making a shoe comprising procuring an element in accordance with the invention having a shape corresponding with the desired shape of part of a shoe upper which is to be reinforced and securing the element to said part of the shoe upper.

Preferably the part of the shoe upper which is to be reinforced is the top-line around the heel of the shoe and the element is disposed in a pocket between the outer integument of the upper and the lining of the upper and is secured to the upper adjacent the top-line by any convenient means, for example using a suitable adhesive.

A shoe in accordance with the invention including an element reinforcing the top-line, will usually also include a counter which itself is
incorporated in the shoe upper during manufacture of the shoe in a manner known to those skilled in the art.

Whereas the use of an element in accordance with the invention is especially beneficial in reinforcing the top-line in a shoe upper, an element in accordance with the invention may be utilised, if desired, in other regions of the shoe.

There now follows a detailed description, to be read with reference to the accompanying drawings, of a shoe shape-retaining element, a shoe, and a method of making the shoe, embodying the invention. It will be realised that this element, shoe and method have been selected for description to illustrate the invention by way of example.

In the accompanying drawings:

Figure 1 shows a load deformation curve for shape metal alloy and for a standard metal;

Figure 2 is a perspective view of a ladies' fashion shoe showing the position of an element in accordance with the invention;

Figure 3 is a view in section of the heel region of an upper showing the positioning of the element embodying the invention in a counter pocket of the upper; and

Figure 4 is a diagrammatic sectional view from above through the shoe upper at the ankle region of a wearer indicating the element embodying the invention in the counter pocket.
Figure 2 shows a ladies' fashion shoe embodying the invention, having a shoe upper 12 and a shape-retaining element 14 embodying the invention positioned at the top-line 22 of the shoe upper 12 around the wearer's ankle at the heel region of the upper.

As can be seen viewing Figures 2 and 4, the shape-retaining element 14 is of a generally U-shape and corresponds with the desired shape of the top-line of the shoe upper around the heel region.

The shape-retaining element 14 is made from a strip of shape memory nickel/titanium alloy, the strip having a cross-sectional area of about 2.0 square millimetres being about 4 millimetres wide and being 0.5 millimetres in thickness. A suitable alloy is supplied under the name NiTiNOL supplied by FURUKAWA ELECTRIC COMPANY and is of a type currently used in orthodontic wire. The strip is shaped round a suitable former, heated to a so-called training temperature and maintained at that temperature for a sufficient period of time for the shape memory alloy to become set in that shape - in other words it has a memory of that shape. After cooling to ambient temperatures, should the element 14 substantially be deformed from this set shape by an amount below its elastic limits its shape memory property will cause it to return to its set shape - that is in the present embodiment, the desired shape of the top-line of the shoe upper around the heel region.

A suitable "training" temperature is about 600°C and the element needs to be heated to that temperature for a suitable length of time, conveniently about 10 minutes, and is quenched by plunging into a water bath at ambient temperatures whilst still maintained in the desired shape.
The strip is thereby set in the desired shape to which it will return if deformed at ambient temperatures. By use of a suitable oven and a plurality of forms, a large number of elements 14 may be set to their desired shapes at the same time.

In the illustrative shoe, the shoe has a counter pocket formed between an outer integument 16 of the upper and a lining 18 of the upper. A shoe counter 20 (see Figure 3) is included in the counter pocket in a manner well known to those skilled in the art.

The element 14 is secured to the upper 12 adjacent the top-line 22 in the heel region by any suitable means, for example by a suitable adhesive namely a cyanoacrylate adhesive (so-called "superglue"). The element 14 is thus sealed within the upper, sandwiched between the outer integument 16 and lining 18.

The illustrative shoe 10 is found to fit the leg of a wearer closely at the ankle around the heel region without causing significant discomfort to the wearer, even with substantial distortion of the top-line 22. After removal of the foot from the shoe, the top-line 22 is found to return to its desired shape quite rapidly.
CLAIMS

1. An element suitable for use in retaining the shape of part of a shoe upper, the element being made of shape memory alloy, and the element having a shape corresponding with the desired shape of part of the shoe upper.

2. A shoe shape-retaining element which is of a generally U-shape to correspond with the top-line of a shoe upper around the heel region of the shoe upper and is made of shape memory alloy.

3. An element according to either one of claims 1 and 2 wherein the element has a cross-sectional area of between 0.3 and 5.0 square mm.

4. An element according to any one of the preceding claims wherein the shape memory alloy is a nickel/titanium alloy.

5. A shoe comprising an element according to any one of the preceding claims secured to an appropriate region of a shoe upper.

6. A method of making a shoe comprising procuring an element as set out in any one of claims 1 to 4 having a shape corresponding with the desired shape of part of a shoe upper and securing the element to said part of the shoe upper.

7. A method according to claim 6 wherein the part of the shoe upper is the top-line, the element is disposed in a pocket between the outer integument of the upper and a lining of the upper and is secured to the upper adjacent the top-line.
8. A method according to either one of claims 6 and 7 wherein the element is secured to the upper by adhesive.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A43B23/10

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

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