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(54) **FOOTWEAR WITH KNIT UPPER AND METHOD OF MANUFACTURING THE FOOTWEAR**

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(58) **Field of Search** 36/95 R, 45; 12/146 C, 12/142 G; 66/185, 186, 187, 188

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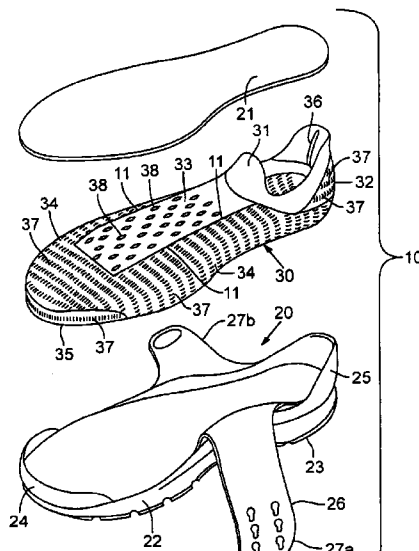
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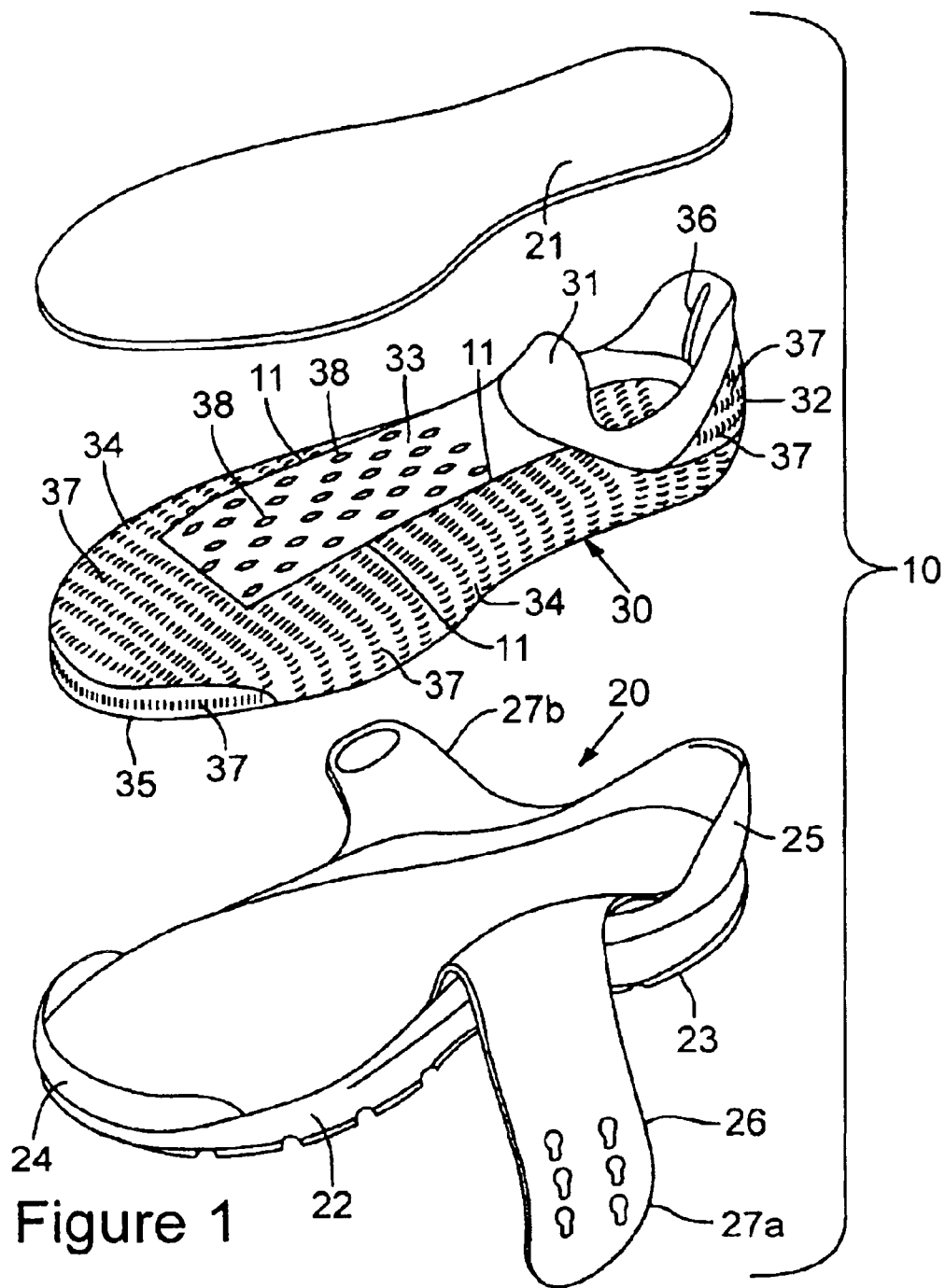
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(57) **ABSTRACT**

An article of footwear with a knit upper and a method of manufacturing the footwear are disclosed. The upper is formed through a knitting process to include a plurality of sections formed of different yarns and knits to provide the sections with different physical properties. In portions of the upper where sections formed of different yarns are in adjacent wales, a tuck stitch is utilized to join the sections. The method utilizes a circular knitting machine having multiple feeds that work together to knit the upper into a unitary, seamless structure. The multiple feeds, each of which provide multiple types of yarns, produce the sections to have varying physical properties.

30 Claims, 3 Drawing Sheets





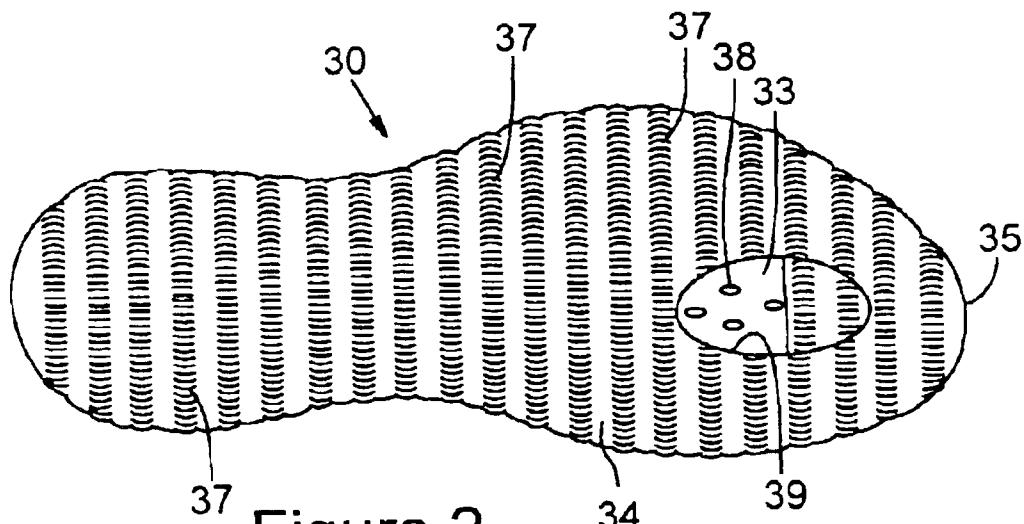


Figure 2

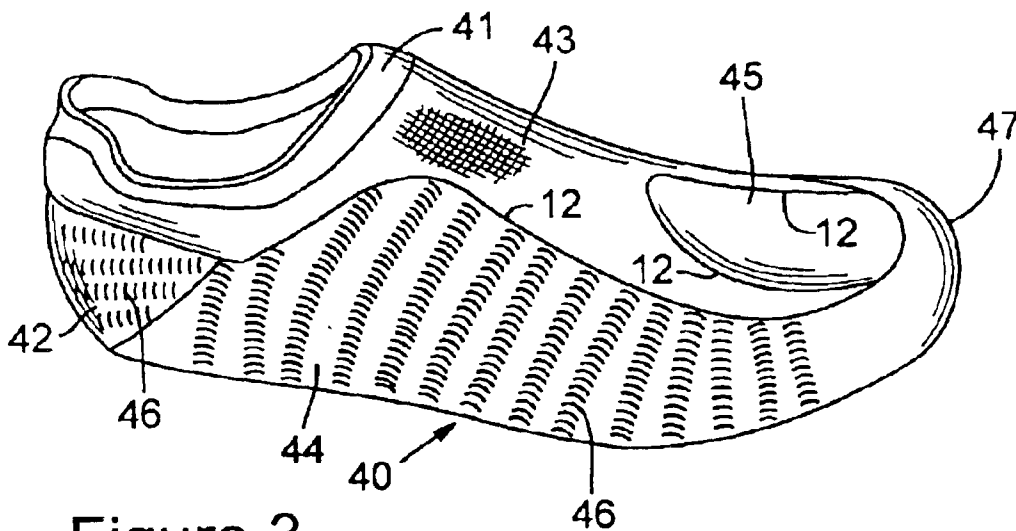


Figure 3

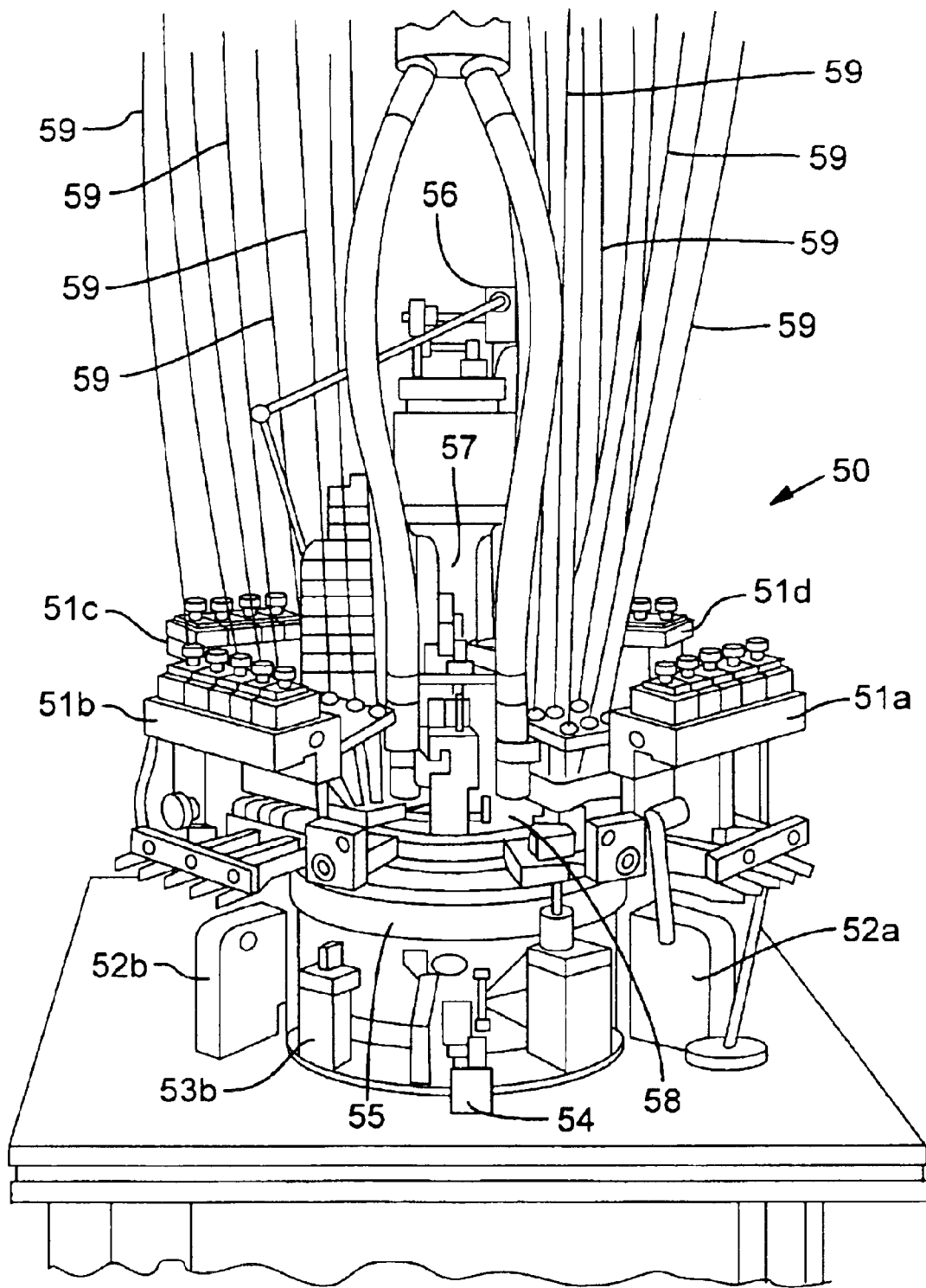


Figure 4

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FOOTWEAR WITH KNIT UPPER AND METHOD OF MANUFACTURING THE FOOTWEAR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to footwear and the manufacture of footwear. The invention concerns, more particularly, a footwear upper formed through a textile manufacturing process to have areas with different physical properties.

2. Description of Background Art

Conventional articles of athletic footwear generally include two primary elements, an upper and a sole structure. The upper is attached to the sole structure and forms a void on the interior of the footwear for securely and comfortably receiving a foot. The sole structure attenuates ground reaction forces and absorbs energy as the footwear contacts the ground, and often incorporates multiple layers that are conventionally referred to as a midsole and an outsole. The midsole forms the middle layer of the sole and serves a variety of purposes that include controlling potentially harmful foot motions, such as over pronation; shielding the foot from excessive ground reaction forces; and beneficially utilizing such ground reaction forces for more efficient toe-off. The outsole forms the ground-contacting element of footwear and is usually fashioned from a durable, wear resistant material that includes texturing to improve traction. The sole structure may also include an insole, which is a thin, cushioning member located within the upper and adjacent to a sole of the foot to enhance footwear comfort.

The upper of most conventional articles of footwear is generally formed from multiple material elements that are stitched and adhesively bonded together to form a comfortable structure for receiving the foot. Conventional athletic footwear may include, for example, an exterior formed of leather and polymer textile materials that are resistant to abrasion and provide the footwear with a particular aesthetic. Foam materials may be located on the interior of the upper to enhance the comfort of the upper, and moisturewicking textiles may be positioned adjacent the foot to limit the perspiration within the upper.

In a departure from the conventional upper described above, NIKE, Inc. of Beaverton, Oregon, United States manufactures athletic footwear with a knit upper under the PRESTO trademark. The knit upper includes a plurality of material elements that are formed through a knitting process. In manufacturing the upper, the material elements are cut from a larger element and sewn together along their respective edges to form a generally hollow structure for receiving a foot. The upper, therefore, includes a plurality of separately-formed, knit sections stitched together to form seams between the various sections.

Based upon the discussion above, the uppers for athletic footwear are generally constructed of numerous materials or elements. In manufacturing the uppers, considerable time and labor is expended in cutting the various elements to have a proper shape and size, and stitching or adhesively bonding the elements to each other. Consequently, these footwear manufacturing techniques are not only time and labor intensive, but also result in an undesirable amount of waste materials resulting from the trimming of the materials to make the elements.

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is knitted to have a sock-like structure in which areas subjected to greater wear and in which a lower degree of elasticity is desired are more densely fabricated to provide heavier weight and less extensibility than in other portions. This may be accomplished, for example, by changing the type of stitch. Other areas, such as the ankle portion, may be formed to have a ribbed construction to provide softness and elasticity.

SUMMARY OF THE INVENTION

The present invention is an article of footwear having a sole structure and an upper. The sole structure provides a ground-contacting surface, and the upper is structured to receive a foot of a wearer. The upper is attached to the sole structure and has a first section and a second section formed of knit materials. The first section is formed of a first yarn with a first physical property, and the second section is formed of a second yarn with a second physical property. The first physical property is different than the second physical property. The first and second sections are connected by tuck stitches that join the first section and the second section in a seamless manner.

Other methods of joining the first section and the second section may form tails, or ends of yarns, that are exposed and may cause the area between the first and second sections to unravel. By utilizing a tuck stitch, however, tails are not formed and the first and second sections are joined seamlessly.

A method of manufacturing an upper that is similar to the upper described above may be performed through three general steps. First, a first section of the upper is knitted from a first yarn having a first physical property. Second, a second section of the upper is knitted from a second yarn having a second physical property, with the first physical property being different than the second physical property. Furthermore, tuck stitches are knitted between the first section and the second section to join said first section with the second section. In order to perform the steps described above, a narrow-tube circular knitting machine may be utilized.

The advantages and features of novelty characterizing the present invention are pointed out with particularity in the appended claims. To gain an improved understanding of the advantages and features of novelty, however, reference may be made to the following descriptive matter and accompanying drawings that describe and illustrate various embodiments and concepts related to the invention.

DESCRIPTION OF THE DRAWINGS

The foregoing Summary of the Invention, as well as the following Detailed Description of the Invention, will be better understood when read in conjunction with the accompanying drawings.

FIG. 1 is an exploded perspective view of an article of footwear that incorporates an upper in accordance with the present invention.

FIG. 2 is a bottom plan view of the upper.

FIG. 3 is a perspective view of another upper in accordance with the present invention.

FIG. 4 is a perspective view of a narrow-tube circular knitting machine that may be utilized in manufacturing uppers in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

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