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Wilchusky

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[54] **FOOTWEAR HAVING TRANSPARENT PARTS**

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[52] **U.S. Cl.** ..... **36/34 A**

[51] **Int. Cl.** **A43b 23/26**

[58] **Field of Search** ..... 36/34 A, 34 R, 2.5 R, 36/1

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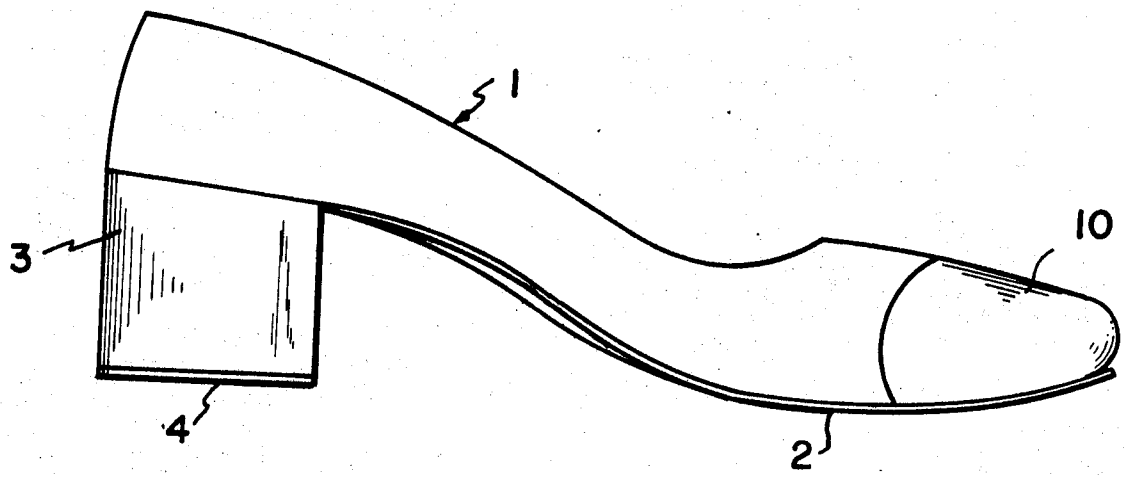
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[57] **ABSTRACT**

Footwear including a portion having a layer comprising a temperature or pressure sensitive liquid crystal system which changes color when the footwear flexes, as when the wearer walks. Footwear made at least partly of a transparent plastic material is preferred.

11 Claims, 6 Drawing Figures



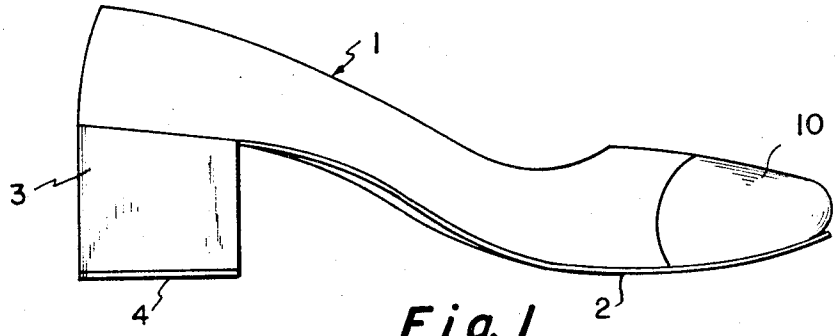


Fig. 1

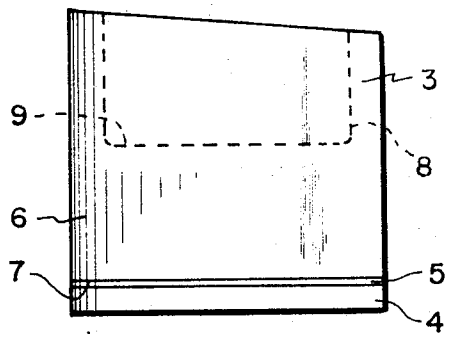


Fig. 2

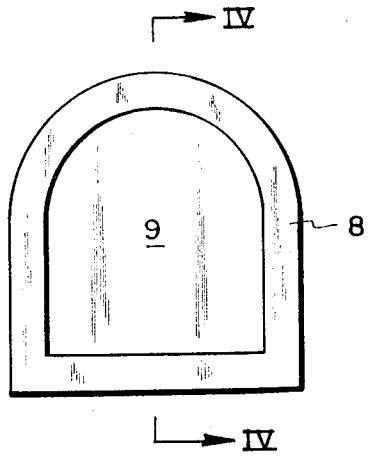


Fig. 3

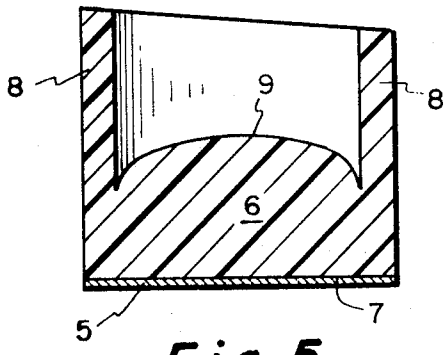


Fig. 5

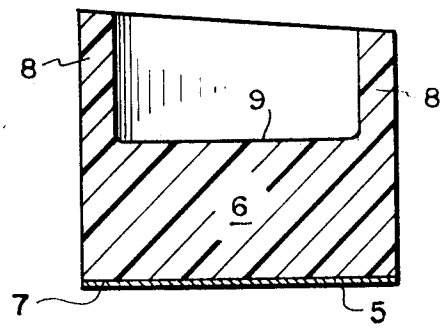


Fig. 4

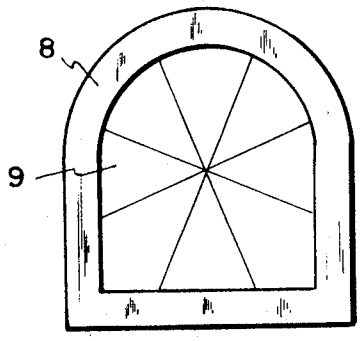


Fig. 6

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FOOTWEAR HAVING TRANSPARENT PARTS

The present invention relates to footwear and more particularly to shoe and boot designs provided with novel means for enhancing their appearance, namely by the use of liquid crystals.

It is well known that style changes in footwear, especially in women's and girl's footwear, generally take the form of changes in the so-called decorations applied to the footwear, such as buckles, bows, and more particularly color. The recognized desire of a woman to want to coordinate her wardrobe, that is, to match her clothes, handbag, and footwear generally results in most women having a large number of pairs of shoes and boots, of differing styles and colors. It is apparent that the important consideration is to wear attractive footwear which will complement the rest of the wearer's ensemble.

I have found that highly attractive footwear can be made using liquid crystals. Liquid crystals exhibit dramatic changes in color; they are highly sensitive to temperature and to pressure.

The surface of an object having a liquid crystal system will exhibit an array of vivid color due to discontinuities in the surface. The pattern is reversible — it will appear and reappear endlessly as the molecular structure of the system is changed. Yet the characteristics of the pattern will vary so that the appearance of a particular color at a particular location in the pattern cannot be predicted.

Liquid crystals are neither liquid nor crystal, but exhibit some of the properties of both states. Many flow like liquid and simultaneously exhibit the optical properties of a crystal by selectively scattering light. In one phase, chloesteric liquid crystals selectively reflect only one wave length of light at each angle and the reflected beam is circularly polarized. When light comes from more than one direction at the same time, a different wave length is reflected at each angle and the resulting mix of different colors is seen as iridescent. A change in temperature or other effect, such as that caused by a change in pressure, causes a shift in the molecular structure of the liquid crystal and thus, a different color at the same angle. As the liquid crystals are heated through their indicating span, for example, they will show a continuously varying color spectrum from colorless to red, successively through yellow, green, blue, violet, and again colorless.

Contemporary footwear, particularly women's footwear, comprise designs of many styles and materials. Most recently, shoes for women have been characterized by a relatively bulky heel. My invention is particularly suitable for footwear having such heels, although the concept of the invention is sufficiently broad to include the application of liquid crystals to footwear of other styles as well.

I have discovered extremely aesthetic footwear, such as shoes or boots, comprising a body portion and a heel portion, in which either or both portions are preferably made of transparent plastic material in which a liquid crystal system is applied to one or both of the portions. By the term "liquid crystal system" is meant liquid crystals in any form, such as for example, in solution or in encapsulated sheet form.

In one embodiment of my invention, I have provided a transparent heel having a base portion, to the bottom surface of which is applied a liquid crystal system. The system is preferably applied as a layer of approximately 1–50 mils by spraying, brushing, dipping or other suitable means. A dark colored or black backing material which may be a conventional top lift is then applied to the liquid crystal layer. The top lift is preferaby made of a non-porous material. The layer of liquid crystals is thus sandwiched between the transparent heel and the top lift and may be viewed through the transparent plastic heel.

The upper portion of the transparent heel may be hollowed out to provide an optically light refractive surface which is substantially in a plane parallel to the layer of liquid crystals. Preferably the refractive surface is curved or shaped, in concave, convex, faceted or other form. I have found that such a refractive surface substantially enhances the aesthetic appearance of footwear including the liquid crystal system.

If my specification is followed in the practice of the invention, those skilled in the art will be able to witness for themselves the distinct improvement in footwear given by the totally new appearance resulting from my invention over similarly styled footwear of conventional materials. A preferred embodiment is shown in the accompanying drawings wherein:

FIG. 1 is an elevation view of a shoe incorporating my invention;

FIG. 2 is an enlarged view of the heel of the shoe shown in FIG. 1;

FIG. 3 is a plan view of the heel of FIG. 2;

FIG. 4 is a sectional view taken on lines IV—IV of FIG. 3;

FIG. 5 is another embodiment of the heel similar to that shown in FIG. 4; and

FIG. 6 is another embodiment of the heel similar to that shown in FIG. 3.

Referring to the drawings, FIG. 1 shows a women's contemporary shoe comprising a body 1 having a sole 2, and heel 3 with a relatively thin top lift 4. The heel 3 is secured to the body 1 in a well-known manner. Conventional heels are usually made of wood, leather or synthetic composition material, and often include a combination of all three materials. Steel or other metal material has also been used. The top lift is usually composition material, which is nailed, adhesively secured or otherwise fastened to the bottom of the heel 3.

My preferred heel 3, shown in FIG. 2, is made of any clear or transparent plastics material, such as acrylic resin, plexiglas and the like, of sufficient strength to support a person wearing a shoe with the heel, and molded to a size and configuration appropriate to the particular shoe style. In a preferred form, the heel material must be essentially transparent to light to be useful in my invention.

FIGS. 1 and 2 clearly show a heel 3 and a top lift 4 having between them a thin layer 5 of liquid crystal material. The heel 3, made of a transparent acrylic resin material, comprises a base portion 6 to the bottom surface 7 of which the layer 5 is applied, and a substantially continuous upstanding wall portion 8, the edges of which are secured to the body 1 of a shoe.

The base portion 6 forms a clear solid plastics medium having an upper light refractive surface 9 which may be substantially flat, i.e. planar and parallel with surface 7. Preferably, to enhance the optical characteristics of the heel by displaying the vibrant colors of the liquid crystal layer thereon, the surface 9 is rounded or concave relative to the surface 7, as shown in FIG. 5.

More particularly, striking designs may be achieved by forming the surface **9** in different configurations, such as by providing it with light refractive facets of the type shown in FIG. **6.** Of course facets may also be provided on the wall portion **8,** or along the top of the heel **3.**

The specific configuration of any shoe or boot heel depends upon the overall style desired for the particular piece of footwear. However, it may be generalized that where a liquid crystal system is applied as a layer to the bottom of the heel portion, the base portion of my heel must be transparent to light and the surface of the base portion should be large enough so that the variable color combinations of the liquid crystals can be observed.

The liquid crystal is generally applied as a thin layer. A solution of liquid crystals is applied to the surface to be coated. Preferably, the liquid crystal layer is used with a backing material of black or dark color. Depending upon the type of system, which may be temperature or pressure responsive, the system will then display color indicative of its environmental characteristics.

While I have had success in practicing my invention in conjunction with the heels of footwear, it is clearly applicable to other portions of a shoe or boot. Again referring to FIG. **1,** a liquid crystal system may be applied to all or part of the body **1** of the shoe or its sole **2.** For example the liquid crystal layer may be applied to the sole portion adjacent the heel so that the crystals refract from the transparent plastic heel **3.** Moreover, the toe portion **10** may be of transparent material to which liquid crystals are applied from within in accordance with my invention. A separate piece of material of dark or black color may be placed inside the shoe in such the portion **10** so as to contact and protect the coating. Thus, the crystals will be observable through the transparent toe portion **10.** Alternatively, a liquid crystal layer may be applied to the toe portion **10** of body **1** of conventional leather or synthetic material and a separate transparent plastics sheet, formed to fit over portion **10** may be secured along its edges to the shoe body **1** to protect the liquid crystal layer. In both cases, movement of the toe portion of the shoe either in normal walking, or by movement of the wearer's toes inside the shoe, will change the molecular structure of the selected liquid crystals, thus varying the colors over their span of the spectrum.

In another form of the invention, a composite sheet of encapsulated liquid crystals may be applied to conventional footwear. Such sheet material has recently become available. It comprises a dark colored backing material to which is applied a liquid crystal layer. A transparent material is placed over the layer to protect the liquid crystals and to seal them onto the backing material. The backing material carrying the liquid crystals may then be secured, such as by adhesive, sewing or the like to any footwear material. While the composite sheet of liquid crystals per se is not my invention, I do claim to have discovered footwear including such a composite sheet having liquid crystals. The composite sheet of liquid crystals may be secured to all or a part of a heel. By the use of the composite sheet any footwear can be made to look more attractive. Of course, since the liquid crystals in the sheets may be made responsive to different environmental conditions, the composite sheets can be changed as desired. For example, a low temperature responsive liquid crystal system may be used in cold weather and a high temperature responsive liquid crystal system may be used in warm or hot weather.

Many and varied designs can be achieved by applying liquid crystals to those parts of a shoe or boot which will result in most attractive footwear styles. As an example, the upper portion of a boot or spats may be coated with liquid crystals so that flexing of the foot upon walking will result in varied color designs. As a further example, a part or all of the surface of the sole of footwear may be coated with liquid crystals. The coated surface may be the upper surface or a surface formed between two laminated layers of material one of which is transparent to light. This is particularly applicable to continuous soled shoes, such as clogs, thongs or sandals.

In addition, it is possible to change the color scheme or span of the design by changing the type liquid crystal system used in the coating step. Many different liquid crystal systems are currently commercially available. If it is desirable, the original system may be removed and a new one applied.

In a further embodiment of my invention, I have provided close-fitting wearing apparel, such as body stockings, hoisery, panty hose, gloves and the like, with heat and pressure sensitive liquid crystals. Preferably the liquid crystals are applied in a layer on a dark backing material, such as plastic sheet or vinyl material, which is adhesively secured or sewn to the apparel fabric. The liquid crystal coating may be applied over the wearing apparel randomly or in a pattern as desired. Temperature and movement of the apparel wearer's body causes a change in orientation of the molecules of the liquid crystal system, and, consequently, a change in the colors displayed by the crystals. When applied to a garment, particularly one which is made of a material having dark color, the variety of liquid crystal patterns greatly improve the attractiveness of the garment.

While I have shown and described the preferred embodiments of my invention, it is understood that it may be otherwise embodied within the scope of the appended claims.

I claim:

1. In combination:

a. footwear comprising a body portion and a heel portion,

b. transparent plastics material forming a part of at least one of said portions, and

c. a layer applied to a surface of at least one of said portions,

d. said layer comprising a liquid crystal system.

2. Footwear as set forth in claim **1** in which the layer is placed on a base of the heel portion.

3. Footwear as set forth in claim **2** and including a top lift secured to the base of said heel portion over said layer.

4. Footwear as set forth in claim **1** wherein the heel portion comprises a solid base portion, the bottom surface of the base portion includes the layer of liquid crystals and the top of the base portion is a light refractive surface.

5. Footwear as set forth in claim **4** in which the light refractive surface is substantially planar and extends substantially parallel to the bottom surface of the base portion.

6. Footwear as set forth in claim **4** in which the light refractive surface is substantially concave with respect to the bottom surface of the base portion.

7. Footwear as set forth in claim 4 in which the light refractive surface comprises a plurality of facets having radially extending edges emanating from the center of the refractive surface.

8. Footwear as set forth in claim 4 and including a top lift secured to the bottom surface of the base portion of the heel.

9. Footwear as set forth in claim 1 in which the liquid crystal layer is applied to a body portion of transparent plastics material and a separate piece of material is placed within said body portion so as to contact and protect the liquid crystals.

10. Footwear as set forth in claim 1 wherein the liquid crystals are carried in a composite sheet comprising a backing material and a transparent plastics material having a layer of liquid crystals sandwiched therebetween, and said composite sheet is secured to at least one of said body and heel portions of the footwear.

11. Footwear as set forth in claim 10 wherein the composite sheet is secured to a surface of the heel portion.

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