ABSTRACT

A ballet pointe shoe for supporting a dancer. The shoe has a shank with fibers of various orientation to provide a stiffness characteristics desired by the dancer. The stiffness of the shank is varied to meet the performance needs of the dancer. In one embodiment the stiffness of the shoe at the arch is greater than the stiffness of the shoe at the ball of the foot.
FIG. 6
BALLET POINTE SHOE

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Application No. 61/005,690, entitled “Ballet Pointe Shoe,” and filed on Dec. 8, 2007, which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention generally relates to the field of dance shoes, and particularly to ballet pointe shoes.

BACKGROUND

[0003] ‘Pointe shoes’, also referred to as toe shoes, are a special type of shoe used by ballet dancers for pointework. The shoes were developed from the desire to have a dancer appear weightless onstage and have evolved to allow extended periods of movement on the tips of the toes (en pointe).

[0004] In general, the pointe shoe is made with a toebox platform at the tip of the shoe that provides a firm flat surface on which the dancer balances. Such a shoe often causes serious injuries that are created by the fact that the toe line of the individual is seldom straight or regular or perpendicular to the ideal vertical line along the dancer’s leg. In addition to serious injuries, dancers wearing pointe shoes get minor, though often uncomfortable, injuries caused by the structure of the shoe. In addition to the injuries, pointe shoes are generally not used until the shoes have been broken-in. The process of breaking-in a new shoe, often effort intensive, includes a variety of actions such as bending and twisting the shoe until it has the characteristics desired by the dancer. After the shoe has been used for practice and performing for several weeks (dependent on the intensity) the shoe no longer has the desired performance characteristics and is usually discarded. Hence, the cost of ballet pointe shoes is generally considered a significant expense for dancers.

[0005] It is desirable that ballet pointe shoes have a reduced break-in effort and have a life in excess of the several weeks of conventional shoes. Further, it is desirable that such a shoe have consistent performance during the life of the shoe.

SUMMARY OF THE DISCLOSURE

[0006] Generally, the present disclosure describes embodiments of an improved structure for a ballet pointe shoe.

[0007] In one embodiment of the disclosure, a ballet pointe shoe is comprised of toebox coupled to a shank, where the shank is comprised of layers (plies) of fiber reinforced polymers. The shank has a first portion having a first number of layers of fiber and a second portion having a second number of layers of fiber. The number of layers of fiber, and the orientation of the layers are varied in each layer, for the portions of the shank determines the stiffness of the corresponding portion of the shank. The number and orientations of layers of fiber is varied to meet the stiffness requirements requested by a dancer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The disclosure can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other, emphasis instead being placed upon clearly illustrating the principles of the invention. Furthermore, like reference numerals designate corresponding parts throughout the several views.

[0009] FIG. 1 depicts an embodiment of a shoe of the present disclosure.

[0010] FIG. 2 depicts a perspective view of a portion of the shoe of FIG. 1.

[0011] FIG. 3 depicts a perspective view of layers of material for the shank of the shoe of FIG. 1.

[0012] FIG. 4 depicts the forming and curing process for the shank of the shoe of FIG. 1.

[0013] FIG. 5 depicts a side view of the shank and sole of the shoe of FIG. 1.

[0014] FIG. 6 depicts the stress versus strain characteristics of the shank as the number and direction of material layers is varied.

DETAILED DESCRIPTION

[0015] The present disclosure generally pertains to a support structure for a ballet pointe shoe and methods for manufacturing the support structure. Examples of materials comprising the support structure are also disclosed. Although the structure as described is particularly valuable for a ballet pointe shoe, the structure may be useful for other shoes to provide a desired shoe stiffness.

[0016] The ballet pointe shoe 100 as depicted to FIG. 1 has a platform 102 located on the toe of the shoe. The platform 102 is flat and functions as contact surface to the floor as the dancer stands on her toes to perform certain ballet dance movements. The ballet pointe shoe top material 104 covers and encloses the dancer’s foot as depicted in the FIG. 1. The shoe 100 has an outer sole 106 and an insole (not shown). A shank 120 is located between the outer sole and the inner sole and provides support for the dancer when the platform 102 is in contact with the floor. The shank 120 is coupled to a toe box 108 such that the toe box and shank combine to serve as a support structure for the dancer’s foot. During dancing movements, the shoe 100 experiences a variety of stresses that could render the shoe unusable and possibly injure the dancer. Hence, it is important that all parts of the shoe, particularly the shank 120 and the toe box 108, be durable and not wear out from the stress associated with dancing.

[0017] FIG. 2 depicts an embodiment of the present disclosure comprising the toe box 108, the shank 120 and a connector strip 122. The x-direction, as shown, goes from the heel to the toe of the shoe 100. The height of the shoe 100 is measured in the z-direction and the width of the shoe in the y-direction. The shank 120 of an embodiment of the present disclosure is coupled to a portion of the connector strip 122 that couples the shank to the toe box and other portions of the shoe 100. The toe box 108 is coupled to the front portion of the outer sole 106 and to the shank 120. The shank 120 is comprised of layers of shaped fiber sheets, such as fiber glass sheets or resin impregnated carbon fiber sheets, wherein the fibers in each sheet (layer) are approximately parallel. The fiber sheets are essentially a rectangular shape, though in other embodiments other shapes are possible. The shank 120 has a ball section 124 (for the ball of a foot), an arch section 126 (for the arch of the foot) and a heel section 128.

[0018] FIG. 3 depicts an embodiment of a shank 120 for ballet shoe 100. The shank 120 is comprised of layers of a fiber material having the fibers in the layers with various orientations. Longitudinal fibers are fibers that are approximately parallel to an axis that goes from the heel of the ballet
shoe 100 to the toe of the ballet shoe, i.e., in the x-direction. Orthogonal fibers go in the y-direction and are thereby approximately perpendicular to the longitudinal fibers. In other embodiments other directions of fibers in any of the layers are possible as is using woven fiber in some, or all, layers. The layers have a length measured in the x-direction, a width measured in the y-direction and a thickness measured in the z-direction. The width and length of the layers are such that each layer (or sheet) will fit on the outer sole of the ballet shoe 100 without extending into the top material 104 of the shoe 100. The thickness of each layer is variable, but generally around a millimeter or less.

[0019] FIG. 3 depicts the shank 120 with a first set of layers 130 and a second set of layers 140. The first set of layers 130 has a first sheet 132 with longitudinal fibers and a second sheet 134 with orthogonal fibers. The second set of layers has two first sheets 142 with longitudinal fibers and two second sheets 144 with orthogonal fibers. The orientation of the fibers alternates as the sheets are stacked together. The fibers forming the shank are then placed on the connector strip 122. During the manufacturing process of the shank 120, the sheets of fiber are impregnated with resin or pre-impregnated fiber sheets may be used. The shank is then shaped, for example by a mold, and as the resin is cured the shank takes the shape provided by the mold. Other methods of manufacturing are possible for other embodiments. The connector strip 122 couples the shank 120 to the toe box 108 and to the heel of the shoe. In some embodiments the shank and toe box are coupled together and can be cured at the same time, or co-cured.

[0020] FIG. 4 depicts a shank resting on a shaping mold 160. In other embodiments other molds are used and such molds would fall within the scope of the present disclosure. The thickness of the layers, as earlier indicated, is not to scale. However, since it is usually desirable for the shank 120 to have greater stiffness near the arch of the shoe 100, the shank has more layers in the arch portion of the shank. The arch portion is the portion of the shank that is near the heel of the shoe and is provides arch support when a dancer is on pointe. FIG. 5 depicts a cross section of the shank for an embodiment that has six sheets (layers) of material. Three of the sheets have longitudinal fibers and the other three sheets have orthogonal fibers. In other embodiments other numbers and orientations of fiber sheets is possible. In general, the greater the number of longitudinal sheets, the greater the stiffness of the shoe.

[0021] FIG. 6 depicts ranges of values for shank stiffnesses. The graph 200 depicting stiffness has a stress axis and a strain axis. The example illustrates the concept of more layers of longitudinal fiber sheets providing greater stiffness. When the number of sheets is N_x, the stiffness of the shank 120 is shown by curve 210. When the number of sheets is N_y, the stiffness of the shank 120 is shown by curve 220 and when the number of sheets is N_z, the stiffness of the shank 120 is shown by curve 230. For the chart 200 depicting stiffness N_x is greater than N_y and N_z is greater than N_y. For the shank structure of the present disclosure the stiffness is adjusted by selecting materials with other physical parameters.

[0022] In a comparative test the shoe 100 having the shank 120 had deflection characteristics corresponding to a shank of medium stiffness shoes of from several known manufacturers. By reducing the number of longitudinal layers, shoe 100 is softer (less stiff) and by increasing the number of longitudinal layers shoe 100 is stiffer. The ballet shoe 100 is adaptable to meet the stiffness requirement of a dancer and does not require a breaking in period. In addition the shoe 100 of the present disclosure is not subject to the short lifetime (several weeks) of conventional ballet pointe shoes.

1. A support structure for ballet pointe shoe, the support structure comprising:
   a. a toe box, and
   b. a shank having a connection strip for coupling to the toe box, the shank having a first set of layers comprised of one or more sheets with longitudinal fibers and one or more sheets with orthogonal fibers, the shank further having a second set of layers comprised of one or more sheets having longitudinal fibers and one or more sheets having orthogonal fibers.

2. The support structure of claim 1, wherein the first set of layers extends into an area of the shoe that would engage the ball of a foot.

3. The support structure of claim 1, wherein the first set of layers and the second set of layers overlap in an area of the shoe that would engage the arch of a foot.

4. A shank for a ballet shoe comprising:
   a. a first set of layers having fiber sheets, wherein the fiber sheets are placed in a first alignment; and
   b. a second set of layers of fiber sheets with second alignment and the second set of layers is combined with the first set of layers.

5. The shank of claim 4, wherein the combined layers are coupled to a connector strip.

6. The shank of claim 5 wherein, the shank is shaped to adapt to the foot of a ballet dancer.

7. The shank of claim 6 wherein the fiber sheets are made of woven or unidirectional fibers and the sheets are impregnated with a polymer resin.

8. A support structure for ballet pointe shoe, the support structure comprising:
   a. a toe box, and
   b. a shank having a connection strip for coupling to the toe box, the shank having a first set of layers comprising one or more sheets with first oriented fibers and one or more sheets with second oriented fibers, the shank further having a second set of layers comprising one or more sheets with third oriented fibers and one or more sheets with fourth oriented fibers.

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