Aug. 4, 1970 M. SIMONS 3,522,669

ATHLETIC SHOE

Original Filed May 2, 1967

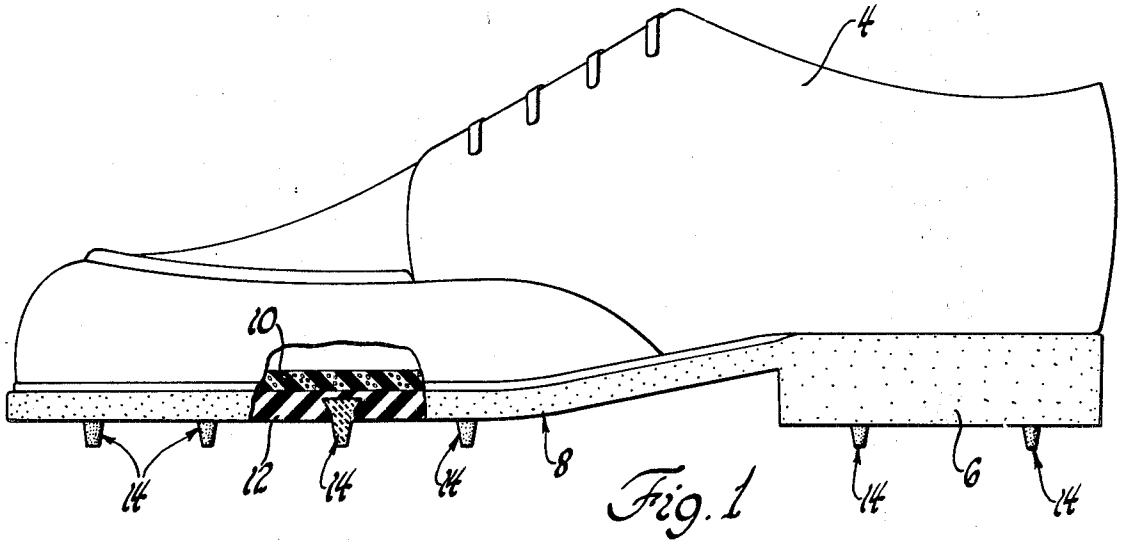


Fig. 1

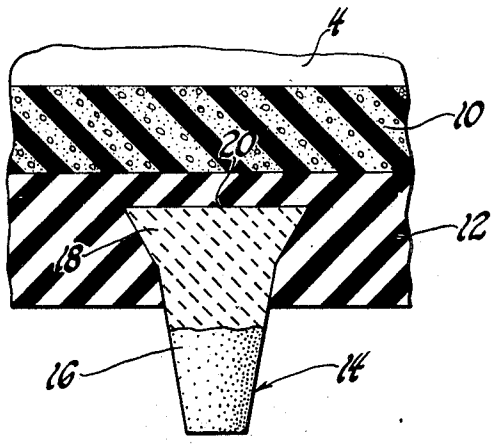


Fig. 2

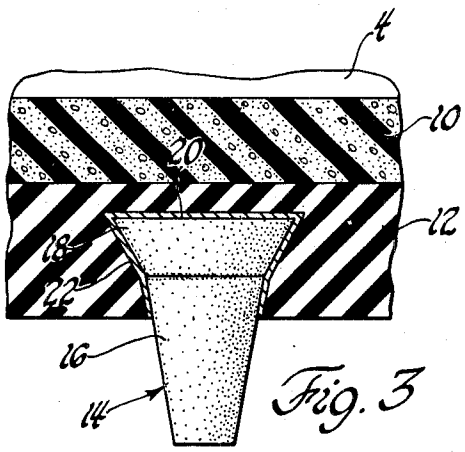


Fig. 3

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ATHLETIC SHOE

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Int. Cl. A43c *15/00*
U.S. Cl. 36—67 5 Claims

ABSTRACT OF THE DISCLOSURE

An athletic shoe having alumina-base ceramic spikes with upper end portions embedded in and bonded to the shoe sole.

This application is a continuation of application Ser. No. 635,482 filed May 2, 1967, and now abandoned.

The subject matter of the present invention is an improved spiked athletic shoe, particularly for use by golfers.

Up until about the 1930's, golf shoes were commonly made by forming each metal spike with a pointed spike portion at one end and a pointed threaded portion at the other end which was threaded directly into the sole of the shoe, there being an intermediate annular flange with notches or openings to enable tool engagement to thread the spike into the sole. This had serious disadvantages particularly in that after the metal spikes became worn and replacement was necessary, the replacement spikes, when threaded into the previously formed openings in the shoe sole, would not form a tight threaded connection and hence would come loose. Then in about the late 1930's, this construction was largely superseded by a construction wherein the shoe sole was fitted with a plurality of internally threaded metal sleeves, each of which sleeves would threadedly receive one of the metal golf spikes. This is the golf shoe construction which is predominantly in use today. It has the advantage that when the metal golf spikes become worn, they can be replaced with the replacement spikes having a good tight threaded connection by way of the internally threaded metal sleeves in the shoe sole. However, such a golf shoe construction has the serious disadvantage of being quite heavy because of the weight of the metal golf spikes and the metal sleeves. Needless to say, a heavy golf shoe is disadvantageous vis-a-vis a lightweight golf shoe in that the heavy shoe is more fatiguing to the golfer. Because of this, it has become the trend to take weight out of other portions of the golf shoe, as by using lighter weight materials for the sole, arch support and upper portions of the golf shoe. Some golfers, however, still prefer the older fashioned heavy golf shoes, despite their weight, because they feel that the heavier sole, arch support and upper shoe construction provides increased foot support. In either case, whether for a heavy shoe or for a light shoe, what is needed is a lightweight spike construction such that for any given weight golf shoe the weight can be used where it is most useful—in the construction of the sole, arch support and upper portions of the shoe. The present invention fulfills this need.

Briefly, the present invention provides a golf shoe wherein the spikes are of relatively light weight and yet are so tough and wear-resistant as to outwear the shoe and never need replacement. Since the spikes never need replacement they can be permanently secured to the shoe sole, thereby simplifying spike structure and dispensing with the need for the aforedescribed internally threaded metal sleeves in the shoe sole with a resultant further reduction in weight.

More specifically, the present invention comprehends a golf shoe wherein the spikes are formed of sintered alumina-base ceramic, as hereinafter described in detail, each spike having a spike portion which extends from the sole of the shoe and an upper portion which is embedded in and bonded to the shoe sole. The sintered alumina-base ceramic is so tough and wear resistant as to outlast the shoe and hence the spikes never need replacement. Since the alumina-base ceramic is only about one-half as heavy as steel and since such spikes can be of simple relatively small construction, with no need for the conventional flange heretofore required for spike replacement, the total weight reduction in the golf shoes owing to the golf spikes themselves can be very substantial.

The above and other features and advantages of the invention will appear more clearly from the following detailed description made with reference to the accompanying drawings in which:

FIG. 1 is a side view in partial section of a golf shoe embodying the invention;

FIG. 2 is an enlarged view of the sectional portion of the shoe shown at FIG. 1; and

FIG. 3 is a view similar to FIG. 2 but showing another embodiment of the invention wherein an intermediate bonding layer is used between the embedded spike portion and the shoe sole.

Referring now to FIG. 1, the golf shoe which is shown has a conventional upper portion **4** which can be of natural or synthetic leather and which is secured, as by stitching, to the shoe base which consists of the heel **6** and the sole **8**. The sole and heel can be of a laminated construction such, for example, as to include an inner pad as shown at **10**. The exposed or lower sole portion **12** can pe formed of an elastomer such as natural rubber, butyl rubber, polyurethane or any of the other synethetic rubbers, with any desired fillers such as carbon black or the like.

Each of the golf spikes **14** consists of a shaped sintered body of alumina-base ceramic having a lower spike portion **16** which extends outwardly from the shoe sole and an upper headed portion **18** which is embedded in and bonded to the shoe sole. Preferably the spike portion **16** is of conventional tapered shape with a flat ground-engaging lower end as shown. The upper portion **18** is headed to provided increased surface area for bonding to the shoe sole and also to provide an increased upper surface area, as shown at **20**, to thereby better distribute to the foot of the wearer the pressure exerted by the spike when it engages the ground.

The spikes extending from the heel **6** are the same as those extending from the sole and have upper head portions embedded in and bonded to the heel.

In accordance with the invention the golf spikes are formed of sintered alumina base ceramic containing upwards of about 85% aluminum oxide and consisting essentially of aluminum oxide crystals bonded together into a dense unitary non-porous body. The aluminum oxide crystals of the body can be bonded to each other either directly or through the medium of an intercrystalline glassy phase formed in situ during the sintering operation in the manufacture of the body by reason of the interaction of the ceramic ingredients included. A spike of such composition and structure demonstrates not only very high wear resistance but also has the other properties essential for practical durable efficient use including, for example, the requisite toughness to insure against breakage from impact with hard surfaces such as rocks or concrete in normal wear by a golfer.

Where the body consists of less than 100% aluminum oxide, the remaining ingredients can be any of a variety

of other oxides or mixed oxides or the like which, by interaction with surface portions the aluminum oxide grains during the sintering operation, function as glass forming ingredients to provide an intercrystalline glassy phase, or as inhibitors to prevent alumina crystal grain growth. Examples of preferred ingredients which can be used as additives to the alumina are: silica either as such or in one of its combined forms such as clay (aluminum silicate) or talc (magnesium silicate); the alkali metal and alkaline earth metal oxides, silicates, carbonates and phosphates; other of the metal oxides either as glassy phase modifiers or as mineralizers and crystal growth inhibitors, such as manganese oxide, chromium oxide, cobalt oxide, and the like. Specific examples of high alumina ceramic compositions useful for the practice of the invention are as follows, the percentages specified always being by weight: 100% aluminum oxide; 99.5% aluminum oxide, .5% chromium oxide; 94% aluminum oxide, 3% silica, 3% magnesium oxide; 90% aluminum oxide, 4% silica, 3% calcium oxide, 3% magnesium oxide; 85% aluminum oxide, 10% silica, 2.5% calcium oxide and 2.5% magnesium oxide. For optimum properties of strength and wear resistance it is preferable that the ceramic contain at least 90% by weight aluminum oxide.

To process such compositions into a sintered unitary dense non-porous body the ceramic raw batch ingredients are first milled to a fine powder batch, preferably of a particle size no longer than 325 mesh, which is then compacted to the desired shape and preferably to a density of about 2 grams per cubic centimeter or more, and then fired to sintering temperature which can be from 1400° C. to as high as 1900° C. depending upon the precise composition. Shaping of the raw batch powder into the shape desired is preferably accomplished by admixing with the ceramic powder a small amount of temporary organic binder such as wax or organic resin and then molding or pressing to shape. The temporary organic binder is, of course, vaporized or burned out in the early stages of the sintering operation. When the composition is 100% aluminum oxide or an extremely high percentage of aluminum oxide with only a small amount of additive other oxide as a crystal growth inhibitor or the like, the final structure is one wherein the alumina crystals are bonded directly to each other. Where a lesser amount of aluminum oxide is included, along with glass forming ingredients, the final structure consists of aluminum oxide crystals with an intercrystalline glassy phase which is formed in situ by interaction of the ingredients during the sintering operation. There is shrinkage during the firing operation, on the order of 10% to 20% and hence the body prior to firing should be larger than the final body desired. The density of the alumina ceramic spikes, after firing, should be at least about 3.4 g./cc. and preferably above 3.7 g./cc. which means that the ceramic is substantially non-porous since the theoretical highest density for alumina ceramic is slightly under 4 g./cc.

The shoe sole and heel should preferably be of an elastomeric material such as natural or synthetic rubber since this provides a resilient base for the ceramic spikes which further assures against cracking of the spikes by way of impact with rocks, concrete or the like. The preferred manner of embedding and bonding the upper headed portions of the spikes into the shoe sole and heel is to mold the sole or heel material directly over and around the spike head portions after or during which molding operation the material can be cured or vulcanized if the material requires same. If the material which is selected for the shoe sole or heel does not form a sufficiently strong bond directly to the ceramic, an intermediate organic or inorganic layer can be applied to the

upper headed portions of the spikes to increase the bond strength. For example, a thin metal layer such as titanium or brass can be applied to the head portions of the spikes. This thin metal layer increases the bond strength between the ceramic and natural or synthetic rubber. As an alternative, an extremely thin coating of an organic resin, such as epoxy resin, can be applied to the spike head portions to serve as an intermediate layer between the ceramic and the sole material to increase bond strength. This is illustated in FIG. 3, the intermediate bonding layer being shown at 22 through the thickness of the layer as shown is greatly exaggerated for purposes of illustration.

While the invention has been described specifically with reference to certain embodiments thereof, it will be understood that various changes and modifications may be made all within the full and intended scope of the claims which follows.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A shoe having a ground contacting bottom of resilient elastomeric material and having sintered alumina-base ceramic bodies each with a spike portion extending from said shoe bottom and with an upper portion embedded in and bonded to said shoe bottom, said ceramic bodies containing at least about 85% by weight aluminum oxide and having a density of at least about 3.4 grams per cubic centimeter, and said upper portions of said bodies having means on the surface thereof to increase the bond strength between said bodies and said elastomeric material.

2. A shoe as set forth in claim 1 wherein said upper portion of each of said bodies is headed.

3. A shoe as set forth in claim 1 wherein said means on said upper portions of said bodies comprises a layer of material.

4. A shoe as set forth in claim 1 wherein such bodies contain at least 90% by weight aluminum oxide and have a density above 3.7 grams per cubic centimeter.

5. A shoe having a ground contacting bottom with a plurality of spaced tapered bodies each with a lower relatively small diametered portion extending outwardly from said shoe bottom to serve as a ground contacting spike and with an upper reltaively large diametered portion embedded in and bonded to said shoe bottom, said bodies being of alumina-base ceramic containing at least about 85% by weight aluminum oxide and having a density of at least about 3.4 grams per cubic centimeter, that portion of said shoe bottom in which the upper ends of said bodies are embedded being of a resilient elastomeric material to cushion said bodies against breakage, the upper portions of said bodies having a layer of material thereon to increase the bond strength between said bodies and said elastomeric material.

References Cited

UNITED STATES PATENTS

715,138	2/1902	Pierce	36—67
3,040,450	6/1962	Phillips.	
3,063,165	11/1962	Brough et al.	36—7.7
3,195,246	7/1965	Ueda	36—167.5
3,311,482	3/1967	Klingler.	
3,324,578	6/1967	Brutting.	

FOREIGN PATENTS

291,125	5/1928	Great Britain.
796,835	6/1958	Great Britain.
1,333,185	6/1963	France.

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