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(54) **DIMPLED SOCCER BALL**

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(57) **ABSTRACT**

A soccer ball, that is, European-style football, with a plurality of air-turbulence-producing depressions distributed over a majority of the outer surface of the skin. The depressions produce a preferably circular surface shape, with a breadth of less than about one-quarter inch and preferably having a breadth to depth ratio of about 2 to about 6. The soccer ball of the present invention preferably has depressions distributed substantially uniformly over the majority of the outer surface. A method for providing the soccer ball with altered aerodynamic performance may include forming depressions by embossing the skin or molding depressions therein.

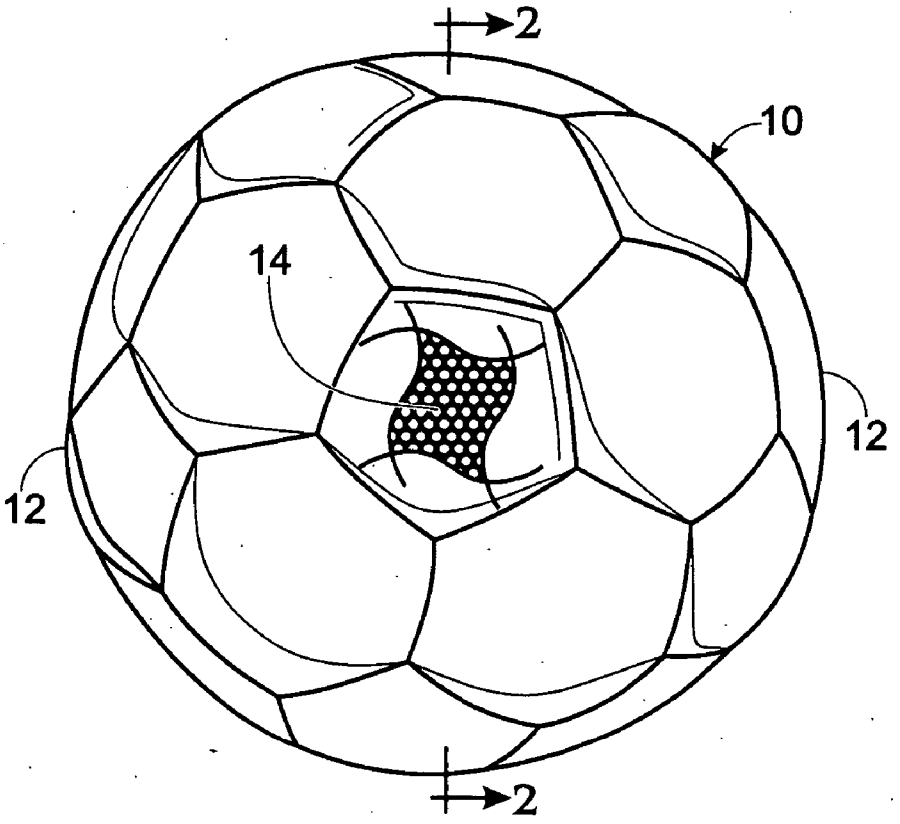
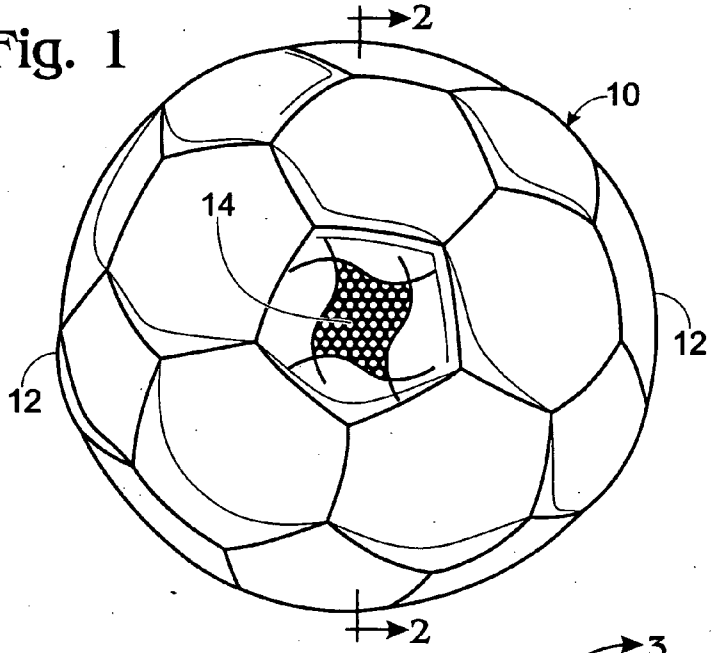


Fig. 1



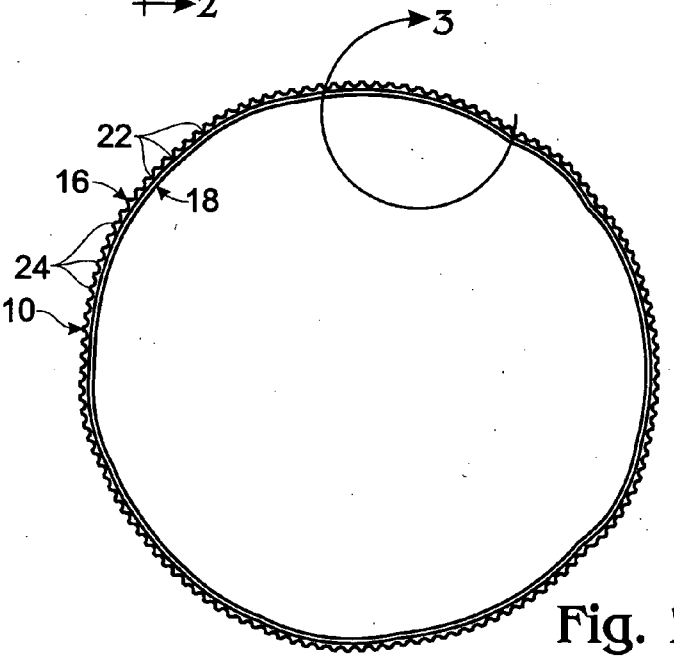
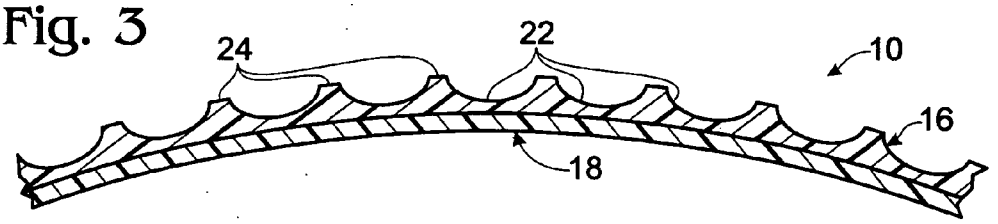


Fig. 2

Fig. 3



DIMPLED SOCCER BALL

FIELD OF THE INVENTION

[0001] This invention relates to soccer balls; and to altering the aerodynamic behavior of soccer balls by providing air-turbulence-generating depressions in the surface thereof.

BACKGROUND

[0002] In sports involving throwing, hitting, kicking or otherwise impelling a soccer ball, the performance characteristics of the ball can greatly affect the play of the game. Properties of the ball such as the inflation pressure, rigidity, and surface characteristics all influence the speed with which the ball can be projected and the attributes of its flight. Although the size, shape and weight of a particular kind of ball are typically governed by the traditions and rules of the given game, it is possible to modify or improve the performance properties of a ball through altering its surface properties. For instance, tennis balls with differing surface properties of their felt coverings and different rigidities or inflation pressures are well known to be used under different circumstances.

[0003] Golf balls, which are of solid construction having an enameled surface covering and a relatively dense resilient core formed of rubber or synthetic plastics, ordinarily are covered by dimples. In the history of development of the golf ball, the surface was originally smooth, but it was discovered from the experience of golfers that a dented ball whose surface had been more or less covered with minute depressions caused by impacts on the ball of hard objects flew further. Golf balls were then deliberately covered with dents or dimples, small depressions in the surface, substantially over their entire surface. This surface texturing provided such a distinct advantage that today all golf balls are covered with such dimpling. The depressions on a typical golf ball are about 1-3 mm in diameter and about 0.5-1.5 mm in depth, and are distributed over the surface uniformly. The physical basis underlying the improved flight characteristics of the dimpled golf ball has been explained as resulting from turbulent flow of the air around a dimpled ball which in turn causes less "flow separation" and a reduced aerodynamic resistance to the ball's travel. Lift may also be generated by a traveling golf ball which has been hit to impart a backspin.

[0004] Few other examples of surface texturing designed to affect the aerodynamic performance, as opposed to the grip, of soccer ball s appear to be known. Another solid and not inflatable ball, the baseball, has been modified by covering the surface with depressions of a size similar those found on golf balls. Thus, U.S. Pat. No. 4,256,304 discloses a baseball suitable for use in an automated pitching machine that is substantially covered with a multiplicity of cup-like or hemispherical depressions. This modification is disclosed to enable the ball to travel greater distances with enhanced accuracy.

[0005] Depressions on a basketball have been disclosed in U.S. Pat. No. 5,518,234, although the depressions are much larger than those used on golf balls. The depressions are stated to be for the purpose of improving the player's grip on the ball. Each depression is of an approximate size to a fingertip to allow the player to grip a ball having a larger convex surface than is otherwise possible. No disclosure is provided regarding any alteration of aerodynamic properties of this ball. The dimples of this basketball are stated to be in the same proportion to the ball's diameter as the dimples on a golf ball to the golf ball's diameter; thus the basketball of this disclosure visually resembles a greatly oversized golf ball and the depressions are thus much larger than those found on a golf ball.

SUMMARY

[0006] The present invention provides a soccer ball with a plurality of air-turbulence-producing depressions distributed over a majority of the outer surface of the skin. The depressions are preferably distributed over the majority of the outer surface of the skin and have sufficient depth and breadth to cause air turbulence adjacent the surface of the skin when the soccer ball is moving through the air. The depressions are preferably circular in shape, with a breadth of less than about one-quarter inch and preferably having a breadth to depth ratio equaling about 2 to about 6, and a surface density of about 23 to about 27 depressions per square inch. The soccer ball of the present invention is preferably substantially covered by a regular array of the depressions.

DESCRIPTION OF DRAWINGS

[0007] FIG. **1** shows a side view of a preferred embodiment of a soccer ball according to the present invention.

[0008] FIG. **2** shows a cross-sectional view of a portion of the skin of a soccer ball according to the present invention.

[0009] FIG. **3** shows a detailed view of a preferred embodiment of the depressions in the skin of a soccer ball according to the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0010] Referring to FIG. **1**, a preferred embodiment of the present invention comprises a soccer ball, or European-style football, **10**. As viewed from the side, the soccer ball is substantially round, the outer surface **12** forming a smooth monotonic curve except for the slight variation caused by the alternating hexagonal and pentagonal patches that preferably make up the skin **16**. In the preferred embodiment, the soccer ball has a circumference of 27-28 inches (68-70 cm) and thus a diameter of 8.6-8.9 inches (21.6-22.3 cm). The soccer ball **10** is circular in any cross-section.

[0011] The soccer ball **10**, which is hollow and formed of an at least moderately flexible skin **16**, sometimes enclosing an air bladder **18** as is shown in FIG. **2**, preferably assumes substantially the dimensions stated upon inflation with air or another suitable gas. The skin is preferably formed of leather, rubber, plastic, or similar suitable material that is both at least moderately flexible and is resistant to tearing or puncturing. The preferred air bladder, which may be constructed of any suitable material, pressurizes the skin upon inflation. The skin of the preferred soccer ball is typically formed by sewing or gluing together alternating hexagonal and pentagonal patches in the pattern of a truncated icosahedron, with the seams disposed inwardly.

[0012] The skin **16** is preferably tough enough to withstand damaging abrasion during handling and play, and to protect the air bladder, if any, from puncture and the resulting loss of air pressure.

[0013] Typically, the soccer ball is inflated to a pressure within a range suitable to confer sufficient elasticity and rigidity to allow it to be firmly grasped, to maintain its shape when subject to acceleration upon being thrown or kicked, but also permitting elastic deformation allowing the ball to bounce, or to be kicked substantial distances. For a soccer ball meeting official rules, it is preferably inflated to a pressure of about 8.5-15.6 psi (60-110 kPa). Normally, the ball is filled with air via a port (not shown) in the skin and bladder that allows for insertion of a hollow needle attached to a source of compressed air, the port then closing to seal the air in the bladder when the needle is removed. Alternatively, the soccer ball may be filled with an elastic foamed material, preferably a plastic, wherein the gas that is trapped within the cells of the foam provides resiliency. When the term "inflated" or "inflatable" is used herein, it is defined as covering both means of providing internal air pressure to keep the ball elastic.

[0014] As shown in FIG. **2**, the soccer ball according to the present invention is provided with depressions **22** on the surface of the soccer ball; the skin is preferably substantially covered by the small depressions. The depressions have sufficient depth and breadth to cause air turbulence adjacent the surface of the skin when the ball is moving through the air. The amount of turbulence created is dependent upon a number of factors including the size, breadth and depth of the depressions **22**, as well as their shape, their density and distribution over the surface, the total proportion of the surface that is covered by the depressions, and the relative velocity of the skin of the soccer ball to the air. Preferably, about **23** to about **27** depressions per square inch cover the surface of the ball **10**, and the depressions **22** on the preferred ball **10** are circular in shape, about 3/16 inches in diameter, and about 1/16 inch deep with a hemispherical profile as shown in FIG. **3**. They preferably cover a majority of or substantially the entire surface of the soccer ball substantially uniformly, such as in a close-packed hexagonal array, but other arrangements may be employed without departing from the principles of the present invention. The preferred size, shape and distribution of the depressions **22** results in a soccer ball **10** having a total number of about 6100 depressions, a section of the pattern of the dimpled texturing **14** being shown in FIG. **1**, although it is understood that this pattern of dimpled texturing covers substantially the entire surface of the soccer ball.

[0015] Turning to FIGS. **2** and **3**, a cross-sectional detail of a section of the soccer ball's covering shows the skin **16** and an air bladder **18** respectively on the outer and inner surfaces thereof. The depressions **22** are preferably hemispherical in contour in the depth dimension. The un-modified skin areas **24** between the depressions **22** form a substantially continuous surface or network over the surface of the soccer ball. Depending on the size and spacing and thus the density of the depressions, the unmodified skin areas may constitute a greater or lesser proportion of the total surface area of the soccer ball. In the preferred embodiment wherein there are about **23** to about **27** depressions per square inch, each depression being a circle of diameter 3/16 inches, the skin areas **24** comprise about 30% and the depressions **22** comprise about 70% of the total surface area of the soccer ball **10**.

[0016] However, the depressions may be of other shapes, sizes and distributions over the outer skin of the soccer ball without departing from the principles of the present invention. For example, the depressions may be polygonal, or even irregularly shaped. For example, the depressions could be hexagonal in form. The depressions may be close packed, or may be substantially separated from each other over the outer skin of the soccer ball.

[0017] The depressions serve to alter the aerodynamic properties of the soccer ball when it is traveling through the air after being thrown or kicked. The aerodynamic properties of a soccer ball according to the invention are altered to a greater or lesser degree depending upon the variables as outlined above. Analogously to the operation of depressions on a golf ball as described above, the depressions on the soccer ball according to the present invention serve to create air turbulence as the soccer ball travels through the air, which lessens aerodynamic resistance by diminishing "separation of the flow." Thus, the increased distance that can be achieved by a throw or kick of a given force is a desirable aerodynamic results.

[0018] In addition to decreasing aerodynamic resistance, the depressions provide greater control over the soccer ball by a soccer player. That is, they increase the frictional engagement between the player's soccer shoe and the soccer ball so that the player can more easily impart controlled spin on the soccer ball. This controlled spin, together with the air turbulence created adjacent the surface of the soccer ball, enables the soccer player to curve the soccer ball in a desired direction more readily. For example, the player is better able to curve the ball around or over a goalie to make a score.

[0019] The depressions **22** may be introduced onto the surface of the soccer ball **10** using a variety of suitable methods. If the skin **16** is formed of leather, the depressions may be impressed into the surface through the use of a die under pressure. The leather surface may then optionally be coated, hardened or fixed as is known in the art. Alternatively, a flat leather surface may be ablated by suitable means, such as by drilling or grinding out the recesses, particularly in the case of circular depressions. The leather so-treated is then assembled into the intact soccer ball. If the skin is to be formed of rubber the depressions may either be molded in place prior to vulcanization of the rubber, or may be embossed with a die or ground out as in the case of the leather. If the skin is to be formed of plastic, the depressions may similarly be formed in place during the molding operation when the plastic monomer is polymerized in a mold, or may be embossed or ground subsequent to the polymerization operation. In the case of a soccer ball having a plastic skin, which may be cast or molded in final three-dimensional form in a single operation rather than as a flat structure or set of structures that are assembled by stitching or gluing as in the case of a leather skin, the depressions may be emplaced at the time of formation of the intact soccer ball.

[0020] The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

1. A soccer ball, comprising:

a flexible, inflatable skin having a generally spherical shape when inflated; and

a plurality of depressions formed in the skin, the depressions being distributed over the majority of the outer surface of the skin and having sufficient depth and breadth to cause air turbulence adjacent the surface of the skin when the ball moves through the air.

2. The soccer ball of claim 1, wherein the depressions are distributed substantially uniformly over the outer surface of the skin.

3. The soccer ball of claim 1, wherein the depressions are distributed in a substantially hexagonal array over the outer surface of the skin.

4. The soccer ball of claim 1, wherein the depressions form substantially circular shapes in the outer surface of the skin.

5. The soccer ball of claim 4, wherein the depressions have a diameter of less than about one-half inch.

6. The soccer ball of claim 4, wherein the depressions have a diameter of less than about one-quarter inch.

7. The soccer ball of claim 4, wherein the depressions have a surface diameter to depth ratio of about 2 to about 6.

8. The soccer ball of claim 4, wherein the depressions comprise a substantially hemi-spherical surface.

9. The soccer ball of claim 8, wherein the depressions have a surface diameter to depth ratio of about 2 to about 6.

10. The soccer ball of claim 1, wherein the ratio of the maximum surface breadth to depth of a majority of the depressions is about 2 to about 6.

11. The soccer ball of claim 1, wherein the surface density of the depressions is about 23 to about 27 depressions per square inch inclusive.

12. The soccer ball of claim 1, wherein the depressions have a diameter of less than about one-quarter inch.

13. The soccer ball of claim 1, wherein the skin comprises a material selected from among leather, rubber, or plastic.

14. The soccer ball of claim 1, wherein the skin forms a hollow inflatable interior.

15. The soccer ball of claim 1, wherein the skin is inflated by an air bladder.

16. The soccer ball of claim 1, wherein the skin is inflated by an elastic foam material.

17. A method for providing a soccer ball with altered aerodynamic performance, comprising

providing a flexible, inflatable skin having a generally spherical shape when inflated; and

forming a plurality of depressions in the skin, the depressions being distributed over the majority of the outer surface of the skin and having sufficient depth and breadth to cause air turbulence adjacent the surface of the skin when the ball is moving through the air.

18. The method of claim 17, further comprising distributing the depressions substantially uniformly over the outer surface of the skin.

19. The method of claim 17, wherein the skin provided is comprised of one of rubber or leather, and the depressions are formed in the skin by embossing the skin with a die.

20. The method of claim 19, wherein the skin is first formed as one or more substantially flat sections, all or a portion of the sections are embossed with the depressions, and the one or more sections are thereafter stitched into the hollow; inflatable form.

21. The method of claim 17, wherein the skin provided is comprised of plastic, and the depressions are formed by molding them into the plastic.

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