

PATENT SPECIFICATION (11)

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(54) GOLF BALL

(71) We, UNIROYAL, INC., a corporation organised and existing under the laws of the State of New Jersey, one of the United States of America, of 1230 Avenue of the Americas, New York, New York 10020, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention pertains to golf balls.

Current practice in the art is to make balls having about 336 dimples arranged on the ball surface with conventional octahedral symmetry. The dimples are generally bowl-shaped and open into the surface of the ball along a circular line when inspected in an undistorted planar front view. The circular line conventionally has a diameter of about 0.13 to 0.14 inch, and the maximum depth of each dimple is conventionally about 0.013 inch, these measurements being made on a finished, painted ball.

According to the present invention a golf ball has a substantially spherical surface on which is formed a plurality of depressions, the intersection of each depression with the spherical ball surface being bounded by a circumference on the ball surface having a diameter of approximately 0.165 inch. Preferably the maximum depth of each depression is approximately 0.015 inch. Conveniently, the depressions cover from approximately 52% to approximately 61% of the total surface area of the ball.

For a better understanding of the present invention, reference is made, by way of example only, to the following description, taken in connection with the accompanying drawings, in which:—

Fig. 1 is a top plan view of a golf ball constructed in accordance with the invention;

Fig. 2 is a cross-sectional view of the internal structure of the golf ball of Fig. 1;

Fig. 3 is a front elevational view of the Fig. 1 golf ball with spatial pattern lines traced about the surface of the ball;

Fig. 4 is a view, to an enlarged scale, of a depression having a hexagonal base;

Fig. 5 is a sectional view to an enlarged scale, taken along line 5—5 of Fig. 4, through the cover of the ball and a portion of the interior of the ball to represent a depression having a hexagonal base;

Fig. 6 is a view, to an enlarged scale, of a depression having a pentagonal base;

Fig. 7 is a sectional view, to an enlarged scale, taken along line 7—7 of Fig. 6, through the cover of the ball and a portion of the interior of the ball to represent a depression having a pentagonal base;

Fig. 8 is a top plan view of a golf ball constructed in accordance with the invention, similar to Fig. 1, depicting several circumferential path lines circumscribed about the top surface of the ball; and

Fig. 9 is a front elevational view of the Fig. 8 golf ball depicting several circumferential path lines circumscribed about the side surface of the ball.

As is well known in the art, the surface of the ball is formed in the final molding operation in a negative mold which is adapted to mold the desired imprint on the surface of the ball. In specifying the surface desired in the ball, it is accepted practice in the art to specify mold dimensions rather than ball dimensions because of the variability inherent in the production of molds and balls. Furthermore, after the ball is molded it is customary to paint the surface of the ball and, therefore, its surface will depart somewhat from the surface imparted in the mold because of the coating of paint applied to the ball. However, any discrepancies which may occur in the ultimate surface of the ball from that provided on the mold are small, and the exigencies of ball production make it acceptable and desirable to specify the ball surface in terms of the mold dimensions. Accordingly, it should be understood that throughout this specification and claims the ball surface is to be achieved by providing a mold having the stated dimensions, and that a ball produced in such a mold will have substantially the desired dimensions, a painted ball further differing

[Price 33p]

Price 75p

slightly from these dimensions. The exact mold dimensions will depend on the type of ball being made and the molding conditions. Those skilled in the art known how to select mold dimensions suitable for the materials being used and the type of ball being made.

Referring now more particularly to Fig. 1 of the drawings, a golf ball comprises a spherical surface 10 having a plurality of depressions 11 therein. The majority of the depressions have substantially the shape of inverted pyramids with hexagonal bases. The ball has two poles 12 (only one of which appears in Fig. 1) and an equator 13 and each polar regions is divisible into five similar equilateral spherical triangles indicated by broken lines 14 with a common vertex at a given pole 12. Lines 14 do not appear on the ball, but are spatial demarcation lines which are illustrative only. These lines may be inscribed to show how the depressions 11 are arranged on the surface of the ball. It will be realized that these depressions are distributed about the face of the ball to define an icosahedral lattice of equilateral spherical triangles. The apex of each pyramid may be slightly rounded as will be described more fully hereafter. It will be understood that the hexagonal base of the pyramid is substantially hexagonal being on a spherical surface. If the ball is rotated 180° in the direction of the arrow 15, the bottom plan view appears identical with the top plan view. The depressions cover approximately 50% of the surface area of the golf ball. This arrangement is further described and is claimed in our co-pending Application No. 29831/72 (Serial No. 1,402,271).

Referring now more particularly to Figs. 1 and 3 of the drawings, each vertex 16 of equilateral triangles 14, 14, 14 other than the polar vertex 12 serves as a vertex for a similar spherical equilateral triangle 14, 17, 17 having at least one vertex 16 across the equator 13 from another vertex 16 of the triangle 14, 17, 17. Referring to Fig. 3, rotation of the ball by 72° increments in the direction of the arrow 18 (running along the equator of the ball) would present four additional elevational views which appear identical with Fig. 3 as shown.

As mentioned previously, the other polar region of the ball is divisible into five additional equilateral triangles 14, 14, 14 similar to the previously described triangles 14, 14, 14 and having a common vertex at the other pole 12 and having common vertices 16 with the triangles 14, 17, 17 crossing the equator. The arcs 14 and 17 bounding all the equilateral triangles pass through the apices of a plurality of the depressions 11 and each equilateral triangle includes within its arcs the same number of depressions and

each vertex of the equilateral triangles is in a depression.

All of the depressions 11 except the vertices 12 and 16 of the spherical triangles have substantially the shape of inverted pyramids with hexagonal bases and are of substantially the same size, being bounded by a circumcircle of approximately 0.165 inch at the ball surface and having a maximum depth of approximately 0.015 inch. The depressions 12 and 16 which are the vertices of the equilateral triangles may have substantially the shape of inverted pyramids with pentagonal bases and are of substantially the same size, being bounded by a circumcircle of approximately 0.165 inch at the ball surface and having a maximum depth of approximately 0.015 inch. The pentagonal bases of such pyramids are substantially pentagonal being on a spherical surface. The pentagonal shape of the depressions 12 and 16 is preferred, but the depressions 12 and 16 could conceivably take the shape of conventional part-spherical depressions if so desired.

Referring now more particularly to Figs. 4 and 5, a hexagonal depression 11 is shown in plan and in section to an enlarged scale. Referring to Figs. 6 and 7, the pentagonal base preferably has vertices on a circle of the same diameter as the hexagonal base and the pentagonal depression preferably has the same depth as the hexagonal depression. The sides of both the hexagonal and the pentagonal pyramids may be curved, and the apices of the pyramids may be slightly rounded. Portions of the interior of the ball appear in Figs. 5 and 7.

Figs. 2, 5 and 7 show the internal cross-section of the golf ball. The core of the ball may comprise a center 26 of cis-polybutadiene or cis-polybutadiene/rubber mixture and a rubber thread winding 25 wound thereabout. The diameter of the core may be between 1.57 and 1.59 inches. A cover 27 is molded about the core and may be between 0.045 and 0.055 inch thick (depending on the core diameter). Suitable corers are described and claimed in our co-pending Application No. 41046/74.

Figs. 8 and 9 correspond to the ball surfaces of Figs. 1 and 2, respectively. Arrow lines 20 are inscribed about the face of the ball to demonstrate that any chosen circumferential path line will eventually intersect several depressions. The air stream rushing over the surface of the ball in any flight path will intersect the depressions causing the ball to exhibit enhanced aerodynamic characteristics.

However, due to the limitations imposed by mold-making equipment the equatorial mold line 21 and adjacent small circles 22 and 23, respectively, may trace a continuous uninterrupted path about the surface of the

ball. Lines 21, 22 and 23, however, are extremely narrow being about or less than .005 inch in width, and do not therefore, present a significant path line to the air stream.

Thus, there are no closed circumferential pathways of substantial width that may be circumscribed about the face of the golf ball without intersecting depressions.

meter constructed in accordance with the above described icosahedral lattice and which was found to have longer carry in the air, that is, could be driven further in the air than similar conventional balls. The nominal parameters of the mold for a standard USGA approved ball in accordance with this invention, having the required diameter of not less than 1.680 inches are as follows:

The following are the mold specifications for a golf ball of 1.680 to 1.690 inches dia-

25	Number of depression-forming regions	252
	Number of depression-forming regions with hexagonal bases	240
	Number of depression-forming regions with pentagonal bases	12
30	Diameter of ball-forming regions	1.68—1.69 inches
	Arc length of equilateral triangle	.93—.94 inch
	Chordal length from vertex to vertex	.883—.896 inch
35	Size of hexagonal and pentagonal bases of depression-forming regions	Vertices on circle of .165 ± .015 inch diameter
40	Maximum depth of hexagonal and pentagonal depression-forming regions from spherical surface	.015 ± .003 inch

While the ball has been described above as having a diameter of between 1.680 and 1.690 inches, it is also contemplated that other balls of different diameters can be manufactured. For example, the standard diameter of the golf ball normally used in Great Britain is 1.620—1.630 inches. Other intermediate diameters, such as 1.660—1.670 inches can also be made.

It is within the scope of this invention that the exterior features of the disclosed golf ball can be varied. Thus, some or all of the depressions on the golf ball may be all or in part arcuate in shape rather than polygonal as shown, i.e. they may be curvilinear either in circumference or in depth (when viewed in cross-section) or in both. In particular, all or some of either the disclosed hexagonal or pentagonal depressions may be replaced by spherically curved depressions such as to have a generally hemispherical shape with an opening at the surface of the ball which is circular when inspected in an undistorted planar front view. Merely by way of example, a golf ball according to the invention may have all the surface depressions thereof hemispherically shaped, or only those located where hexagonal depressions are shown in Figs. 1 and 2 while the remaining depressions are pen-

tagonal in shape, etc. The depressions need not be arranged in an icosahedral pattern as described. Any arcuate shape depressions may also have an elliptical curvature in either the circumference or the depth or both.

The exterior surface patterns disclosed herein may, of course, be applied to various golf ball constructions. Thus, the ball may have a fluid, liquid or a solid center or core, and the solid core may be made of metal or of synthetic plastics or of elastomeric material. The entire ball may be a solid, preferably homogeneous composition, with or without a separate cover, and if desired the center or core may be surrounded by windings of elastomeric yarns or filaments or by an elastomeric composition, having a sufficient radial dimension to ensure that the golf ball will have the desired outer diameter. If a cover is provided in any of the foregoing described golf ball constructions, the depression pattern will be provided in the cover itself.

A preferred cover material is that described in U.S. Patent 3,264,272. In particular, the cover material is that which is known in the trade as "Surlyn A", a trademark of duPont. By way of example, a solid golf ball may be an elastomer cured

in the presence of a relatively large amount of a monomer which is capable of acting as a cross-linking agent for the elastomer and under conditions which will additionally result in polymerization of the monomer. In this elastomer a structure is formed which consists of the elastomer cross-linked into a three dimensional network with a high density of cross-links. A solid golf ball of this type is described in U.S. Patent 3,313,545.

Another example of a solid golf ball is a composition comprised of a polybutadiene elastomer; an ionomer (such as described in the aforementioned U.S. Patent 3,264,272; a thermoplastic resinous material other than an ionomer; a filler; a polyfunctional curing monomer ester having at least two non-conjugated ethylenic double bonds and a source of free radicals. A solid golf ball of this composition is described in U.S. Patent 3,421,766. A further example of a solid golf ball composition comprises a cured elastomer in conjunction with resin micro-balloons. A golf ball of this composition is described in U.S. Patent 3,238,156.

Although the present invention is operative with any thermoplastic material as noted above, it should be emphasized that certain thermoplastic materials such as polystyrene will not have the properties needed in a top quality golf ball to be used in competition; however, such materials can be used to form range balls, novelty golf balls or display golf balls etc. Particularly effective thermoplastic materials which can be used in the present invention are polyethylene, polypropylene and a copolymer of an alkylene compound such as ethylene, propylene or butylene and acrylic or methacrylic acid. The acid portion of the copolymer may be in a free acid form, partially converted to a salt or fully converted to a salt. Any of the monovalent or divalent elements of groups 1 and 2 of the periodic table can be used to form the cation of the salt in the copolymer. However, the monovalent metals such as sodium or potassium are preferred to divalent metals such as zinc because the monovalent metals possess better physical properties. The acid portion of the copolymer is preferably about 5—20% by weight of copolymer. A more complete disclosure of these copolymers is found in U.S. Patent 3,264,272. Also useful are the various nylons presently available, thermoplastic polyurethanes, polycarbonates, polysulfones and balata.

WHAT WE CLAIM IS:—

1. A golf ball having a substantially spherical surface on which is formed a plurality of depressions, the intersection of each depression with the spherical ball surface

being bounded by a circumcircle on the ball surface having a diameter of approximately 0.165 inch.

2. A golf ball according to claim 1 in which said diameter is 0.165 ± 0.015 inch.

3. A golf ball according to claim 1 or claim 2 in which each depression has a maximum depth of approximately 0.015 inch.

4. A golf ball according to claim 1 in which each depression has a maximum depth of 0.015 ± 0.003 inch.

5. A golf ball according to any one of the preceding claims in which the depressions cover from approximately 52% to approximately 62% of the total surface area of the ball.

6. A golf ball according to any one of the preceding claims in which a substantial number of the depressions form a circular intersection with the spherical surface of the ball.

7. A golf ball according to any one of claims 1 to 4 in which a substantial number of the depressions form a polygonal intersection with the spherical ball surface.

8. A golf ball according to claim 7 in which a substantial number of said polygons are hexagons.

9. A golf ball according to claim 8 in which the ball is divisible about its equatorial plane into two hemispheres and the depressions on each hemisphere are arranged so that notional spacial demarcation lines can be drawn through a number of adjacent depressions to form spherical triangles and parts of spherical triangles which substantially conform to the radial projection of a concentric regular half-icosahedron inscribed on the hemispherical surface.

10. A golf ball according to any one of claims 7 to 9 in which some of the said polygons are pentagons.

11. A golf ball according to any one of the preceding claims in which there are 252 depressions on the ball surface.

12. A golf ball according to claim 11 in which 12 of the depressions form a pentagonal intersection with the spherical ball surface.

13. A golf ball according to any one of the preceding claims wherein any closed circumferential pathway having a width of 0.005 inch or greater that may be inscribed on the surface of the ball will intersect at least one depression.

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in the presence of a relatively large amount of a monomer which is capable of acting as a cross-linking agent for the elastomer and under conditions which will additionally result in polymerization of the monomer. In this elastomer a structure is formed which consists of the elastomer cross-linked into a three dimensional network with a high density of cross-links. A solid golf ball of this type is described in U.S. Patent 3,313,545.

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2. A golf ball according to claim 1 in which said diameter is 0.165 ± 0.015 inch.

3. A golf ball according to claim 1 or claim 2 in which each depression has a maximum depth of approximately 0.015 inch.

4. A golf ball according to claim 1 in which each depression has a maximum depth of 0.015 ± 0.003 inch.

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