



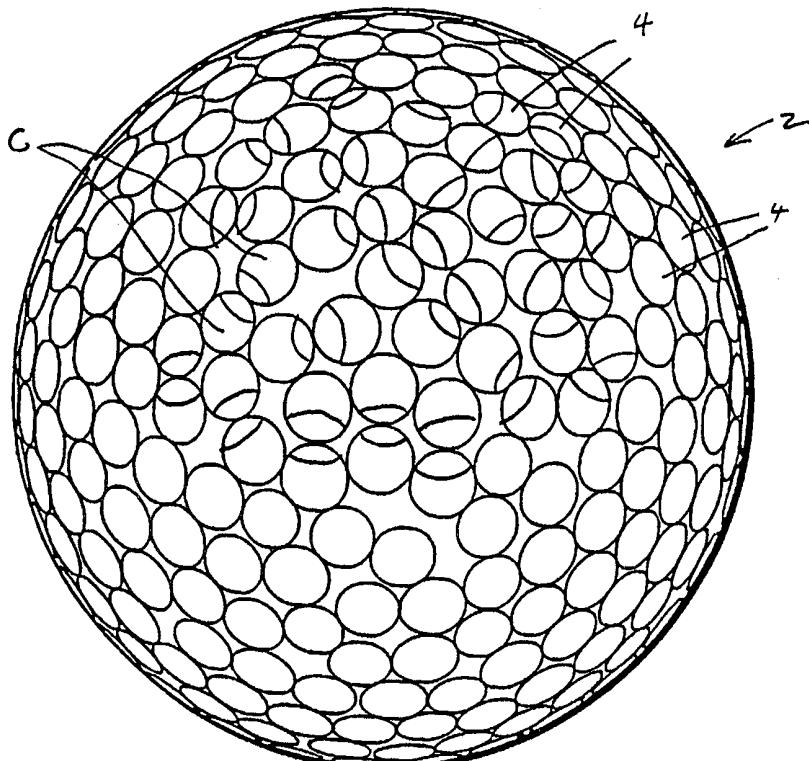
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: GOLF BALL WITH CONTOURED DIMPLES

## (57) Abstract

A new configuration for dimples (4) on the surface of a golf ball (2) is characterized by at least a portion of the bottom surface of the dimple (4) having a raised contour which is still below the surface of the ball (2). The contoured portion may comprise many shapes including of a crescent (2, 3) or a sinusoidal (4, 5) configuration. Moreover, the contoured portion may have different portions having different depths. The contours within at least some of the dimples (4) on the surface of the ball (2) alter the air flow across the golf ball (2) surface to reduce drag and increase the distance the ball (2) will travel.



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GOLF BALL WITH CONTOURED DIMPLESBACKGROUND OF THE INVENTION

The present invention relates to a new configuration for the dimples on a golf ball surface which improve the flight characteristics of the ball.

5 According to the United States Golf Association (U.S.G.A.) rules, a golf ball may not have a weight in excess of 1.620 ounces or a diameter smaller than 1.680 inches. The initial velocity of balls conforming to U.S.G.A. regulations may not exceed 250 feet per second with a maximum tolerance of 2%. Initial velocity is measured on a standard machine kept by the U.S.G.A. A projection on  
10 a wheel rotating at a defined speed hits the test ball, and the length of time it takes the ball to traverse a set distance after impact is measured. U.S.G.A. regulations also require that a ball not travel a distance greater than 280 yards when hit by the U.S.G.A. outdoor driving machine under specified conditions. In addition to this specification, there is a tolerance of plus 4% and a 2% tolerance for test error.

15 These specifications limit how far a struck golf ball will travel in several ways. Increasing the weight of a golf ball tends to increase the distance it will travel and lower the trajectory. A ball having greater momentum is better able to overcome drag. Reducing the diameter of the ball also has the effect of increasing the distance it will travel when hit. This is believed to occur primarily because a  
20 smaller ball has a smaller projected area and, thus, a lower drag when traveling through the air. Increasing initial velocity increases the distance the ball will travel.

25 Drag on a golf ball is also reduced by forming a plurality of dimples, often circular, in the outer surface of the ball. The dimples serve to reduce the pressure differential between the front and rear of the ball as it travels through the air.

BRIEF DESCRIPTION OF THE PRIOR ART

Numerous dimple configurations for use on golf balls are well-known in the patented prior art, including contoured dimples. For example, the Lu U.S. patent No. 5,503,398 discloses a golf ball having a plurality of dimples arranged 5 on the spherical outer surface thereof, each of the dimples including a series of overlapping scales extending inwardly on an arcuate shaped sidewall surface of the dimple. The ball has improved directional control and increased lift and flight distance. The Oka U.S. patent No. 5,005,838 discloses a golf ball having a plurality of dimples in its outer surface. Each of the dimples includes a circular 10 projection positioned in a bottom portion thereof. The projections are alleged to increase the coefficient of drag as the ball passes through the air, thereby decreasing the distance the ball will travel.

As opposed to the Oka golf ball, the present invention was developed in order to provide a golf ball with reduced drag so that the ball will travel a greater 15 distance than conventional golf balls having circular dimples.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a golf ball having a spherical surface including a plurality of dimples arranged in the surface. The dimples are concavities in the ball surface at least some of which 20 are modified so that part of the dimple surface is convex with respect to the dimple concave surface. Thus, these dimples have a raised contoured surface relative to the dimple bottom, with the contoured surface remaining below the surface of the ball.

According to another object of the invention, the contoured portion has a crescent configuration relative to the bottom surface. The contoured portion may comprise portions of different depths. The depth of a dimple at any point is the distance between the original undimpled ball surface and that point measured 5 along a ball radius. In one embodiment the contoured portion includes a spaced pair of first portions having a first depth and a second portion arranged between the first portions and having a second depth different from the first depth. The contoured portion may also cover the entire bottom surface of the dimple.

According to a further embodiment, the contoured portion of at least one 10 dimple is arranged adjacent to the contoured portion of an adjacent dimple.

#### BRIEF DESCRIPTION OF THE FIGURES

These and other objects according to the invention will become apparent from a study of the following specification when viewed in the light of the accompanying drawing, in which:

15 Fig. 1 is plan view of a golf ball including a plurality of contoured circular dimples according to the invention;

Figs. 2 and 3 are plan and sectional views, respectively, of a contoured dimple according to a first embodiment of the invention;

20 Figs. 4 and 5 are plan and sectional views, respectively, of a contoured dimple according to a second embodiment of the invention;

Figs. 6 and 7 are plan and sectional views, respectively, of a contoured dimple according to a third embodiment of the invention;

Figs. 8 and 9 are plan and sectional views, respectively, of a contoured dimple according to a fourth embodiment of the invention;

25 Figs. 9 and 10 are plan and sectional views, respectively, of a non-circular

oval dimple according to a fifth embodiment of the invention; and

Figs. 11 and 12 are plan and sectional views of a triangular dimple according to a sixth embodiment of the invention.

#### DETAILED DESCRIPTION

5 In Fig. 1, there is shown a golf ball 2 having a spherical surface which contains a plurality of circular dimples 4, the circle being defined where the dimple intersects with the surface of the ball. The dimples may all be of the same diameter, or different diameter dimples may be provided. As shown in Fig. 3, each dimple has a bottom surface 6 defined by a radius of curvature  $r$  for the  
10 dimple. The radius further defines the depth  $d$  of each dimple.

At least some of the dimples on the golf ball surface include a contoured portion 8 on the bottom surface. The contour --which is analogous to a filled-in portion of the dimple-- can take many different shapes, examples of which will be described in the embodiments of Figs. 2-9. The contoured portion has a depth less  
15 than the radius of curvature of the dimple. Thus, each contoured dimple includes a raised contoured portion relative to the dimple bottom, with the contoured portion being maintained below the surface of the golf ball. Thus, the ball diameter is not increased by the contoured portions. In order to comply with U.S.G.A. regulations, the ball 2 has an outer diameter of at least 1.680 inches.

20 A first contoured dimple configuration is shown in Figs. 2 and 3. The circular dimple has a crescent shaped contoured portion 8. This portion has a depth  $d_1$  less than the depth  $d$  of the dimple 4. The depth of a dimple at any point is the distance between the original undimpled ball surface and that point measured along a ball radius. The width of the crescent is preferably in the  
25 vicinity of one-half the diameter of the dimple, but other widths may be provided

as well.

In the second embodiment shown in Figs. 4 and 5, the dimple 104 in a golf ball 102 has a bottom surface 106 with a sinusoidal contoured portion 108. As with the crescent-shaped contoured portion of the embodiment of Figs. 2 and 3,  
5 the sinusoidal contoured portion 108 has a depth  $d_2$  less than the depth  $d$  of the dimple 104.

A third embodiment for a contoured circular dimple 204 in a golf ball 202 is shown in Figs. 6 and 7 wherein the contoured portion 208 in the dimple bottom surface 206 includes generally parallel portions 208a, 208b, 208c having different  
10 depths all of which are less than the total depth of the dimple. As shown particularly in Fig. 7, the portions 208a, 208b, and 208c define a stairstep configuration within the dimple.

In the fourth embodiment shown in Figs. 8 and 9, the contoured portion 308 covers the entire original bottom surface 306 of the dimple 304 in a golf ball  
15 302. Moreover, the contoured portion comprises portions of different depths. Preferably, the contoured portion includes a first portion 308a having a first depth, a second portion 308b having a second depth and a third portion 308c having a depth equal to that of the first portion as shown in Fig. 9. Thus the second portion 308b is preferably arranged between the first and third portions and has a depth  
20 greater than the first depth.

In Figs. 10 and 11 is shown the fifth embodiment of the invention wherein the dimple 404 in a golf ball 402 has an oval configuration. The contoured portion 408 of the dimple bottom surface 406 has a depth  $d_4$  less than the depth  $d$  of the dimple.

25 A sixth embodiment of the invention is shown in Figs. 12 and 13 wherein the dimple 504 in a golf ball 502 has a triangular configuration, as does the contoured portion 508 of the dimple bottom surface 506.

Referring once again to Fig. 1, at least some of the contoured dimples C are arranged so that the contoured portions of adjacent dimples are also arranged adjacent one another. If desired, all of the contoured dimples can be paired with an adjacent dimple with the contoured portions adjacent. It will be appreciated 5 that all of the dimples on the golf ball surface may be provided with contoured portions. Moreover, the dimples can be arranged on the golf ball surface in a random or geometric pattern. Any combination of contoured and non-contoured dimples may be provided.

In all of the embodiments, the contoured portion within the dimple 10 significantly alters the air flow across the surface of the ball as it travels through the air when struck by a golf club. The altered air flow serves to decrease the drag on the ball, thereby increasing the distance that it will travel.

## WHAT IS CLAIMED IS:

1. A dimple arranged in a spherical surface of a golf ball, comprising a concavity in the ball surface in which at least a portion of said concavity is modified so that a portion of the dimple surface is convex with respect to a surface defining the concavity, thereby to define a contoured portion of the dimple, said contoured portion being maintained below the surface of the ball.
2. A dimple as defined in claim 1, wherein said contoured portion has a sinusoidal configuration relative to the bottom surface.
- 10 3. A dimple as defined in claim 1, wherein said contoured portion has a crescent configuration relative to the bottom surface.
4. A dimple as defined in claim 3, wherein said contoured portion includes portions having different depths.
- 15 5. A dimple as defined in claim 4, wherein said contoured portion includes a spaced pair of first portions having a first depth and a second portion arranged between said first portion and having a second depth different from said first depth.
6. A dimple as defined in claim 5, wherein said contoured portion covers said dimple bottom surface.
- 20 7. A dimple as defined in claim 1, wherein said dimple has a circular

configuration.

8. A dimple as defined in claim 1, wherein said dimple has an oval configuration.
9. A dimple as defined in claim 1, wherein said dimple has a triangular configuration.
10. A golf ball having a spherical surface containing a plurality of dimples, each of said dimples comprising an outer edge at the intersection with the spherical surface and a concavity in the ball surface in which at least a portion of said concavity is modified so that a portion of the dimple surface is convex with respect to a surface defining the concavity, thereby to define a contoured portion of the dimple, said contoured portion being maintained below the surface of the ball.
11. A golf ball as defined in claim 10, wherein said contoured portion has a crescent configuration relative to the bottom surface.
- 15 12. A golf ball as defined in claim 11, wherein said contoured portion of at least one dimple is arranged adjacent to said contoured portion of an adjacent dimple.
13. A golf ball as defined in claim 11, wherein said contoured portion includes portions having different depths.

14. A golf ball as defined in claim 13, wherein said contoured portion includes a spaced pair of first portions having a first depth and a second portion arranged between said first portion and having a second depth different from said first depth.
- 5 15. A golf ball as defined in claim 14, wherein said contoured portion covers said dimple bottom surface.
16. A golf ball as defined in claim 10, wherein said contoured portion has a sinusoidal configuration relative to the bottom surface.
- 10 17. A golf ball as defined in claim 10, wherein at least one of said dimples has a circular configuration.
18. A golf ball as defined in claim 10, wherein at least one of said dimples has an oval configuration.
19. A golf ball as defined in claim 10, wherein at least one of said dimples has a triangular configuration.

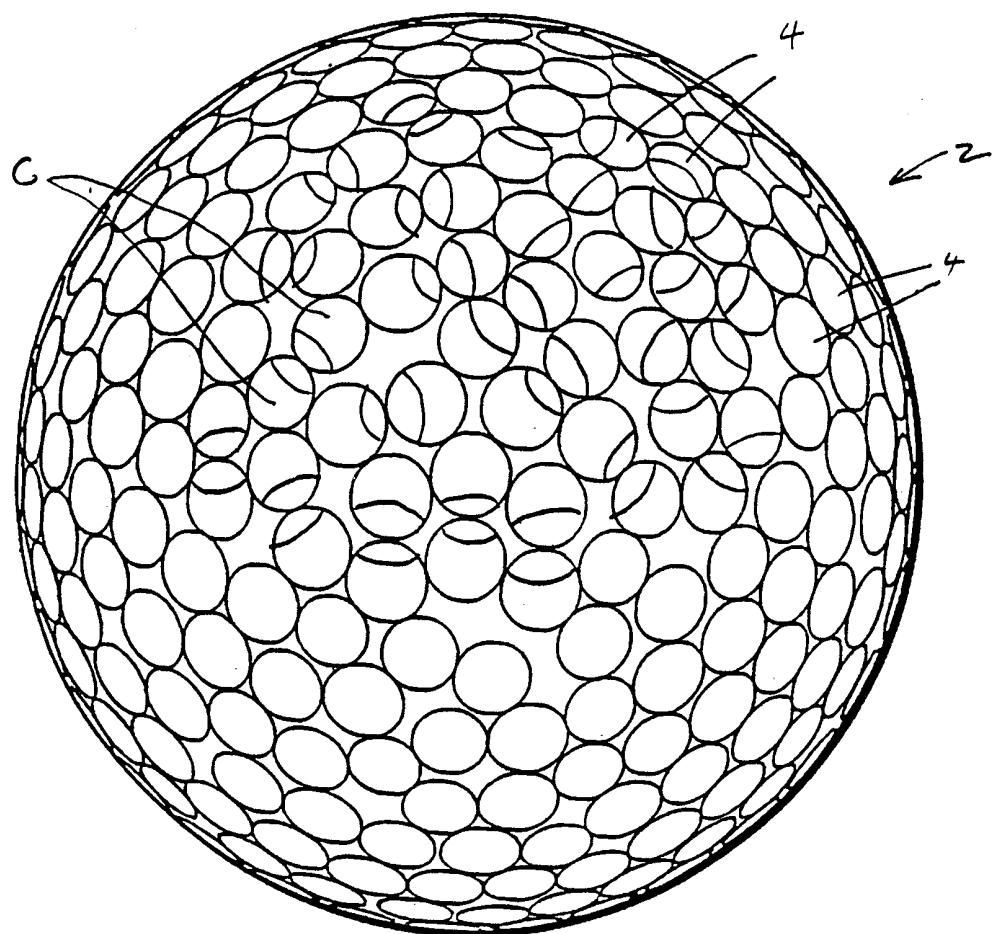


FIG. 1

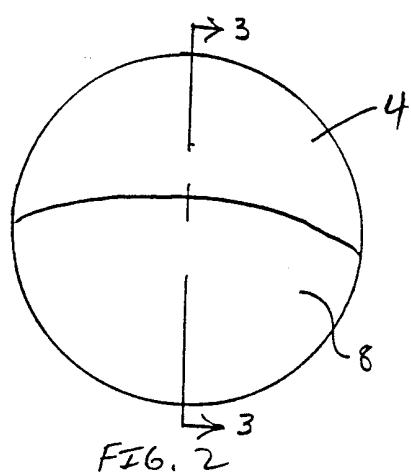


FIG. 2

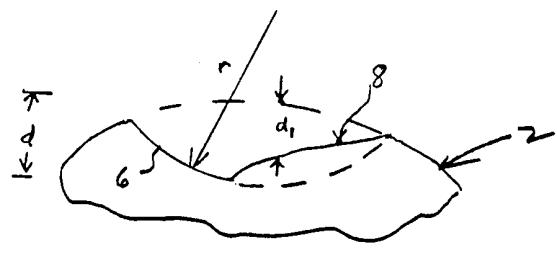


FIG. 3

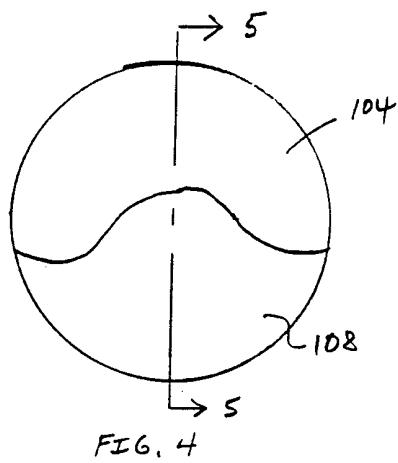


FIG. 4

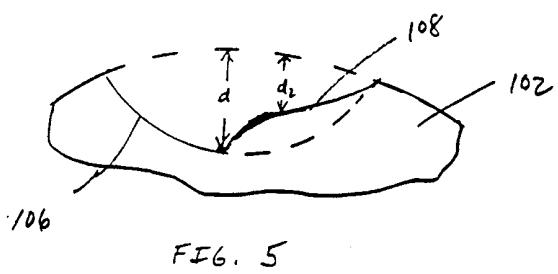


FIG. 5

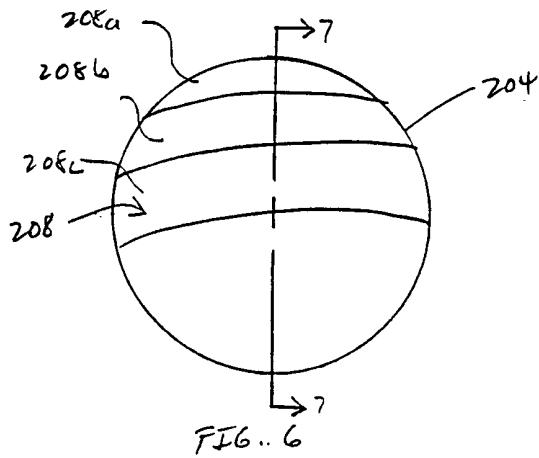


FIG. 6

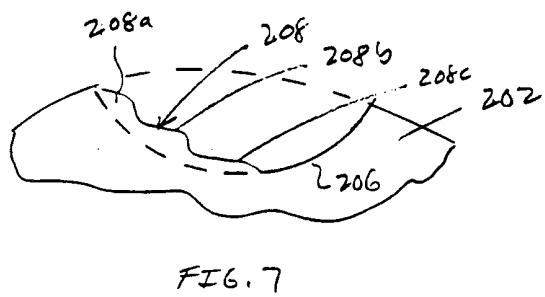


FIG. 7

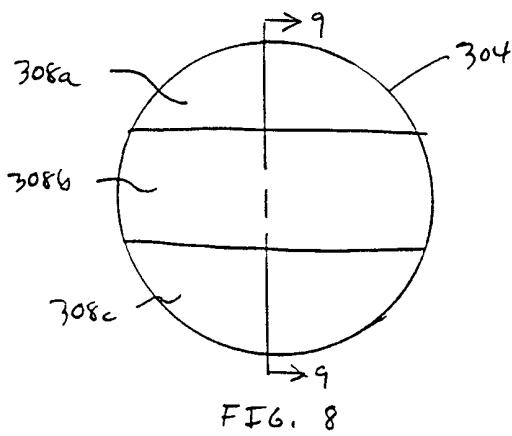


FIG. 8

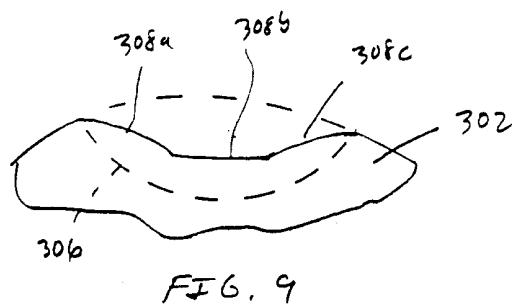


FIG. 9

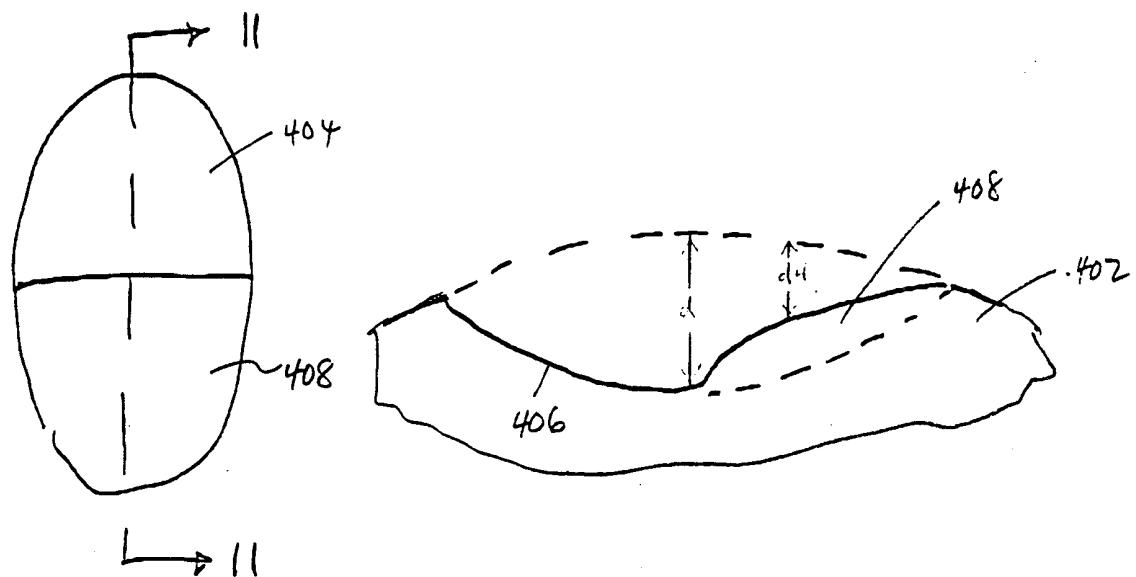


FIG. 10

FIG. 11.

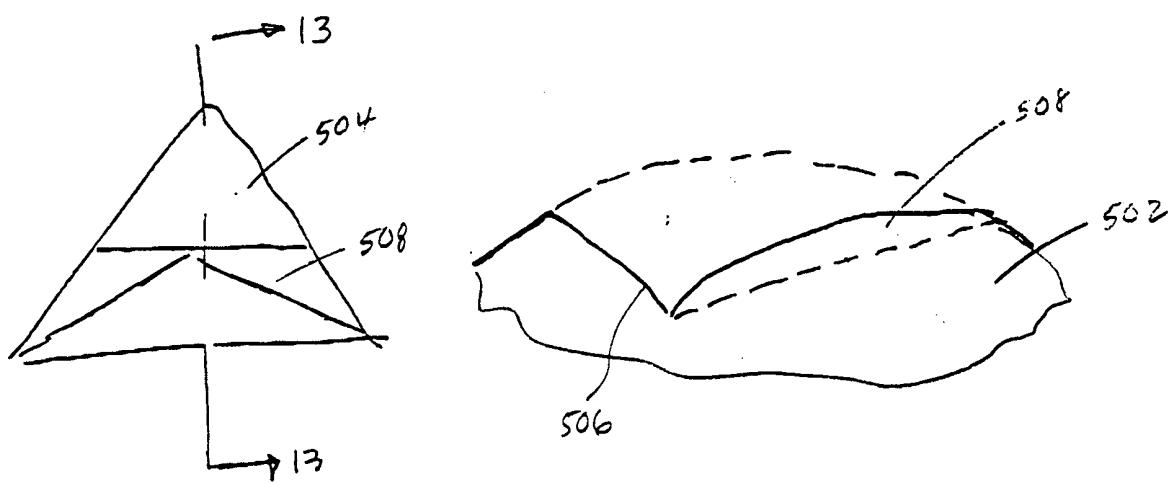


FIG. 12

FIG. 13

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/05386

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A63B 37/02, 37/14  
US CL :273/218, 227, 232, 235

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 273/218, 227, 232, 235

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, EAST, WEST Database

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,681,323 A (ALAKI ET AL.) 21 JULY 1987, See Figures 5-12, col. 1, lines 16-29 and lines 60-68, col. 2, lines 22-26, col. 3, lines 11-37.	1, 3, 4 and 10-13

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
02 MAY 2000	22 MAY 2000

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-7058	Authorized officer PAUL KIM Telephone No. (703) 308-8356	<i>Sheila Veney</i> Sheila Veney Paralegal Specialist Technology Center 3700
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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US00/05386

**Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1, 3, 4 and 10-13

**Remark on Protest**

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/US00/05386

**BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING**

This ISA found multiple inventions as follows:

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows:

Species A, Fig. 2 and 3.

Species B, Fig. 4 and 5.

Species C, Fig. 5 and 6.

Species D, Fig. 6 and 7.

Species E, Fig. 8 and 9.

Species F, Fig. 10 and 11.

The claims are deemed to correspond to the species listed above in the following manner:

Species A - claims 1, 3, 4 and 10-13.

Species B - claims 1, 2, 10 and 16.

Species C - claims 1, 7, 10 and 17.

Species D - claims 1, 3-6 and 10-15.

Species E - claims 1, 8, 10 and 18.

Species F - claims 1, 9, 10 and 19.

The following claims are generic:

claims 1 and 10 are generic claims of Species A-F.

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons:

Species A has a special technical feature of a golf ball having a crescent shaped contoured dimple.

Species B has a special technical feature of a golf ball having a sinusoidal shaped contoured dimple.

Species C has a special technical feature of a golf ball having a stairstep shaped contoured dimple.

Species D has a special technical feature of a golf ball having a different dimple depths.

Species E has a special technical feature of a golf ball having a oval shaped contoured dimple.

Species F has a special technical feature of a golf ball having a triangular shaped contoured dimple.