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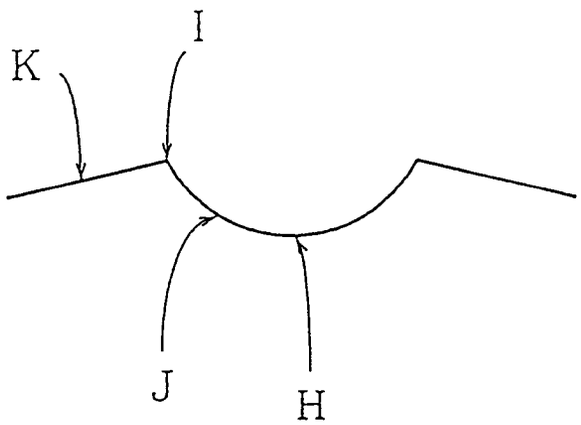
(54) Golf ball and method of manufacturing the same.

(57) A golf ball has a surface uniformly covered with a paint coating so that the carrying properties of dimples can be stably elicited. A paint to which a voltage of more than 50,000 V is applied is supplied to a disc revolving at a speed of more than 15,000 rpm for atomization, the atomized paint being coated on the surface of the golf ball to form a paint coat within a thickness in the range of from 5 to 60 μm, with a maximum/minimum coat thickness ratio of 1 to 2.

Fig. 1



EP 0 601 861 A1

The present invention relates to a golf ball which can stably elicit the carrying or flight properties of the dimples on the ball, and a method of manufacturing the same.

A golf ball has its surface covered with a coating formed from both enamel paint and clear paint, or clear paint alone, so that the ball may keep a clean outer appearance and prevent dirt from depositing thereon.

The golf ball is formed on its surface with depressions, called dimples, which are intended to help produce certain carrying properties of the ball.

However, in order to stably elicit the carrying properties of which the dimples are possessed, it is necessary that the coat of paint which covers the surface of the golf ball must be uniformly distributed. With air gun painting, for example, which is one of the painting techniques commonly used in the art, it is impractical to arrange that the interior of each dimple is uniformly coated. In particular, where the paint is applied thickly as a result of a few coats of paint, the edge portion of each dimple is, in effect, coated relatively thinly; furthermore, the resulting coating involves considerable variations in thickness from part to part of the ball.

Instead of the above discussed air gun painting, attempts have been made to coat the surface of a golf ball by electrostatic painting. However, with the electrostatic painting methods employed so far, it has been not possible to positively elicit the carrying properties of the dimples, because the method can only produce a coat of paint which is excessively thick.

The present invention is directed to overcoming the above mentioned problems of the prior art, and accordingly it is an object of the invention to provide a golf ball including a surface coat capable of stably eliciting the carrying properties of dimples.

Accordingly, the present invention provides a golf ball having a surface covered with a paint coating having a thickness in the range of from 5 to 60 μm, the ratio of the maximum to the minimum coat thickness being in the range of from 1 to 2, so that the carrying properties of dimples can be stably brought out. A coat of paint of such uniform thickness is formed by supplying a paint to which a voltage of more than 50,000 V to a disc revolving at a velocity of more than 15,000 rpm for atomization, and coating the atomized paint onto the surface of the golf ball.

First, the thickness and thickness uniformity of the paint coating covering the surface of the golf ball will be discussed. When the thickness of the coating is less than 5 μm, the coating lacks durability and its gloss will be lost as a result of several strokes given to the ball. When the coating thickness is more than 60 μm, even if the coating is uniformly effected, the dimples lose their pre-coat configuration with the result that their carrying properties will change.

In the invention, therefore, the thickness of the coating is within the range of from 5 to 60 μm, preferably within the range of 10 to 30 μm. The ratio of the maximum to the minimum coating thickness (maximum coat thickness / minimum coat thickness) represents the degree of uniformity of the coat. When the ratio is greater than 2, the uniformity of the coat is lost, and dimples lose their pre-coat configuration, which results in changes in the carrying properties of dimples.

Next, the methods for coat formation will be discussed. Air gun painting is known as a painting method for forming a coat of paint. In order to form such a coat by air gun painting, however, it is necessary that a few coats of paint, each of 2 to 3 μm in thickness, must be applied, which results in level degradation and an unsightly appearance.

Where the conventional electrostatic painting method is employed, it is impractical to run a disc at a rotational speed of more than 10,000 rpm. Therefore the paint atomization by the coating machine does not provide paint particles of a sufficiently fine size. Consequently, the paint coating at the edge portion of each dimple is thinner than that at other portion of the dimple, so that no uniform coating can be obtained within the thickness range of 5 to 60 μm, with respect to the edge portion.

Hence, according to the invention, a paint to which a voltage of more than 50,000 V has been applied is supplied to a disc revolving at a speed of more than 15,000 rpm for atomization, and the atomized paint is coated onto the surface of the golf ball to form a paint coating.

In other words, since the paint is supplied to a disc which is rotating at such a velocity of more than 15,000 rpm for atomization of the paint, fine paint particles can be obtained, so that the coating at the edge portion of each dimple can be formed to a thickness similar to that at the other portion of the dimple. Thus, it is possible to obtain a uniform coating that has a thickness in the range of from 5 to 60 μm, with the ratio of the maximum to the minimum coat thickness being less than 2.

According to the present invention, in carrying out the electrostatic coating, the voltage applied to the paint is more than 50,000 V, preferably more than 80,000 V, more preferably 90,000 to 120,000 V. The speed of rotation of the disk is preferably more than 15,000 rpm, more preferably 25,000 to 35,000 rpm.

It is preferred that the surface of the golf ball to which the paint coating is to be applied is previously coated with an electroconductive agent so as to readily enable the ball to adsorb charged paint particles. As the conductive agent, a quaternary amine or the like is preferred which will adsorb airborne moisture after it is coated

on the golf ball.

Preferably, the charged paint particles are applied so that they enclose the golf ball; and it is especially preferred that they are applied from the lower portion of the ball. Also, it is preferred that the golf ball is kept in rotation during the coating process.

According to the invention, it is possible to uniformly cover the surface of the golf ball with a paint coating, thereby to stably elicit the carrying properties of the golf ball dimples.

Fig. 1 is a view schematically illustrating a dimple and its periphery on the surface of a golf ball of the invention.

To further illustrate the invention, the following examples are given together with comparison examples.

Examples 1 to 4, and Comparison Examples 1 to 8

Golf balls were formed on their respective surfaces with dimples according to the following specifications and were subjected to surface coating. Evaluation was made with respect to their characteristics.

1. Golf balls used:

Two-piece golf balls each comprising a core formed by vulcanizing a rubber composition, and a cover formed principally of an ionomer rubber, the core being covered with the cover.

2. Number of dimples formed on each golf ball:

Dimples were formed in either of the following two ways, with respect to their number.

A : 432

B : 342

3. Coating methods:

C : electrostatic painting; disk diameter 80 mm

D : electrostatic painting; disk diameter 200 mm

E : air gun painting, 1 time coat

F : air gun painting, 2 time coat

G : electrostatic painting; disk diameter 200 mm

In electrostatic painting C, D and G, the voltage applied to the paint was 90,000 V, and speed ranges of disk rotation were C: 25,000 to 35,000 rpm; D: 7,000 to 9,000 rpm; and G: 7,000 to 9,000, as shown in Table 1 given hereinafter.

The speed of ball rotation during the process of electrostatic painting was 50 rpm. After painting, each ball was dried at a temperature of less than 50 °C. for 24 hours. In cases C, D and G, for the purpose of electrostatic painting, the surface of the ball was previously coated with Plaslac Electroconductive Agent NC (trade name ; available from Cashew Co.) that had been diluted with isopropyl alcohol to a concentration of 1 %. In cases E and F for air gun painting, the pressure applied during the painting process was 2 kg/cm^2.

4. Paint

Clear paint only was used.

Coating amounts on sample balls were: 200 mg one minute after coat application, in each of cases C to E; 100 mg in case F; and 500 mg in case G.

5. Manner of Evaluation

Evaluation was made on four items: appearance, coat thickness, maximum coat thickness / minimum coat thickness, and carrying property or flight performance.

(1) Appearance:

For each example, 12 golf balls were visually observed in respect of their appearance. Observation results are expressed on the basis of the following evaluation criteria:

O: generally iniform in color and dimples are clearly contoured;

△: dimple edge portion is slightly lighter in color than other portion, but dimples are clearly contoured; and

×: dimple edge portion is noticeably different in color from other portion, or dimples are not clearly contoured.

(2) Coat thickness:

Using 12 golf balls as samples, measurements were made with three portions of each golf ball, at four positions designated H, I, J and K in Fig. 1; and with respect to each measured portion, the average of coat thickness values measured at the four positions was taken as the coat thickness of that particular portion.

On the basis of the measurements was determined the average for each golf ball.

Then, an average was determined for the 12 golf balls. Evaluation results are shown in overall average values and R (difference between maximum value and minimum value) values.

Referring to Fig. 1, there is schematically shown a portion of a golf ball including a dimple and its periphery on the surface of the ball. In the drawing, H, I, J, K represent the following positions.

H: dimple center, or deepmost portion of the dimple;

I: edge portion of the dimple;

J: midportion between the dimple center and the edge portion; and

K: peripheral surface portion of the dimple.

(3) Max. coat thickness / min. coat thickness:

Calculated on the basis of the measurements of coat thickness in (2) above. The results are shown in both average and R values.

(4) Carrying property:

In each example, 12 golf balls were used as samples, which were tested by employing a swing robot of Trus Temper's make in such a way that each ball was hit by a No. 1 wood club at a head speed of 45 m/s. The carry of the ball and the height of its flight trajectory were measured. The results are shown in both average and R values. Tests were carried out under, the conditions of no wind and 24°C.

The height of the flight trajectory of each hit ball is expressed by the angle which a straight line connecting between the highest point of the trajectory and the point of hitting makes with the horizontal.

The appearance evaluation results, coat thickness measurement results, and maximum coat thickness / minimum coat thickness ratios are shown in Table 1, and the carrying property measurement results are shown in Table 2.

Table 1:

	No.	No. of dimples	Coating		Appearance	Coat thickness (μm)		Max. coat thickness / Min. coat thickness	
			Method	Rotary speed (rpm)		Aver.	R	Aver.	R
Example	1	A	C	25,000	○	18.5	2.1	1.53	0.24
	2	A	C	30,000	○	19.3	1.4	1.31	0.20
	3	A	C	35,000	○	18.1	1.9	1.61	0.31
	4	B	C	30,000	○	19.5	1.7	1.40	0.26
Comparison example	1	A	D	7,000	×	18.6	4.5	4.80	1.80
	2	A	D	9,000	×	18.9	3.0	2.30	0.60
	3	B	D	9,000	×	19.4	2.3	2.40	0.60
	4	A	E	———	×	18.8	10.9	7.80	3.50
	5	B	E	———	×	19.1	11.2	8.80	3.20
	6	A	F	———	△	19.6	8.3	2.60	0.80
	7	B	F	———	△	18.9	7.8	2.50	0.70
	8	A	G	9,000	×	65.3	20.0	1.50	0.21

Table 2:

	No.	No. of dimples	Carrying property			
			Carry (yard)		Height of flight trajectory (°)	
			Aver.	R	Aver.	R
Example	1	A	231.3	1.2	13.8	0.20
	2	A	231.7	1.1	13.7	0.20
	3	A	231.0	1.1	13.8	0.10
	4	B	230.8	1.6	13.4	0.20
Comparison example	1	A	230.5	3.0	14.0	0.50
	2	A	230.9	2.1	13.8	0.40
	3	B	229.3	2.2	13.6	0.40
	4	A	228.1	3.9	14.9	0.80
	5	B	226.4	4.1	14.6	0.80
	6	A	230.3	2.5	14.1	0.50
	7	B	228.5	4.7	13.9	0.60
	8	A	210.5	1.7	17.5	0.21

As may be appreciated from Table 1, balls of Examples 1 to 4 are all satisfactory in appearance and within a coat thickness range of 5 to 60 μm, with a maximum coat thickness / minimum coat thickness ratio registered lower than 2, which shows good uniformity of coat thickness. Therefore, as Table 2 shows, balls of Examples 1 to 4 exhibited a greater carry than balls of comparison examples having corresponding numbers of dimples,

stably eliciting the potential flight performance of dimples.

In contrast to this, balls of Comparison Examples 1 to 8 are all unsatisfactory in appearance and, although balls of Comparison Examples 1 to 7 are within a coat thickness range of 5 to 60 μm anyhow, they have a maximum to minimum coat ratio greater than 2, showing lack of coat thickness uniformity. In Comparison Example 8, in which the coat thickness is particularly large, dimples of each ball have lost their pre-coat configuration and, therefore, the flight performance or carrying property of the ball is rather low as shown in Table 2.

Claims

1. A golf ball having a surface covered with a paint coating having a thickness in the range of from 5 to 60 μm, the ratio of the maximum to the minimum thickness of the coat being in the range of from 1 to 2.

2. A golf ball as claimed in claim 1 wherein the coat of paint has a thickness in the range of from 10 to 30 μm.

3. A method of manufacturing a golf ball characterised in that a paint to which a voltage of more than 50,000 V is applied is supplied to a disc revolving at a velocity of more than 15,000 rpm for atomization, the atomized paint being coated on the surface of the golf ball.

4. A method as claimed in claim 4 wherein the applied voltage is more than 80,000 V.

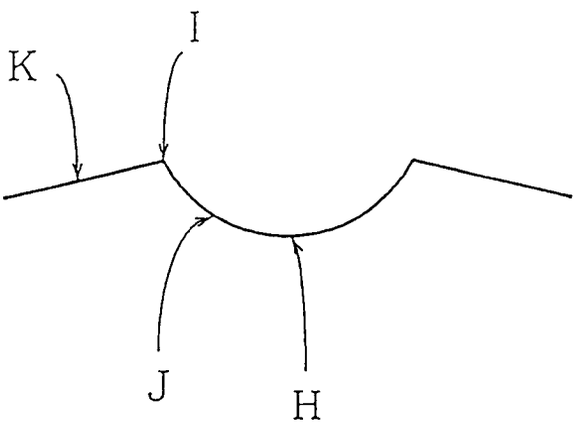
5. A method as claimed in claim 4 or claim 5 wherein the applied voltage is 90,000 to 120,000 V.

6. A method as claimed in any one of claims 3 to 5 wherein the disc is revolved at a velocity in the range of from 25,000 to 35,000 rpm.

7. A method as claimed in any one of claims 3 to 6 wherein the golf ball is pretreated with an electroconductive agent.

8. A method as claimed in claim 7 wherein the electroconductive agent is a quaternary amine.

Fig. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 9922

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X Y	US-A-4 802 674 (KITAOH) * column 2, line 25 - line 32; figure * ---	1,2 3-8	A63B37/12 B05B5/04
Y	PATENT ABSTRACTS OF JAPAN vol. 014, no. 363 (C-0746)7 August 1990 & JP-A-02 131 786 (BRIDGESTONE CORP) 21 May 1990 * abstract * ---	3-8	
A	US-A-4 871 589 (KITAOH ET AL) * column 2, line 14 - line 22 * -----	1-8	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

A63B
B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 February 1994	Clarkson, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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