Title: PUTTER GOLF CLUB HEAD OF TUNGSTEN ALLOY AND METHOD OF MANUFACTURING THE SAME

Abstract: Disclosed is a putter golf club head made of a tungsten alloy, in which the tungsten alloy normally used as a weight insert to control the center of gravity of the golf club is applied to the head of the putter, thus increasing stability and accuracy of putting. Additionally, a method of manufacturing the putter head is provided, including mixing 60 to 90 wt% tungsten and 10 to 40 wt% nickel, with impurities of less than 1 wt%; drying the mixture at temperatures lower than 100°C; removing impurities using a screen; forging the mixture at 2 to 5 tons/cm²; pre-sintering the forged product at 800 to 1000°C; re-sintering the pre-sintered product at 1400 to 1500°C; cutting the sintered product to flatten surfaces thereof; machining the sintered product by electric discharging using an electrode; grinding the sintered product using a diamond wheel; and polishing the sintered product using diamond powder.
PUTTER GOLF CLUB HEAD MADE OF TUNGSTEN ALLOY AND METHOD OF MANUFACTURING THE SAME

Technical Field

The present invention relates, in general, to putter golf club heads made of tungsten alloy and manufacturing methods thereof. More specifically, the present invention relates to a putter golf club head, characterized in that a tungsten alloy which is mainly used for a golf club as a weight insert to control the center of gravity of the golf club is applied to the whole head of the putter for putting, whereby the center of gravity of the putter is naturally lowered, thus increasing the stability and accuracy of putting; and a method of manufacturing the putter golf club head.

Background Art

Generally, a set of golf clubs required for playing golf comprise wood clubs, iron clubs and a putter.

The wood club includes a driver and fairway woods, and is used for long range shots. The iron club is classified into long irons, middle irons and short irons, and is used to increase shot accuracy in a middle distance range. In addition, the driving distances and head angles of iron clubs vary.
The putter is the golf club used to move a golf ball into a hole from a relatively close position by putting the ball, rather than forcefully hitting it onto the green. Putters include T-, egg-, pin- and L-shapes, based on the outer forms thereof. Moreover, unlike functions of wood clubs and iron clubs, the putter exhibits a very important function at the final step of a golf hole to move the golf ball into the hole. That is, the putter plays an important role in putting requiring masterly skill and concentration because the golfer should get the correct lie and control the putting force.

Therefore, such a putter has a head conventionally made of stainless steel and titanium.

However, since the above-mentioned head materials have undesirable low weight, it is difficult to enlarge an effective club face by lowering the center of gravity of the putter. Further, the head made of the above materials has non-uniform density, resulting in failing to enlarge an effective club face.

To overcome the problems, there is provided a conventional putter head as shown in FIG. 1, including a body 1 formed of titanium or aluminum having low density, and two inserts 3 formed of tungsten and attached to the opposite ends of the body 1. The conventional putter head is advantageous in that the two inserts 3 serving as heel weight and toe weight are contained in the body 1 of the club head, to provide a high moment of inertia. Thereby,
when a golf ball hits points other than the center point of the club head, the occurrence of twisting of the club head may be reduced.

However, the above putter head is disadvantageous in terms of providing non-uniform weight and density distribution to the whole head of the putter, due to the different densities of titanium used for the body and tungsten used for the two inserts, consequently providing a narrow effective club face and low resistance to twisting when the golf ball is hit.

Disclosure of the Invention

Leading to the present invention, the intensive and thorough research on putter heads, carried out by the present inventors aiming to avoid the problems encountered in the related art, resulted in the finding that a tungsten alloy used for a golf club as a weight insert to control the center of gravity of the golf club may be applied to a head of a putter for putting, whereby the center of gravity of the golf club can be naturally lowered, thus increasing the stability and accuracy of putting. Thus, women or golf beginners can realize square impact and ideal head turn control by using the putter head of the present invention. Also, the putter head of the present invention, which has uniform weight distribution, does not shudder when the ball
is struck, therefore accurately maintaining the flight direction of the golf ball.

Accordingly, an object of the present invention is to provide a putter golf club head made of a tungsten alloy.

Another object of the present invention is to provide a method of manufacturing the putter golf club head.

In order to accomplish the above objects, the present invention provides a method of manufacturing a putter golf club head made of a tungsten alloy, including mixing 60 to 90 wt% tungsten and 10 to 40 wt% nickel, with inevitable impurities of less than 1 wt%; drying the resulting mixture at temperatures lower than 100°C; removing impurities from the mixture using a screen; forging the mixture at 2 to 5 ton/cm²; pre-sintering the forged product at 800 to 1000°C in a heat treatment furnace in the natural atmosphere or an inert gas atmosphere; re-sintering the pre-sintered product at 1400 to 1500°C in a heat treatment furnace in the natural atmosphere or an inert gas atmosphere; cutting the sintered product to flatten all surfaces thereof using a milling machine; machining the sintered product having flattened surfaces into a predetermined form by electric discharging using an electrode; grinding the sintered product using a diamond wheel; and polishing the ground sintered product to a shine using diamond powder.

Brief Description of the Drawings
The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a conventional putter golf club head;

FIG. 2 is a perspective view of a putter golf club head according to a first embodiment of the present invention; and

FIG. 3 is a perspective view of a putter golf club head according to a second embodiment of the present invention.

Best Mode for Carrying Out the Invention

Hereinafter, a detailed description will be given of a putter golf club head made of a tungsten alloy and a method of manufacturing the same, according to the present invention, with reference to the appended drawings.

FIG. 2 is a perspective view of a putter golf club head according to a first embodiment of the present invention, and FIG. 3 is a perspective view of a putter golf club head according to a second embodiment of the present invention.

In the present invention, in cases where a specific description for the related techniques or structures is
considered to be unnecessary, the specific description is omitted.

Further, it should be understood that the terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting.

As shown in FIG. 2, the putter golf club head of the present invention includes a head 10 and a shaft 20. In addition, an implanted part 30 is provided on a predetermined portion of the head 10, as seen in FIG. 3.

The head 10, which is L-shaped, includes a front face 12 that comes into contact with a golf ball during the action of putting the ball, a back weight 14 to control the weight and center of gravity, a sole 16 having a wholly flat surface, and an upper face 18 having a shaft bore 19 to insert a shaft 20 into a side portion thereof.

Further, on a central portion of the upper face 18 of the putter head 10 and other predetermined portions thereof, there is provided the implanted part 30 inlaid with gold, platinum, or diamond. Such an implanted part 30 functions to provide a luxurious appearance to the golf club, and as well, it serves to indicate the sweet spot when the golf ball is hit by the front face of the putter head, so that anyone can hit the ball without mis-hits.

As such, the putter head 10 comprises 60 to 90 wt% tungsten and 10 to 40 wt% nickel, with impurities of less than 1 wt%.

Tungsten is advantageous because it has high
hardness, superior brightness and scratch resistance, so that tungsten-containing products can be semi-permanently used.

Since tungsten has a very high melting point of about 3410°C, it is difficult to melt tungsten. Thus, in cases where tungsten should be thoroughly melted, arc or plasma techniques are adopted.

For use, tungsten having a high melting point is powdered and then sintered because it becomes denser (has high density) due to diffusion even at temperatures lower than its melting point, thus obtaining a desired product.

However, tungsten having high hardness is disadvantageous because it has low resistance to impact.

Accordingly, nickel is added in an amount of 10 to 40 wt%, so that the putter head face which comes into contact with the golf ball has high resistance to impact.

In addition, nickel functions to allow hot working and cold working to be easily performed.

When the putter head made of the tungsten alloy is manufactured using a forging process, nickel acts to confer toughness to the putter head which is brittle due to the high hardness of tungsten. Thus, the putter head has increased hot and cold workability.

As such, if nickel is added in an amount of less than 10 wt%, forgibility of the tungsten alloy is poor, and the putter head may be easily broken. On the other hand, if nickel is added in an amount exceeding 40 wt%, the putter
head decreases in weight thereof, and it is impossible to enlarge the effective club face of the putter head. As well, the putter head has non-uniform weight and density distribution over the center and the perimeter thereof, resulting in a narrow sweet spot of the putter head.

Upon manufacturing the putter head of the present invention, the use of the tungsten alloy containing the controlled amount of nickel results in the weight of the putter head being increased by 15% or more. Thus, larger amounts of energy are transferred to the golf ball upon putting, whereby women or golf beginners can readily realize square impact and ideal head turn control. Further, since the putter head has uniformly distributed weight, it does not shudder when the ball is struck, consequently accurately maintaining the flight direction of the golf ball.

In addition, the manufacturing method of the putter golf club head made of the tungsten alloy is as follows.

1. Preparing Alloy Powder

   Powder, which includes 60 to 90 wt% tungsten and 10 to 40 wt% nickel, with inevitable impurities of less than 1 wt%, is mixed for 60 to 90 hours by ball milling.

2. Drying

   The mixed tungsten alloy powder is placed into an oven at temperatures lower than 100°C for drying.

   At this time, the dried tungsten alloy powder should be in the anhydrous state so as to realize good mixing and
uniform powder size distribution, thus obtaining a density in the range of 10.0 to 20.0 g/cm³. Also, the anhydrous tungsten alloy powder allows the following step to be easily performed.

(3) Removing Impurities

By adopting a screening process to sort the anhydrous tungsten alloy powder according to size with the use of various standard screens, impurities are removed from the anhydrous tungsten alloy powder.

That is, to separate the impurities from the 0.8 μm or smaller tungsten alloy powder, 10 screens of 20 to 40 mesh are mounted to a vibration machine and the screening process is carried out at 40 cycles per minute.

(4) Forging

The tungsten alloy powder without impurities is subjected to forging at room temperature under pressure of 2 to 5 ton/cm³.

(5) Pre-sintering

The forged product is pre-sintered into a predetermined form at 800 to 1000°C which is lower than the melting point of tungsten in a heat treatment furnace in the natural atmosphere or an inert gas atmosphere, so as to securely aggregate while being melted.

(6) Re-sintering

The pre-sintered forged product is re-sintered at 1400 to 1500°C in a heat treatment furnace in the natural atmosphere or an inert gas atmosphere.
As such, the tungsten alloy is pre-sintered in the form of the putter head as shown in FIGS. 2 and 3. In addition, when the pre-sintered forged product aggregates while being melted, its distortion and depression can be checked. In this way, since the re-sintering step is performed after the form of the pre-sintered product is confirmed, a desirable sintered product can result.

(7) Cutting
The sintered tungsten alloy is cut using a milling machine so that all surfaces of the tungsten alloy are flattened and accurate dimensions thereof are ensured.

(8) Electric Discharging
The sintered product having flattened surfaces is machined into a predetermined form to have a hole therein by electric discharging using a silver-containing electrode, an electric discharging apparatus and a 0.001 mm electric super drill.

(9) Grinding
The above sintered product is ground using a grinding machine at 300 rpm and a diamond wheel, to form the desired shape.

(10) Final Polishing
The ground sintered product is polished to a shine using diamond powder, wood plate, and wool, to obtain a final product.

(11) The central portion indicating the sweet spot of the final product and another portion thereof are machined
by electric discharging to form the implanted part 30 having inlaid gold or diamonds, for a luxurious appearance, and to form the shaft bore 19 to insert the shaft 20 therein, respectively.

Compared to conventional putter golf club heads made of stainless steel and titanium, the putter golf club head of the present invention composed of the titanium alloy has higher density and is heavier. Accordingly, when two metals having equal volumes are compared, the total weight of the putter head can increase even though a smaller amount of the tungsten alloy is used. Further, it is possible to uniformly distribute the weight and density over the center and the perimeter of the putter head, thus enlarging the sweet spot.

Furthermore, the putter golf club head has increased weight, and thus, a low center of gravity thereof is always maintained, thereby enlarging the effective club face. Even upon mis-hits, the flight direction of the golf ball can be maintained within the desired range. Thereby, an easily usable putter golf club head having high putting accuracy can be obtained.

Also, the larger the sweet spot on the putter head face which comes into contact with the golf ball, the higher the moment of inertia of the putter head. Therefore, upon off-center hitting, it is possible to maintain a stable driving distance.
Industrial Applicability

As described above, the present invention provides a putter golf club head made of a tungsten alloy and a method of manufacturing the same. The putter golf club head of the present invention is advantageous because it maintains a low center of gravity and enlarges the effective club face, on account of the larger weight thereof. Therefore, women or golf beginners can enjoyably play golf while realizing square impact and ideal head turn control by using the present putter head. Further, upon putting strokes, the putter head of the present invention does not shudder, consequently accurately maintaining the flight direction of the golf ball.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.
Claims

1. A method of manufacturing a putter golf club head made of a tungsten alloy, comprising:
   mixing 60 to 90 wt% tungsten and 10 to 40 wt% nickel, with inevitable impurities of less than 1 wt%, to obtain tungsten alloy powder;
   drying the resulting mixture at temperatures lower than 100°C;
   removing impurities from the mixture using a screen;
   forging the mixture at 2 to 5 ton/cm³;
   pre-sintering the forged product at 800 to 1000°C in a heat treatment furnace in a natural atmosphere;
   re-sintering the pre-sintered product at 1400 to 1500°C in a heat treatment furnace in a natural atmosphere;
   cutting the sintered product to flatten surfaces thereof using a milling machine;
   machining the sintered product having flattened surfaces into a predetermined form by electric discharging using an electrode;
   grinding the sintered product using a diamond wheel; and
   polishing the ground sintered product to a shine using diamond powder.

2. The method according to claim 1, further comprising implanting gold or diamonds.
3. The method according to claim 1, wherein the mixing of the tungsten alloy powder is performed for 60 to 90 hours by ball milling.

4. The method according to claim 1, wherein the pre-sintering and the re-sintering are performed in the heat treatment furnace in an inert gas atmosphere.

5. The method according to claim 1, wherein the golf club putter head made of the tungsten alloy has a density in a range of 10.0 to 20.0 g/cm³.

6. The method according to claim 1, wherein the tungsten alloy powder has a size of 0.8 μm or less.

7. A golf club putter head made of a tungsten alloy, manufactured according to any one of claims 1 to 6.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**IPC7 A63B 53/04**

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)

IPCG7 A63B

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

KR,JP : IPC as above

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>US 2004/58744 A (JOHN A. SOLHEIM et. als.) 25 March 2004 (25.03.2004) see the whole documents</td>
<td>1-7</td>
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<tr>
<td>A</td>
<td>US 6440010 A (UDAY V. DESHMUKH) 27 August 2002 (27.08.2002) see the whole documents</td>
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<tr>
<td>A</td>
<td>US 6406382 A (UDAY V. DESHMUKH et. als.) 18 June 2002 (18.06.2002) see the whole documents</td>
<td>1-7</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search

12 APRIL 2005 (12.04.2005)

Date of mailing of the international search report


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