An iron golf club and a set of iron golf clubs which realize the accurate travelling direction of a ball as well as the accurate travelling distance thereof. Both a tolerance of a loft angle and that of a lie angle of a head 1 are set within a range of ±0.25 degree. For a set of iron golf clubs, a difference between loft angles of respective two golf clubs of adjacent club numbers is set so as to have a tolerance of ±0.5 degree or less. To realize such accuracy, there is proposed for example a head 1 constructed of a head body 21 and a hosel member 22, which are joined to each other by laser welding, electron beam joining or amorphous joining.
IRON GOLF CLUB AND A SET OF IRON GOLF CLUBS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part application of U.S. Ser. No. 09/325,818 filed on Jun. 4, 1999, now pending.

BACKGROUND OF INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a golf club and a set of iron golf clubs, particularly relates to the structures thereof.

[0004] 2. Prior Art

[0005] In a golf club head, a loft angle and lie angle of a head are important factors to characterize the same. In FIGS. 3 and 4 is illustrated a head 1 of an iron golf club, which defines a ball striking face 2 at its front face, a back 3 at its rear side, a sole 4 at its lower side, a top 5 at its upper part, a heel 6 at one side and a toe 7 at the other side, respectively. The heel 6 is formed at its upper portion with a neck 8, from which extends upwardly a hosel 9. The hosel 9 serves as a shaft connector for coaxially connecting a shaft 10 thereto. Reference numeral 11 designates a plurality of concave grooves formed on the face 2, which are called score lines.

[0006] As illustrated in FIG. 4, a loft angle α is defined as an angle of the substantially flat face 2 to a vertical plane including a central axis (a) of the shaft 10. Particularly, a loft angle α exerts an influence upon an angle of elevation at which a struck ball initially travels, so that it affects a travelling distance of a ball. On the other hand, a lie angle β, as is illustrated in FIG. 3, is defined as an angle of the central axis (a) of both the hosel 9 and the shaft 10 to a horizontal plane H when the sole 4 is grounded on the horizontal plane H at a middle point M of the score lines 11, said lie angle being defined by what is called sole-standard. A lie angle β, being in association with a length of the shaft 10, affects the orientation of the face 2, and thus affects the travelling direction of a ball. Incidentally, the angle of the score lines 11 to the shaft 10 also is called a lie angle defined by what is called score line or corrugation-standard, which is distinguished from the lie angle by aforesaid sole-standard. It should be noted that for iron golf clubs, a lie angle has normally been measured by the score-line-standard rather than by the above-mentioned sole-standard.

[0007] When playing golf, various golf clubs of different club numbers are used according to varying playing situations, whether they may be iron clubs or wood clubs. Typically, for a set of such plural golf clubs, the larger a club number becomes, the shorter the shaft 10 becomes and thus results in a larger lie angle β and a larger loft angle α. As each of loft angle α and lie angle β affects a golf play, as above mentioned, the stable and precise setting thereof is desirable to a golf club of each club number.

[0008] Conventionally, loft angle α and lie angle β of an iron golf club, for example, have been set through the adjustment of the angles in a manner of fixing a head formed integrally with a hosel to a jig, then cold bending the hosel manually, using a special purpose adjuster. Such conventional adjustment is the one using human power, and thus it requires a skill to a certain extent. Further, as it is cold working, the precise adjustment would be difficult. Specifically, for a mass production, the deviation of each of the loft angle α and lie angle β would inevitably be at least about ±0.5 to 1.0 degree.

[0009] For a loft angle α, however, with the deviation of as much as ±0.5 to 1.0 degree, the difference between the maximum and the minimum would amount to 2 degrees, thus resulting in a deviation of 2 degrees at maximum. Therefore, there would be a likelihood of the occurrence of a great difference in travelling distance among golf clubs of the same club number. Also, for a lie angle β, it is typically set in units of 0.5 to 1.0 degree among a set of iron golf clubs, and thus if the deviation is as much as ±0.5 to 1.0 degree, a reverse setting is likely to occur, such as a smaller lie angle for a larger club number. Thus, the travelling direction of a ball would be adversely affected.

[0010] Regarding this problem, U.S. Pat. No. 6,089,070 to Hancock discloses that a respective tolerance for loft and lie angles of a wood golf club is kept in the range of ±0.25 degrees, using CNC milling. However, the manufacture of a golf club by CNC milling requires so time-consuming and expensive works that it is impractical in mass production. In addition, the method for measuring the loft and lie angles of a wood golf club is different from that for an iron golf club, such that in a wood golf club, the loft angle is determined by measuring the angle of the sole to the face, and the lie angle is measured by the aforesaid sole-standard. According to the method, however, the measurement must be carried out with the sole 4 being grounded on the horizontal plane H at a middle point M of the score lines 11, and thus it is more difficult than the method by the score line standard.

SUMMARY OF THE INVENTION

[0011] To eliminate the above-mentioned problems, it is, therefore, a primary object of the present invention to provide an iron golf club with such an improved precision of a loft angle that it realizes as accurate a travelling distance of a ball as possible.

[0012] It is another object of the invention to provide an iron golf club with such an improved precision of a lie angle that it realizes as accurate a travelling direction of a ball as possible.

[0013] It is a further object of the invention to provide a set of iron golf clubs with an optimal loft angle per each club number.

[0014] Also, it is a further object of the invention to provide a set of iron golf clubs with an optimal lie angle per each club number.

[0015] Still also, it is a further object of the invention to manufacture a set of iron golf clubs with such improved precision of lie angle and loft angle per each club number, at low costs and high efficiency.

[0016] To attain the above objects, there is proposed an iron golf club having a head, said head comprising a striking face and a shaft connected thereto, wherein tolerances of loft angle and lie angle of the head are each set within a range of ±0.25 degree.
Further, there is also proposed a set of iron golf clubs consisting of a plurality of golf clubs, each comprising a head having a striking face, a shorter shaft connected thereto and a larger loft angle as a club number thereof increases, wherein the tolerance of a difference between two loft angles set for respective two golf clubs of adjacent club numbers is set in a range of ±0.5 degree.

Furthermore, there is also proposed a set of iron golf clubs consisting of a plurality of golf clubs, each comprising a head having a striking face, a shorter shaft connected thereto and a larger lie angle as a club number thereof increases, wherein the tolerance of a difference between two lie angles set for respective two golf clubs of adjacent club numbers is set in a range of ±0.5 degree.

Still further, there is also proposed an iron golf club having a head, said head comprising a striking face and a shaft connecting portion, said face being formed with score lines prior to being joined to a hosel member, said head being constructed of a head body and the said column-shaped hosel member, said head body being formed with a flat end face, serving as said shaft connecting portion, said head body being formed by forging, provided with a short, column-shaped fitting portion for joining the hosel member thereto, said fitting portion having an end face which is formed so flat that it is joined to the flat end face of said hosel member so that a tolerance of a loft angle of the head is set within a range of ±0.25 degree, wherein said head body is retained with reference to respective positions of said score lines and face so that the end face of the fitting portion is machined to define a predetermined lie angle, while said hosel member is joined to the end face of the fitting portion so that a central axis thereof may be perpendicular thereto. With the structure, the accuracy of the lie and loft angles can be enhanced, at low costs but at high efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will be apparent to those skilled in the art from the following description of the preferred embodiments of the invention, wherein reference is made to the accompanying drawings, of which:

FIG. 1 is an exploded perspective view showing a golf club of an embodiment of the invention.
FIG. 2 is a section of a golf club of FIG. 1.
FIG. 3 is a front view showing one example of an iron golf club.
FIG. 4 is a section of an iron golf club of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter is explained an embodiment of an iron golf club and a set of iron golf clubs of the invention with reference to the attached drawings.

It is to be noted that in the hereinafter-described embodiments of the invention is illustrated an iron golf club of which the overall basic configuration is the same as that illustrated in FIGS. 3 and 4, as previously referred to. Therefore, the same portions as those described with reference to FIGS. 3 and 4 in the foregoing prior art paragraph will be designated by the same reference numerals, and their repeated detailed descriptions will be omitted hereinafter. It is further to be noted that a set of iron golf clubs according to the invention consists of a plurality of golf clubs in which each shaft 10 becomes shorter, while each loft angle α and lie angle β becomes greater, as a club number increases.

In FIGS. 1 and 2 showing an embodiment of the invention, a head 1 is constructed of two pieces, i.e., a head body 21 and a hosel member 22 which is cylinder-shaped and thus constructs a hosel 9. These head body 21 and hosel member 22 are each made of suitable metallic materials, such as steel, titanium, titanium alloy, beryllium copper or the like, which are each formed by means of suitable processes, such as a press-working, forging, casting, machining or the like.

A neck 8 of the head body 21 is formed with a short, column-shaped fitting portion 23 for joining the hosel member 22 thereto. To an end face 23a of this hosel member fitting portion 23 is joined one end face 22a of the hosel member 22. These end faces 22a and 23a thus joined to each other are each basically of the same configuration, such as a flat plane or the like. The other end face of the hosel member 22 is formed with a shaft attachment hole 24. Into this shaft attachment hole 24 is fixedly inserted one end of the shaft 10, thereby coaxially connecting the shaft 10 to the hosel member 22. This shaft attachment hole 24 may be processed prior to joining the hosel member 22 to the head body 21, or otherwise, may be formed by machining or the like after the joining process.

For joining the head body 21 to the hosel member 22, a laser beam welding, electron beam joining or amorphous joining may be used. A laser beam welding is carried out, utilizing heat generated when a laser or a thermal energy concentrated optical beam impinges upon respective butting portions of the head body 21 and hosel member 22. With such laser beam welding, a high precision welding will be realized, as a wider range of a laser generating condition is able to be set. For an electron beam joining, it is carried out, utilizing heat generated when electrons are accelerated by applying high voltage thereto in a vacuum tank, and then, the concentrated energy of the electron beams is allowed to impinge upon the respective butting portions of the head body 21 and hosel member 22. With such electron beam joining as well, a high precision welding will be realized, as a wider range of an electron beam generating condition is able to be set. What is referred to as an amorphous joining is a kind of diffusion joining by means of high frequency heating, using an amorphous alloy as a joining material, which will also enable a high precision welding.

By using such laser beam welding, electron beam joining or amorphous joining for the purpose of joining the head body 21 to the hosel member 22, the orientation of the hosel member 22 relative to the head body 21 can be set precisely with comparative ease. Such setting is able to be performed by for example machining or grinding either the end face 23a of the hosel member fitting portion 23 of the head body 21 or the end face 22a of the hosel member 22 prior to the joining process. Alternatively, such setting may be carried out by holding the head body 21 and the hosel member 22 with the same being properly aligned at the time of the joining.

In a preferred form of the invention, the head body 21 is formed by forging, while the head body 21 is formed...
with the score lines 11 prior to being joined to the hosel member 22. Subsequently, the head body 21 is held by a jig or the like so that the face 2 and the score lines 11 may take reference positions, respectively, while the end face 23a of the hosel member fitting portion 23 is machined to obtain preset loft and lie angles as specified. At that time of moment, the end face 23a is machined so that the central axis of the hosel member may be perpendicular thereto. Incidentally, the end face 22a of the hosel member 22 is machined in advance so that the central axis thereof may be perpendicular thereto.

[0032] Thus, a golf club according to the foregoing embodiment of the invention easily attains that both the tolerance of a loft angle $\alpha$ and that of a lie angle $\beta$ of the head 1 are set within a range of $\pm 0.25$ degree (15). Further, for a set of iron golf clubs according to the embodiment, the tolerance of a difference between two loft angles for respective adjacent club numbers is able to be set within a range of $\pm 0.5$ degree, while that of a lie angle therefor within $\pm 0.5$ degree as well.

[0033] Through such improved precision of a loft angle $\alpha$, more accurate travelling distance of a ball is effected. Likewise, through such improved precision of a lie angle $\beta$, more accurate travelling direction of a ball is effected.

[0034] Further, with such a set of iron golf clubs, less deviation of loft angles among the golf clubs thereof as well as optimal setting of respective loft angles per each club number are effected. Accordingly, a proper travelling distance per each club number can be obtained. Furthermore, less deviation of lie angles $\beta$ as well as optimal setting of lie angles $\beta$ per each club number can be obtained.

[0035] Specifically, although a lie angle $\beta$ is typically set in units of 0.5-1.0 degree in a set of iron golf clubs, the tolerance in the order of $\pm 0.5$ degree will be able to prevent the undesirable reverse setting, such as a smaller lie angle $\beta$ for a larger club number. Accordingly, a more accurate travelling direction of a ball can be obtained per each club number.

[0036] Hereinafter is described another embodiment of the invention, in which the head 1 has the hosel 9 integrally extending therefrom. FIGS. 3 and 4 as previously referred to are used to illustrate the configuration of the head 1 in this embodiment as well.

[0037] In manufacturing the club head, the head 1 integral with the hosel 9 is press-worked, using a sizing die, thereby setting the orientation of the hosel 9. Such press-working using a sizing die enables the enhancing of the accuracy of the orientation of the hosel 9, whereby both the tolerance of a loft angle $\alpha$ and that of a lie angle $\beta$ of the head 1 are able to be set within a range of $\pm 0.25$ degree (15). Further, for a set of iron golf clubs, each difference in loft angle $\alpha$ between the respective two clubs of adjacent club numbers is able to enjoy a tolerance within $\pm 0.5$ degree, while each difference in lie angle $\beta$ between the respective two clubs of adjacent club numbers is able to enjoy a tolerance within $\pm 0.5$ degree.

[0038] Next, a further embodiment of the invention is described, which also has the head 1 integral with the hosel 9. Likewise, FIGS. 3 and 4 as previously referred to are used to illustrate the configuration of the head 1 in this embodiment.

[0039] In manufacturing the golf club, the hosel 9 is bent relative to the main body of the head 1 having the face 2, with the neck 8 located at the proximal end of the hosel 9 being subjected to a local heating, whereby the angle of the hosel 9 is corrected, thus correcting the loft angle $\alpha$ and the lie angle $\beta$ thereof at the same time. It should be noted that for the aforesaid local heating may be used any suitable heating means. Further, such correcting work after the heating may be performed either manually or using a press. With such hot correcting, the work is so simplified that both the tolerance of the loft angle $\alpha$ and that of the lie angle $\beta$ of the head 1 are able to be set within a range of $\pm 0.25$ degree (15).

[0040] In addition, for a set of iron golf clubs, a tolerance of $\pm 0.5$ degree or less is made possible for each difference in loft angle $\alpha$ between the respective two golf clubs of adjacent club numbers and for each difference in lie angle $\beta$ therebetween.

[0041] Incidentally, the present invention should not be limited to the foregoing embodiments, but may be modified within a scope of the invention. For example, whilst the iron golf club is described as one example in the foregoing embodiments, the invention may apply to a putter golf club and a wood golf club, particularly to a metallic wood club. In addition, the club head should not be limited to the aforesaid one which is either wholly integrated or is provided with the separate hosel, but may be one which has a separate balance weight joined either to the back or to the sole.

What is claimed:
1. An iron golf club having a head, said head comprising a striking face and a shaft connecting portion, said head being constructed of a head body and a column-shaped hosel member, said hosel member being formed with a flat end face, serving as a shaft connecting portion, said head body being formed by forging, provided with a short, column-shaped fitting portion for joining the hosel member thereto, said fitting portion having an end face which is formed so flat that it is joined to the flat end face of said hosel member so that a tolerance of a loft angle of the head is set within a range of $\pm 0.25$ degree.

2. An iron golf club having a head, said head comprising a striking face and a shaft connecting portion, said head being constructed of a head body and a column-shaped hosel member, said hosel member being formed with a flat end face, serving as a shaft connecting portion, said head body being formed by forging, provided with a short, column-shaped fitting portion for joining the hosel member thereto, said fitting portion having an end face which is formed so flat that it is joined to the flat end face of said hosel member so that a tolerance of a loft angle of the head is set within a range of $\pm 0.25$ degree.

3. An iron golf club according to claim 1, wherein said head body and hosel member are joined to each other by means of laser beam welding.

4. An iron golf club according to claim 2, wherein said head body and hosel member are joined to each other by means of laser beam welding.

5. An iron golf club according to claim 1, wherein said head body and hosel member are joined to each other by means of electron beam joining.

6. An iron golf club according to claim 2, wherein said head body and hosel member are joined to each other by means of electron beam joining.
7. An iron golf club according to claim 1, wherein said head body and hosel member are joined to each other by means of amorphous joining.

8. An iron golf club according to claim 2, wherein said head body and hosel member are joined to each other by means of amorphous joining.

9. An iron golf club according to claim 1, wherein said face is formed with score lines prior to being joined to said hosel member, while said head body is held with reference to respective reference positions of said score lines and face so that the end face of the fitting portion thereof may be machined to define a predetermined loft angle, said hosel member being joined to the end face of the fitting portion so that a central axis thereof may be perpendicular thereto.

10. An iron golf club according to claim 2, wherein said face is formed with score lines prior to being joined to said hosel member, while said head body is held with reference to respective reference positions of said score lines and face so that the end face of the fitting portion thereof may be machined to define a predetermined lie angle, said hosel member being joined to the end face of the fitting portion so that a central axis thereof may be perpendicular thereto.

11. A set of iron golf clubs consisting of a plurality of golf clubs, each comprising a head having a striking face, a shorter shaft connected thereto and a larger loft angle as a club number thereof increases, said head being constructed of a head body and a column-shaped hosel member, said hosel member being formed with a flat end face, said head body being formed by forging, provided with a short, column-shaped fitting portion for joining the hosel member thereto, said fitting portion having an end face which is formed so flat that it is joined to the flat end face of said hosel member so that a tolerance of a difference between two loft angles set for respective two golf clubs of adjacent club numbers is set in a range of ±0.5 degree.

12. A set of iron golf clubs consisting of a plurality of golf clubs, each comprising a head having a striking face, a shorter shaft connected thereto and a larger lie angle as a club number thereof increases, said head being constructed of a head body and a column-shaped hosel member, said hosel member being formed with a flat end face, said head body being formed by forging, provided with a short, column-shaped fitting portion for joining the hosel member thereto, said fitting portion having an end face which is formed so flat that it is joined to the flat end face of said hosel member so that a tolerance of a difference between two lie angles set for respective two golf clubs of adjacent club numbers is set in a range of ±0.5 degree.

13. A set of iron golf clubs according to claim 11, wherein said head body and hosel member are joined to each other by means of laser beam welding.

14. A set of iron golf clubs according to claim 12, wherein said head body and hosel member are joined to each other by means of laser beam welding.

15. A set of iron golf clubs according to claim 11, wherein said head body and hosel member are joined to each other by means of electron beam joining.

16. A set of iron golf clubs according to claim 12, wherein said head body and hosel member are joined to each other by means of electron beam joining.

17. A set of iron golf clubs according to claim 11, wherein said head body and hosel member are joined to each other by means of amorphous joining.

18. A set of iron golf clubs according to claim 12, wherein said head body and hosel member are joined to each other by means of amorphous joining.

19. A set of iron golf clubs according to claim 11, wherein said face is formed with score lines prior to being joined to said hosel member, while said head body is held with reference to respective reference positions of said score lines and face so that the end face of the fitting portion thereof may be machined to define a predetermined loft angle, said hosel member being joined to the end face of the fitting portion so that a central axis thereof may be perpendicular thereto.

20. A set of iron golf clubs according to claim 12, wherein said face is formed with score lines prior to being joined to said hosel member, while said head body is held with reference to respective reference positions of said score lines and face so that the end face of the fitting portion thereof may be machined to define a predetermined lie angle, said hosel member being joined to the end face of the fitting portion so that a central axis thereof may be perpendicular thereto.

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