(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 116 504 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 158(3) EPC

(43) Date of publication:
18.07.2001 Bulletin 2001/29

(21) Application number: **00929856.3**

(22) Date of filing: **24.05.2000**

(51) Int Cl.[7]: **A63B 53/04**, A63B 53/00

(86) International application number:
PCT/JP00/03336

(87) International publication number:
WO 01/00283 (04.01.2001 Gazette 2001/01)

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **25.06.1999 JP 18072899**

(71) Applicant: **MIZUNO CORPORATION**
Chuo-ku, Osaka 541-8538 (JP)

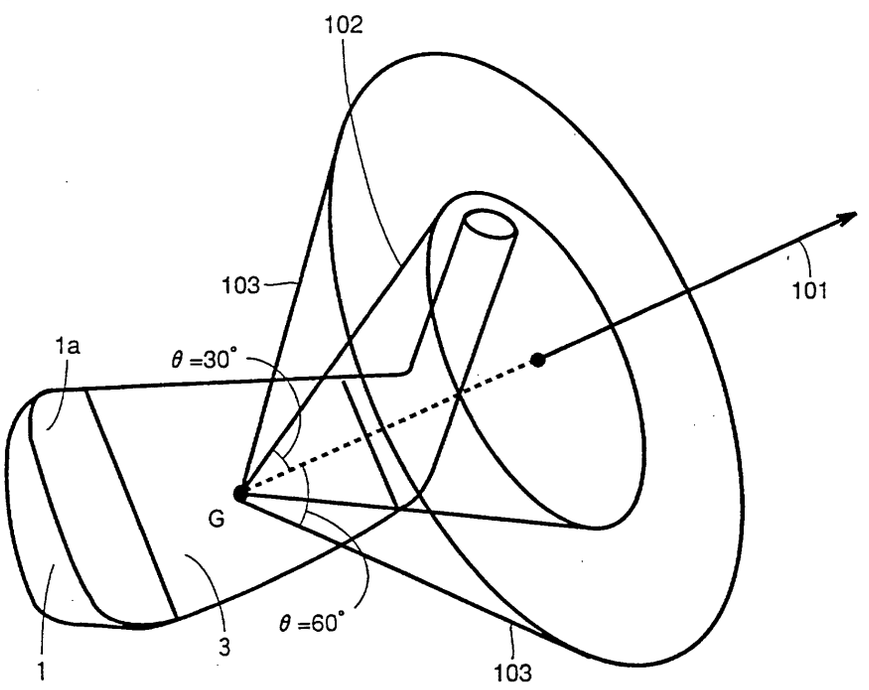
(72) Inventors:
- **IWATA, Mototaka Mizuno Corporation**
Osaka-shi Osaka 559-8510 (JP)
- **SAKAI, Koji Mizuno Corporation**
Osaka-shi, Osaka 559-8510 (JP)
- **NAGAO, Hiroshi Mizuno Corporation**
Osaka-shi, Osaka 559-8510 (JP)

(74) Representative: **Prüfer, Lutz H., Dipl.-Phys. et al**
PRÜFER & PARTNER GbR,
Patentanwälte,
Harthauser Strasse 25d
81545 München (DE)

(54) IRON GOLF CLUB HEAD, IRON GOLF CLUB, AND IRON GOLF CLUB SET

(57) An iron golf club head (1) has three principal axes (I_1, I_2, I_3) of inertia passing through the center of gravity. An angle θ formed by such an axis (I_1) that a moment of inertia about the principal axis of inertia is maximized among the three principal axes (I_1, I_2, I_3) of inertia and a normal vector (101) of a face plane (3f) passing through the center of gravity is at least 10 degrees and not more than 90 degrees.

FIG.4



EP 1 116 504 A1

Description

Technical Field

[0001] The present invention generally relates to an iron golf club head, an iron golf club and an iron golf club set. Specifically, it relates to an iron golf club head, an iron golf club and an iron golf club set efficiently reducing dispersion of carries at the time of hitting a ball.

Background Art

[0002] A golf club head taking a momental ellipsoid into consideration is described in Japanese Patent Laying-Open No. 5-57034. In the golf club head described in this gazette, that increasing weight distribution in the directions of principal axes of inertia and suppressing increase of the weight of the golf club head to the minimum is described.

[0003] In Japanese Patent Laying-Open No. 9-149954, there is disclosed a golf club head regulating angles at the time of projecting principal axes of inertia on a plane and improving stability of a carry and a flying direction.

[0004] The object of an iron golf club is to reliably capture a carry and a direction of a ball aimed at by the hitter. When the direction and the carry of the ball are instabilized due to dispersion of hitting point positions, therefore, it is unpreferable for making a score.

[0005] Accordingly, the present invention aims at providing an iron golf club head, an iron golf club and an iron golf club set in which a carry and directivity are stable.

Disclosure of Invention

[0006] In the prior art, no consideration is made on an angle formed by a principal axis of inertia and a normal vector of a face plane.

[0007] A moment of inertia enlarges with respect to a hitting direction and dispersion of carries at the time of hitting a ball can be efficiently reduced by expressing a moment of inertia of a golf club head having a complicated shape by an equivalent momental ellipsoid and largely setting an angle formed by its principal axis of inertia and a normal vector of a face plane.

[0008] For an iron golf club head generally used at present, however, the angle formed by the principal axis of inertia and the normal vector of the face plane is not taken into consideration although a moment of inertia about one axis or an angle of projection of the principal axis of inertia is taken into consideration.

[0009] In general, the normal vector is a vector indicating a direction perpendicular to a certain plane, and the inner product of a vector included in the plane and this normal vector becomes zero.

[0010] The length of a principal axis of a momental ellipsoid is expressed by the inverse of the square root of the magnitude of a moment of inertia about the axis. In other words, the moment of inertia enlarges as the momental ellipsoid is small.

[0011] The magnitude of the moment of inertia in the case of receiving force from one direction can be expressed by the area of a cut ellipse when cut along a plane, passing through the center of gravity of the momental ellipsoid, rendering the direction a normal vector.

[0012] In other words, the moment of inertia enlarges as this area is small.

[0013] In order to reduce this area, an angle formed by such a principal axis that a moment of inertia about the principal axis of inertia is maximized among three principal axes of inertia and a normal vector of a contact surface at the centroid (center of a face plane) of the face plane must be enlarged.

[0014] In other words, the moment of inertia with respect to a direction to which force is applied enlarges, and hence it is possible to capture the carry and the direction of the ball aimed at by the hitter even if a hitting position is somewhat dispersed. Thus, the present invention can provide an iron golf club head in which a carry and directivity are stable by largely setting the angle formed by the principal axis of inertia of the iron golf club head and the normal vector of the face plane.

[0015] The inventors have made various studies as to the carries and flying directions of golf clubs, to consequently obtain the following conclusion. In other words, while a certain degree of improvement is made also in the aforementioned prior art, it has been proved that more efficient improvement is enabled not by projecting a momental ellipsoid on a plane but by three-dimensionally capturing the same and specifying what kind of inclination may be provided on which axis of principal axes of inertia.

[0016] Accordingly, the present invention intends to provide a golf club head more effectively suppressing dispersion of carries and hitting directions with respect to dispersion of hitting positions by setting three-dimensional inclination of a principal axis of inertia desirable for the golf club head and an axis whose inclination must be controlled, not disclosed in the prior art.

[0017] At present, a golf club head is designed mainly in consideration of a sweet area. However, the sweet area may be expressed by the magnitude of a moment of inertia about an arbitrary axis horizontal in a toe-heel direction. However, no consideration is made on directions of three axes of a three-dimensionally existing momental ellipsoid.

[0018] The present invention provides a golf club head and a golf club in which a carry and directivity are stable by designing the same so that an angle formed by one axis among mutually orthogonal principal axes of inertia possessed by the golf club head and a normal vector of a face plane passing through the center of gravity of the golf club head reduces.

[0019] A body has a three-dimensional momental ellipsoid, and the momental ellipsoid has orthogonal three principal axes of inertia. When external force is applied, the body most readily rotates about an axis whose moment of inertia is small, and hence it most hardly rotates with respect to a moment received from the direction of an axis I_3 whose moment of inertia is the smallest.

[0020] An iron golf club head according to the present invention, proposed by the aforementioned recognition, has three principal axes of inertia passing through the center of gravity. An angle θ formed by such an axis that a moment of inertia about the principal axis of inertia is maximized among the three principal axes of inertia and a normal vector of a face plane passing through the center of gravity is at least 10 degrees and not more than 90 degrees.

[0021] Preferably, the angle θ is at least 30 degrees and not more than 90 degrees.

[0022] Preferably, the angle θ is at least 50 degrees and not more than 90 degrees.

[0023] Further preferably, the angle θ is at least 70 degrees and not more than 90 degrees.

[0024] An iron golf club according to the present invention comprises the aforementioned iron golf club head and a shaft whose one end is connected to the iron golf club head.

[0025] An iron golf club set according to the present invention comprises a plurality of iron golf clubs whose identification numbers are different, having the aforementioned plural iron golf club heads and shafts whose single ends are connected to the respective ones of the iron golf club heads.

Brief Description of Drawings

[0026] Fig. 1 is a diagram showing coordinates in an iron golf club head according to the present invention.

[0027] Fig. 2 is a diagram showing principal axes of inertia in the iron golf club head according to the present invention.

[0028] Fig. 3A, Fig. 3B and Fig. 3C are diagrams showing the concept of a cutting elliptic plane in the iron golf club head according to the present invention.

[0029] Fig. 4 is a diagram showing the concept of angles of inclination of principal axes of inertia in the present invention.

[0030] Fig. 5 is a diagram showing a state dividing the iron golf club head according to the present invention.

[0031] Fig. 6 is a perspective view of an iron golf club head according to one Example of the present invention.

[0032] Fig. 7 is a perspective view of an iron golf club head according to another Example of the present invention.

[0033] Fig. 8 is a perspective view of an iron golf club head shown for illustrating an angle formed by such an axis that a moment of inertia about a principal axis of inertia is maximized and a normal vector of a face plane passing through the center of gravity.

Best Mode for Carrying Out the Invention

[0034] Referring to Fig. 1, it is assumed that an axis perpendicular to the ground 60 and passing through the center G of gravity is a Z axis. It is assumed that an axis parallel to an intersection line 62 of a contact surface 61 at the centroid (center) 3c of a face plane 3f and the ground 60, perpendicular to the Z axis and passing through the center G of gravity is an X axis. It is assumed that an axis perpendicular to both of the X axis and the Z axis and passing through the center G of gravity is a Y axis.

[0035] As shown in Fig. 2, it is assumed that a normal vector of a plane parallel to the intersection line between the contact surface at the centroid 3c of the face plane 3c and the ground and passing through the center G of gravity is $f(l,m,n)^T$, for calculating the following respective vectors:

$$f_1(l_1, m_1, n_1)^T = f \times Z\,(0, 0, 1)^T$$

$$f_2(l_2, m_2, n_2)^T = f_1 \times f$$

$$f_3(l_3, m_3, n_3)^T = f_1 \times f_2 \qquad (1)$$

where x denotes outer products.

[0036] Then, it is assumed that an axis parallel to the intersection line between the contact surface at the centroid of the face plane 3f and the ground and passing through the center G of gravity is an α axis. It is assumed that an axis parallel to the contact surface at the centroid of the face plane 3f and perpendicular to the α axis is a β axis. It is assumed that an axis perpendicular to the α axis and the β axis is a γ axis. Transformation from α, β, γ coordinate systems to X, Y, Z coordinate systems is expressed by the following equations:

$$X = l_1 \cdot \alpha + l_2 \cdot \beta + l_3 \cdot \gamma$$

$$Y = m_1 \cdot \alpha + m_2 \cdot \beta + m_3 \cdot \gamma$$

$$Z = n_1 \cdot \alpha + n_2 \cdot \beta + n_3 \cdot \gamma \quad (2)$$

[0037] Assuming here that I_1, I_2 and I_3 are moments of inertia related to X, Y and Z axes, I_{12} is a product of inertia related to the YZ plane and the XZ plane, I_{13} is a product of inertia related to the YZ plane and the XY plane and I_{23} is a product of inertia related to the XZ plane and the XY plane, the following relation is obtained:

$$I_1 \cdot X^2 + I_2 \cdot Y^2 + I_3 \cdot Z^2 + 2 \cdot I_{12} \cdot X \cdot Y + 2 \cdot I_{13} \cdot X \cdot Z + 2 \cdot I_{23} \cdot Y \cdot Z = 1 \quad (3)$$

[0038] An ellipsoid expressed by the equation (3) is referred to as a momental ellipsoid. This indicates the magnitude of inertial resistance in each direction. When substituting the equations (2) in the equation (3) and rendering the term of γ zero, an equation (4) is obtained on a cutting elliptic plane.

$$\begin{aligned}&(I_1 l_1^2 + I_2 m_1^2 + I_3 n_1^2 + I_{12} l_1 m_1 + I_{13} l_1 n_1 + I_{23} m_1 n_1)\alpha^2 \\ &+ (I_1 l_2^2 + I_3 m_2^2 + I_3 n_2^2 + I_{12} l_2 m_2 + I_{13} l_2 n_2 + I_{23} m_2 n_2)\beta^2 \\ &+ (I_1 l_1 l_2 + I_2 m_1 m_2 + I_3 n_1 n_2 + I_{12} l_1 m_2 + I_{12} l_2 m_1 + I_{13} l_1 n_2 \\ &+ I_{13} l_2 n_1 + I_{23} m_1 n_2 + I_{23} m_2 n_1)\alpha\beta = 1 \quad (4)\end{aligned}$$

[0039] The magnitude of this cutting plane expresses the magnitude of inertial resistance indicating easiness of rotation of the body on this plane. Further, the cutting plane expresses perpendicular inertial resistance of the plane. As shown in Fig. 3A to Fig. 3C, further, it is obvious that the shape of this cutting plane becomes a plane ellipse since it is a cutting plane of a solid momental ellipsoid.

[0040] A specific embodiment of the present invention is now described.

[0041] An iron golf club head, an iron golf club and an iron golf club set according to the embodiment of the present invention are formed by the following elements.

[0042] Fig. 4 shows an angle θ formed by such an axis that a moment of inertia about a principal axis of inertia is maximized among three principal axes of inertia about the center of gravity and a normal vector 101 of a face plane passing through the center G of gravity. A solid line 102 shows the range where the angle θ is 30 degrees. A solid line 102 shows the range where the angle θ is 60 degrees. As shown in Fig. 8, an angle θ formed by such an axis I_1 that a moment of inertia about a principal axis of inertia is maximized among three principal axes I_1, I_2 and I_3 of inertia passing through the center G of gravity and a normal vector 101 of a face plane 3f passing through the center G of gravity is at least 10 degrees and not more than 90 degrees in an iron golf club head 1. More preferably, the angle θ is at least 30 degrees and not more than 90 degrees. More preferably, the angle θ is at least 50 degrees and not more than 90 degrees. Preferably, the angle θ is at least 70 degrees and not more than 90 degrees.

[0043] Further, an iron golf club 80 according to the present invention comprises the iron golf club head 1 and a shaft 70 whose one end is connected to the iron golf club head 1. An iron golf club set according to the present invention comprises a plurality of iron golf clubs 80 whose identification numbers are different, having the aforementioned iron golf club heads 1 and a plurality of shafts 70 whose single ends are connected to the respective ones of the iron golf club heads 1.

[0044] The iron golf club head according to the present invention is described on the basis of drawings.

[0045] Fig. 5 is a perspective view showing the iron golf club head in a divided manner for setting the directions of principal axes of inertia to target directions. In other words, as shown in Fig. 5, the iron golf club head 1 is partitioned

into a shaft insertion part 2 and a face part 3, and the iron golf club head 1 is further cut along virtual cutting planes 7 of an XY plane 4 passing through the centroid 3c of the face part 3 and a YZ plane 5 and divided into four. Further, the iron golf club head 1 is cut along planes 6 parallel to a YZ plane 5 passing through the centers of Y axes of the parts divided into four and the virtual cutting lines, and it is assumed that parts divided into nine are a to i respectively.

[0046] Further, the respective parts divided into nine are bisected along the virtual cutting planes 7 toward the side of the face plane 3f and the side of a back 1b, for dividing the same into 18 parts in total. The respective ones of the parts are assumed to be parts al to i1. Fig. 6 shows an iron golf club head according to Example 1 of the present invention. In other words, weight members 8a (structured by a stainless alloy, a tantalum alloy, a tungsten alloy or the like) consisting of a metal having high specific gravity are arranged on the part c1 and the part i1 of the iron golf club head 1. Thus, the angle θ formed by such an axis that the moment of inertia about the principal axis of inertia is maximized and the normal vector of the face plane 3f can be set to a value aimed at by the present invention as shown in Table 1. Table 1 shows the angle formed by the principal axis I_1 of inertia and the normal vector of the face plane 3f.

Table 2

	Conventional Iron Golf Club	Iron Golf Club of Example 1
Angle θ	8.9 degrees	12.6 degrees

[0047] Further, Fig. 7 shows an iron golf club head according to Example 2 of the present invention.

[0048] The iron golf club head 1 is divided into a shaft insertion part 2 and a face part 3. Further, the iron golf club head 1 is cut along virtual cutting planes 7 of an XY plane 4 and a YZ plane 5 passing through the centroid 3c of the face part 3 for dividing the same into four. Then, the iron golf club head 1 is cut along virtual cutting planes 7 of planes 6 parallel to the YZ plane 5 passing through the centers of the parts divided into four in the Y axis direction for dividing the same. Then, the respective divided parts are cut along the virtual cutting planes 7 and bisected for assuming the respective parts as parts on the side of the face plane 3f and parts on the side of a back 3b.

[0049] Thus, the iron golf club head 1 is divided into 18 parts in total, and the respective parts are assumed to be parts a1 to i2. Weight members 8b (structured by a lithium alloy, a beryllium alloy, an aluminum alloy, a titanium alloy or the like) consisting of a metal having low specific gravity are arranged on the part a1, the part d1 and the part h2. Thus, the angle θ of such a principal axis that the moment of inertia about the principal axis of inertia is maximized and the normal vector of the face plane 3f can be set within the range aimed at by the present invention as shown in Table 2. Table 2 shows the angle formed by the principal axis I_1 of inertia and the normal vector of the face plane 3f.

Table 2

	Conventional Iron Golf Club	Iron Golf Club of Example 2
Angle θ	8.9 degrees	32.8 degrees

[0050] As a method of arranging the weight members 8a and 8b consisting of a metal having high specific gravity or a metal having low specific gravity, it is possible to form concave portions on a head body 1a of the iron golf club head 1 and engage/press-fit the weight members 8a and 8b in the concave portions. It is also possible to weld or braze the weight members 8a and 8b to the concave portions for depositing the same.

[0051] Table 3 shows results obtained by 10 general middle-class persons hitting balls with the iron golf club according to Example 1.

Table 3

Carry is rather stabilized in conventional club	Carry is rather stabilized in inventive club	Indistinct
two persons	seven persons	one person

[0052] The iron golf club head 1 of the present invention is such that the angle formed by such a principal axis that the moment of inertia about the principal axis of inertia is maximized among three principal axes of inertia and the normal vector of the face plane 3f passing through the center of gravity is largely set. Such a principal axis that the moment of inertia about the principal axis of inertia of the iron golf club head 1 is generally directed to the direction of a flying line of a ball, and the area of a cut ellipse at the time of cutting a momental ellipsoid 10 along a plane parallel to the face plane passing through the center of gravity is substantially at the maximum.

[0053] In general, the length of the principal axis of the momental ellipsoid 10 is expressed by the inverse of the square root of the magnitude of the moment of inertia about the axis. In other words, the moment of inertia enlarges as the momental ellipsoid 10 is small.

[0054] The magnitude of a moment of inertia in the case of receiving force from one direction can be expressed by the area of a cut ellipse at the time of cutting the momental ellipsoid 10 along a plane passing through the center G of gravity and rendering the direction receiving the force a normal vector. In other words, the moment of inertia with respect to the direction reduces as this area is small.

[0055] In order to reduce this area, it is necessary to enlarge the angle formed by such a principal axis that the moment of inertia about the principal axis of inertia is maximized among the three principal axes of inertia and the normal vector of the plane parallel to the contact surface at the centroid 3c o the face plane 3f.

[0056] In other words, the moment of inertia with respect to the direction where the force is applied enlarges, and hence it becomes easy to capture a carry and a direction of a ball aimed at by the hitter also when the hitting position is somewhat dispersed.

[0057] Orthogonal three axes existing in a space do not take values greater than 90 degrees with respect to a certain vector in general, and hence the moment of inertia enlarges with respect to the direction where the force is applied and the effect is high when the angle θ formed by such an axis that the moment of inertia about the principal axis of inertia is maximized among the three principal axes of inertia and the normal vector of the face plane takes a value of at least 30 degrees and not more than 90 degrees, at least 50 degrees and not more than 90 degrees when further saying, and further at least 70 degrees and not more than 90 degrees.

[0058] The iron golf club head 1 according to the present invention is such that a carry and directivity of a hit ball are stabilized by largely taking the angle formed by such an axis that the moment of inertia about the principal axis of inertia is maximized and the normal vector (normal vector of the face plane 3f) of the contact surface at the centroid 3c of the face plane 3f, as hereinabove described.

[0059] In the iron golf club set of the present invention, in addition, a carry of a hit ball specific to the golf club of each identification number is stabilized in the golf club set while the directivity of the hit ball is also further stabilized by largely taking the angle formed by such an axis that the moment of inertia about the principal axis of inertia is maximized and the normal vector of the contact surface at the centroid 3c of the face plane 3f. Therefore, a golf club set stable for a golfer can be provided.

[0060] The iron golf club head according to the present invention is such that a carry and directivity of a hit ball are stabilized by enlarging the angle formed by such an axis that the moment of inertia about the principal axis of inertia is maximized and the normal vector of the contact surface at the centroid of the face plane from the center of gravity, as hereinabove described. It can be used as an iron golf club attaching a shaft and a grip to these iron golf club heads. Further, it can be used as a set of a plurality of golf clubs whose identification numbers are different.

[0061] According to the present invention, as hereinabove described, the ball carry and the directivity are stabilized by largely taking the angle formed by such an axis that the moment of inertia about the principal axis of inertia is maximized and the normal vector of the contact surface at the centroid of the face plane in the iron golf club head, the iron golf club and the iron golf club set.

Industrial Applicability

[0062] The present invention is employed in the field of an iron golf club head, an iron golf club and an iron golf club set.

Claims

1. An iron golf club head (1) having three principal axes (I_1, I_2) I_3) of inertia passing through the center of gravity, wherein
   an angle θ formed by such an axis (I_1) that a moment of inertia about said principal axis of inertia is maximized among said three principal axes (I_1, I_2, I_3) of inertia and a normal vector (101) of a face plane (3f) passing through the center of gravity is at least 10 degrees and not more than 90 degrees.

2. The iron golf club head according to claim 1, wherein said angle θ is at least 30 degrees and not more than 90 degrees.

3. The iron golf club head according to claim 1, wherein said angle θ is at least 50 degrees and not more than 90 degrees.

4. The iron golf club head according to claim 1, wherein said angle θ is at least 70 degrees and not more than 90 degrees.

5. An iron golf club comprising the iron golf club (1) according to claim 1 and a shaft (70) whose one end is connected

to said iron golf club head (1).

6. An iron golf club set comprising a plurality of iron golf clubs (70) whose identification numbers are different, having a plurality of iron golf club heads (1) according to claim 1 and shafts (70) whose single ends are connected to the respective ones of said iron golf club heads (1).

FIG. 1

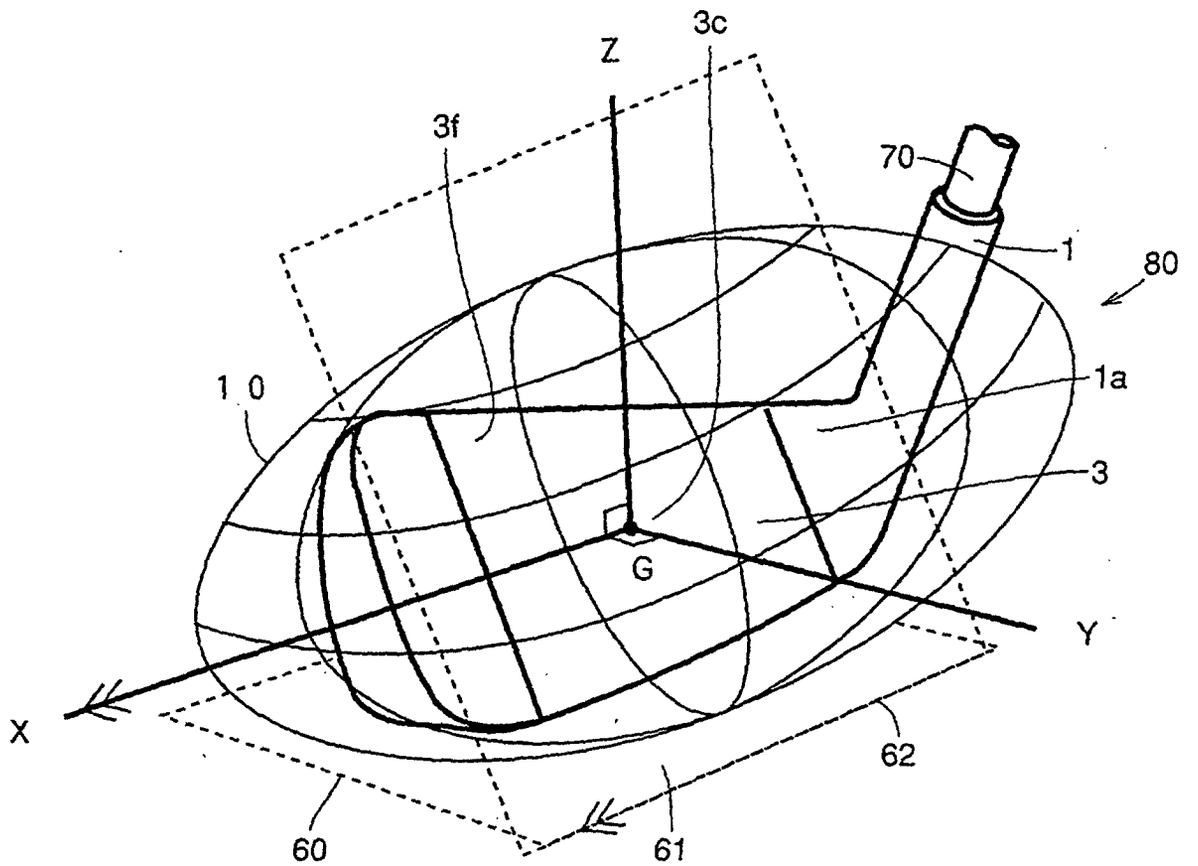


FIG.2

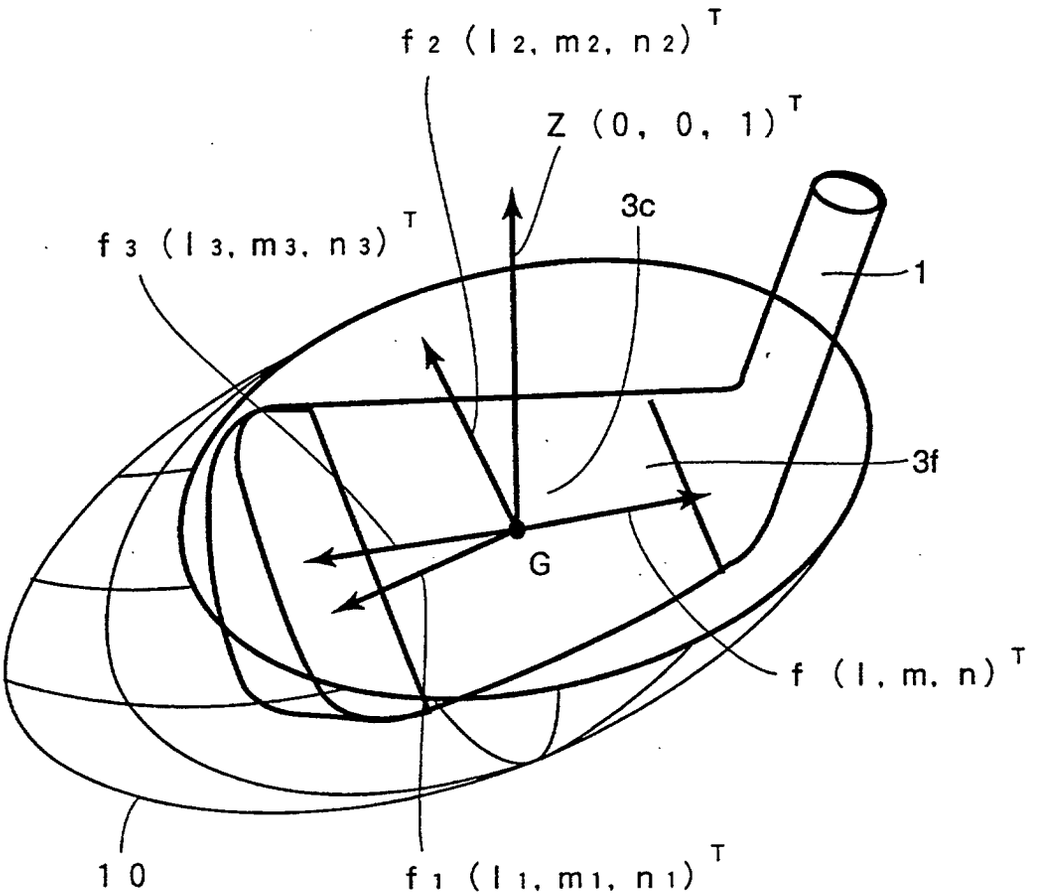


FIG.3A

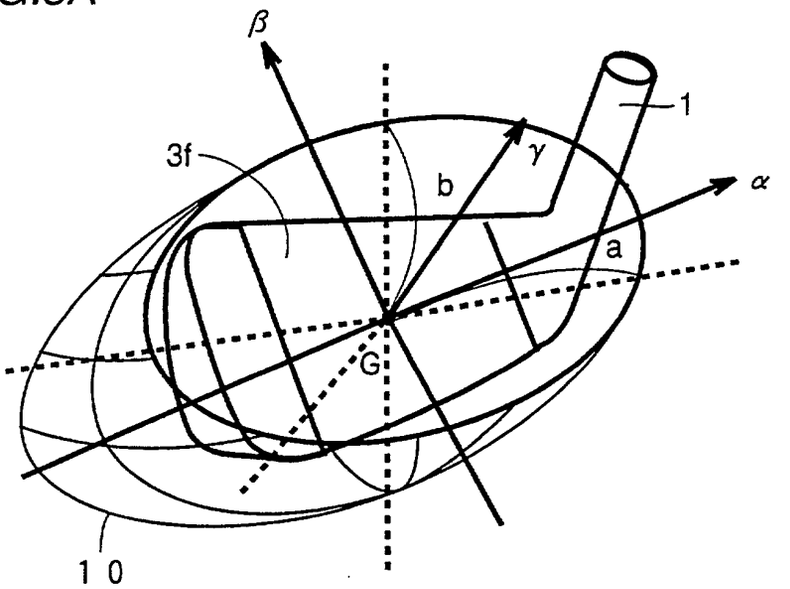


FIG.3B

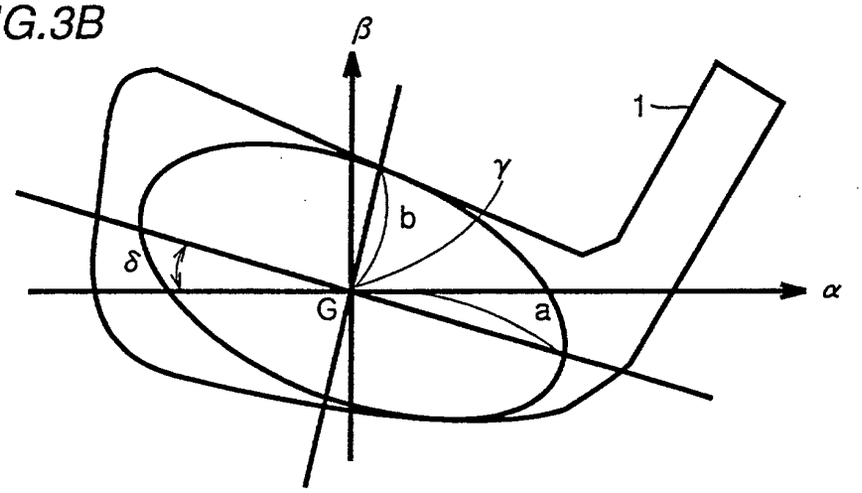


FIG.3C

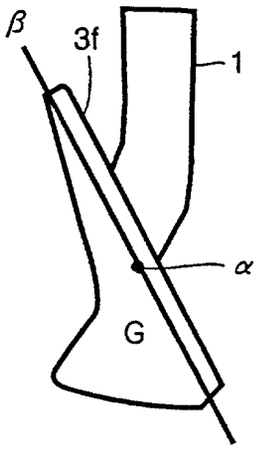


FIG.4

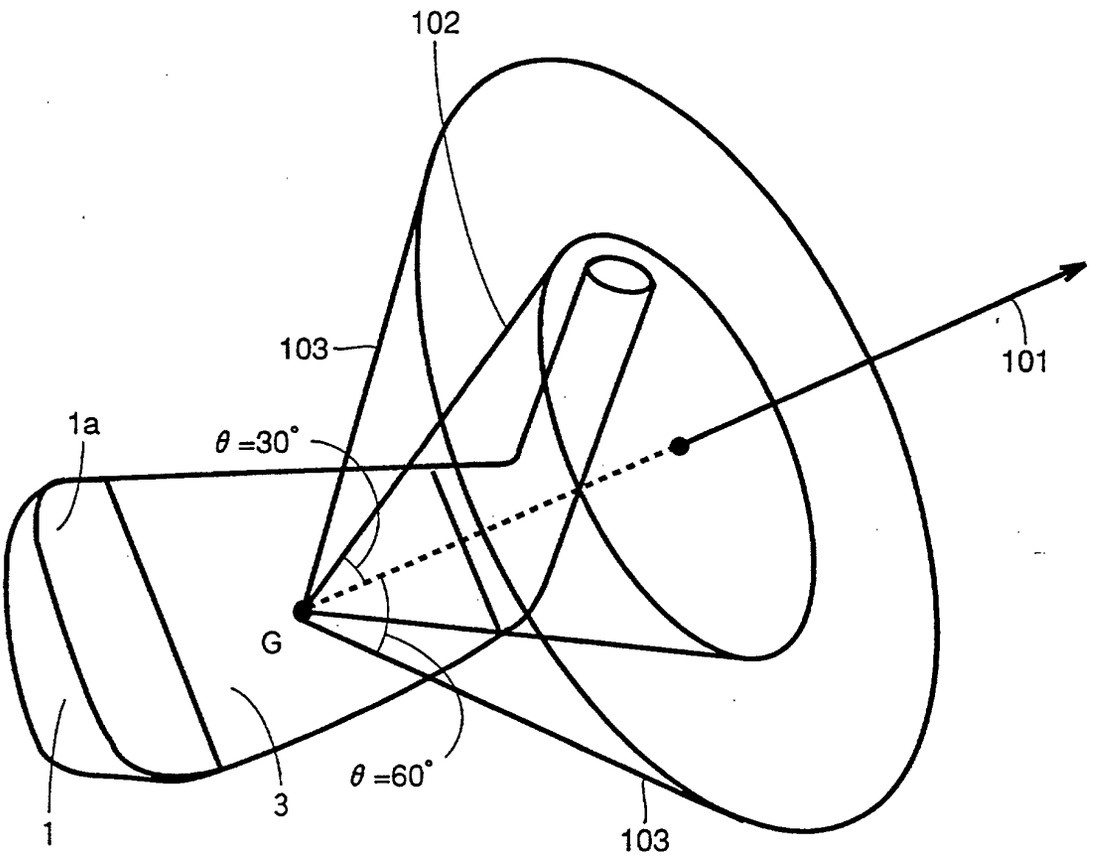


FIG.5

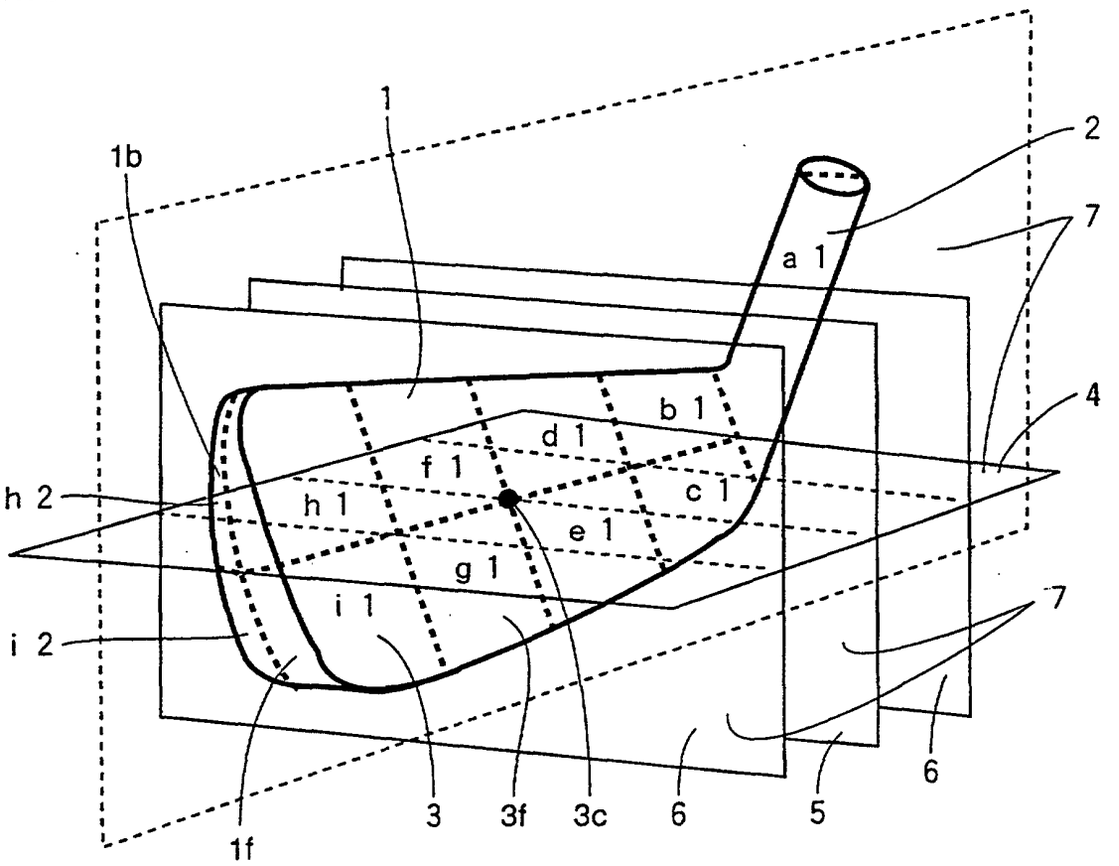


FIG.6

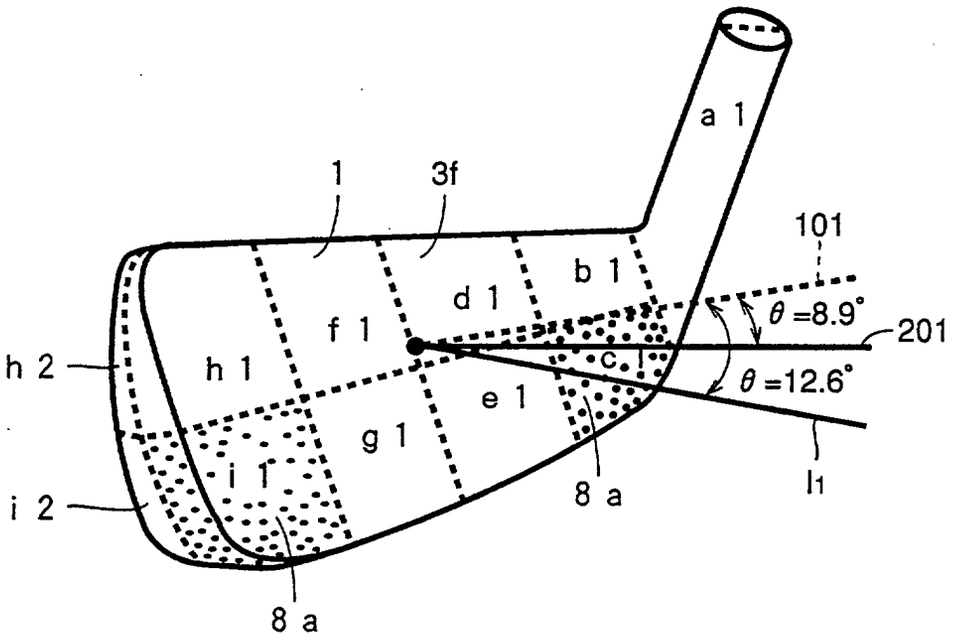

a 1
1
3f
101
b 1
d 1
θ =8.9°
201
f 1
h 2
h 1
c 1
θ =12.6°
e 1
g 1
i 1
8 a
l1
i 2
8 a

FIG.7

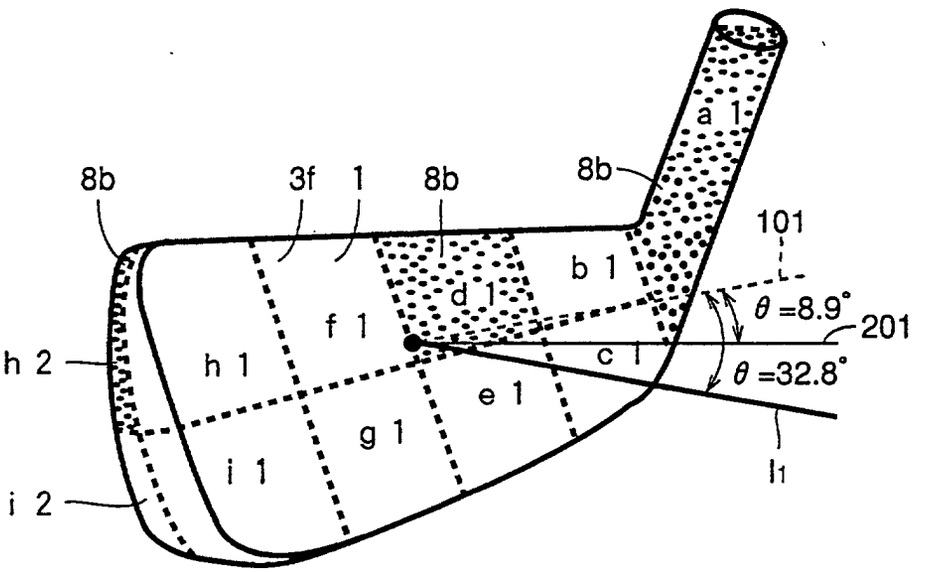
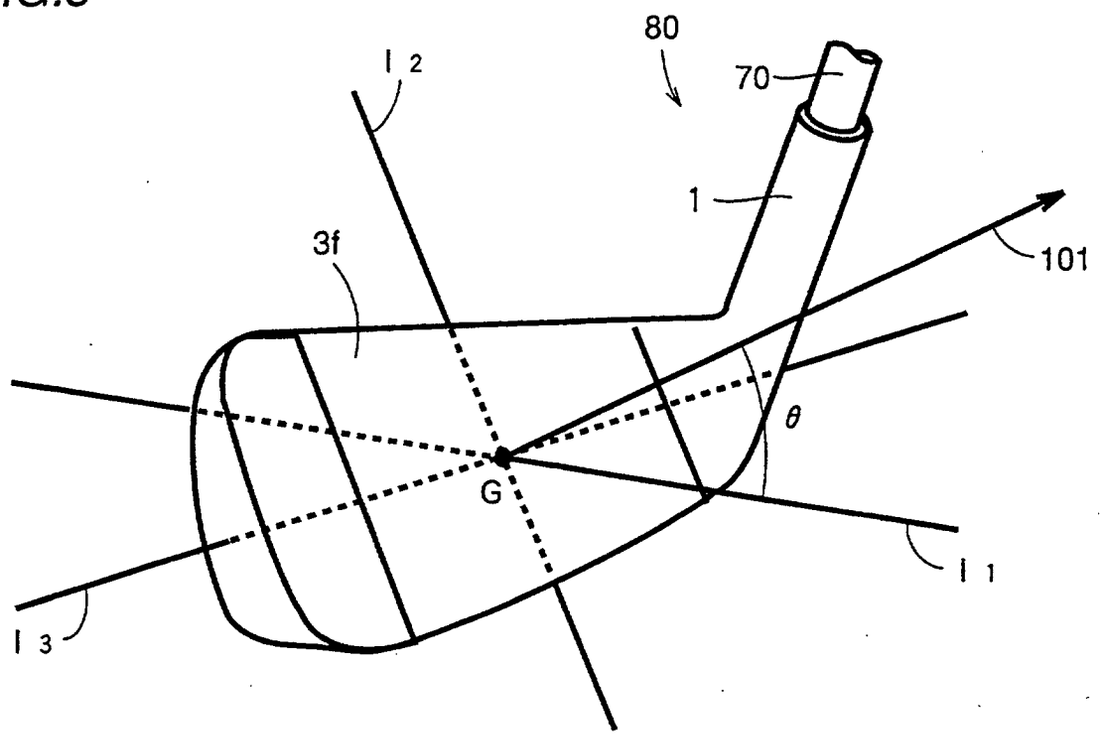

a 1
8b
3f
1
8b
8b
101
b 1
d 1
θ =8.9°
201
f 1
h 2
h 1
c 1
θ =32.8°
e 1
g 1
i 1
l1
i 2

FIG.8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/03336

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] A63B53/04, 53/00

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)
Int.Cl[7] A63B53/00-53/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2000
Kokai Jitsuyo Shinan Koho 1971-2000 Jitsuyo Shinan Toroku Koho 1996-2000

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, 5836830, A (Sumitomo Rubber Industries, Ltd.), 17 November, 1998 (17.11.98), Full text; Figs. 1 to 16 & JP, 9-149954, A	1-6
A	JP, 5-57035, A (Maruman Golf Corporation), 09 March, 1993 (09.03.93), Full text; Figs. 1 to 4 (Family: none)	1-6
A	JP, 59-17364, A (Bridgestone Corporation), 28 January, 1984 (28.01.84), Full text; Figs. 1 to 5 (Family: none)	1-6

☐ 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
"E" earlier document but published on or after the international filing date
"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)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 August, 2000 (17.08.00)	05 September, 2000 (05.09.00)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)