CORRELATED GOLF CLUB SET

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ABSTRACT
A correlated set of golf clubs of the type commonly referred to as irons is disclosed. Various dimensions are the same for all club heads of a set even though loft and lie angles A and C are different for each. Weight is controlled by the depth of a cavity in the rear of the club head. A slope angle B of the sole is increased from a small negative value to a larger positive value as loft is increased from a minimum to a maximum, with substantially zero slope for a midrange club of the usual set of clubs numbered 1 to 9.

13 Claims, 10 Drawing Figures
The present invention relates to golf clubs, and particularly to a series of golf clubs of the type commonly referred to as irons in a correlated set.

The present invention relates to golf clubs, and particularly to a series of golf clubs of the type commonly referred to as irons in a correlated set.

In the past, golf clubs have been sold in sets matched or correlated as to some properties or characteristics, such as "swing weight" or shaft length. However, since the loft of each club is different, the swing will not feel the same for all clubs of the set because prior art designs do not take into account the varying loft except as to shaft length. In the usual series of clubs numbered 1 to 9, 10, 11 or 12, the shaft is progressively shortened as the loft is increased for the successive clubs. To compensate for the shortening of the shaft, the lie of the club is also increased as loft is increased, and to maintain a uniform swing weight, the weight of the club head is progressively increased as loft is increased. As a consequence, the club head is made progressively longer from heel to toe as the loft is increased.

Some efforts have been made to correlate the club head designs, but without a full appreciation for all of the factors involved. For example, it has been suggested that a set of golf clubs be correlated so that the point of impact with the ball always lies in a plane passing through the axis of the club shaft and extending along the length of the club head, i.e., in a plane passing through the centerline of the shaft and perpendicular to a vertical plane passing through the anticipated initial line of flight of the ball. However, such uniformity in club head design would not produce the same "feel" for all clubs. This is because the club shaft will not lead, or lag, the club head uniformly. Instead, the club shaft will lead more, or lag less, as the loft is increased.

While little attention has been directed to the impact point relative to the plane of the centerline of the shaft, even less attention has been directed to other aspects of club head design which are important for optimum performance. Accordingly, one object of the present invention is to provide a correlated golf club set.

SUMMARY OF THE INVENTION

The present invention provides a correlated golf club set by having the point of impact with a ball on the face thereof so located as to have the plane of the centerline of the shaft (i.e., the plane passing through the centerline of the shaft and parallel to the leading edge of the club head) a uniform distance from, and preferably behind, the center of the ball at the moment of impact.

Another feature of the present invention is the provision of a set of clubs with heads of uniform height and length. Height is measured between a first plane tangent to the sole, where the sole slopes relative to a ground plane perpendicular to the plane of the centerline of the shaft at a different angle for each club of the set, i.e., where the sole is at a different angle with respect to the aforesaid plane passing through the axis of the shaft and a second plane parallel to the first plane and tangent to the highest point on the club face. Length is measured from a point where the center line of the shaft passes a plane parallel to the first plane to a vertical plane tangent to the toe and perpendicular to the club face. Still another feature is a uniform maximum thickness in the heads of a set of clubs as measured on a line perpendicular to the club face.

The present invention also provides a set of clubs in which the slope of the sole (relative to the ground at the moment of impact) varies from a maximum negative slope (upward incline from front to rear) to a maximum positive slope (downward incline from front to rear) as the loft increases.

In accordance with another feature of the invention, the slope of the sole for a given club is decreased (i.e., made less positive or more negative) in successive sections of the head thereof taken in planes perpendicular to the club face on each side of the plane passing through the sweet spot. In that manner a crown is provided along the length of the sole which becomes more pronounced toward the trailing edge of the sole.
ducular to the second plane. The first and second planes are vertical and horizontal ground planes, respectively, for the golf clubs as viewed in Figs. 1 to 4.

The ground plane can be said to pass through the central portion of the leading edge of the club head and even when the corners of the head are rounded as shown because the radius customarily used to round the corners of a club head is quite small. However, to be more precise, it may be said that the ground plane passes through the central portion of the leading edge of the club head where the striking face 14 is connected to the sole 17 to include both the possibility of a sharp edge and a rounded edge.

The distance X is uniform (always the same) for all of the clubs of the set under the same conditions as illustrated in Figs. 1, 2, 3, and 4. Since the striking face is flat, the sphere represented by the dotted-line circle 13 may be placed tangent to the ground plane and to the striking face anywhere between the toe and heel of the club head to satisfy the conditions required in establishing the dimension X, as may be more clearly seen with reference to Figs. 9 and 10 for club heads of Figs. 1 and 4.

In that manner, the axis of club shaft 12 of each club in the set will lead its club head 10 by the same amount as in all other clubs of the set.

The point at which the golf ball is tangent to the striking face (while the ball is also tangent to the ground plane) is progressively lower and closer to the leading edge 16 of the head 10 for shorter trajectory (higher loft) clubs, as shown in Figs. 2, 3 and 4 for the Nos. 5, 9 and 11 in order to get under the ball progressively more for greater loft. That is as it should be, but in accordance with the present invention, the plane of the centerline of the shaft 12 remains the same distance X from the center of the ball.

The point at which a golf ball is tangent to the striking face (indicated by a radius line normal to the striking face in Figs. 1 to 4) is not important. What is important is the position of the shaft 12 relative to the center of the ball. When that is uniform, the feel will be the same for all clubs of the set. Once the distance X is set, the point of tangency is simply allowed to be what is necessary for the loft selected to provide the trajectory desired. The distance X is maintained constant by having the axis of the shaft progressively to the left as viewed in Figs. 1-4, 9 and 10 relative to the leading edge 16 of the club heads as loft is increased. Notice that for the No. 3 iron shown in Figs. 1 or 3 the axis of the shaft passes slightly in from of the leading edge 16; for the No. 5 iron, the axis of the shaft passes through the leading edge 16; and for the No. 9 iron shown in Fig. 3, the axis passes through the club head substantially behind the leading edge 16. For the No. 11 or pitching wedge shown in Figs. 4 and 10, the axis of the shaft is even more to the left of the leading edge 16.

As noted hereinbefore, the same reference numerals are used for the corresponding parts of clubs illustrated in Figs. 1 to 4 because, except for differences imposed by differences in loft, the clubs are the same, with one other exception that pertains to the slope of the club sole 17. That exception will now be described. The practice has been to provide a positive slope (angle B) for the sole 17 in only the shorter trajectory, special purpose, club shown in Fig. 4, namely the No. 11 commonly referred to as a sand wedge, but not for other longer trajectory clubs, namely the Nos. 1 to 10. However, it has been found to be advantageous to provide a slope for the sole of all clubs of a set and progressively decrease the slope for progressively longer trajectory clubs to a midrange club of the set, and then provide a negative slope for the longer trajectory clubs, as shown for the No. 3 club in Fig. 5 and progressively increasingly negative for the negative slope for progressively longer trajectory clubs, with a substantially zero slope for a midrange club, such as the No. 5 in Fig. 2.

The positive slope of the sole 17 on short trajectory (high loft) clubs will cause the club face to move upward during and after initial impact with the ball, thereby maintaining contact with the ball longer after initial impact to increase desired backspin. While desired backspin is thus easily achieved by the forward force of the club face against the ball due to the low point of impact in a club having a large loft angle A, it is more difficult to achieve it with longer trajectory clubs having a small loft angle because the point of impact is only slightly below the center of the ball. Therefore, to increase backspin with a small loft angle it is necessary to meet the ball with a somewhat downward motion that should increase as the loft angle decreases from the loft of the midrange club. To facilitate that, the negative slope of the sole 17 is made progressively greater with a decrease in the loft from the loft angle A of the midrange club.

It should be noted that the midrange club selected for this set is the No. 5 shown in Fig. 2, but the No. 4 or No. 6 iron could just as well be selected as the midrange club of a particular set, depending upon how the golfer wishes to use the clubs with a loft in the range of the Nos. 4 to 6. However, once the "midrange" club is selected, progressively greater positive slope is provided for clubs of higher (shorter) trajectory and progressively greater negative slope for clubs of lower (longer) trajectory. Thus, for the clubs of greater loft illustrated in Figs. 3 and 4, a positive slope angle (+B) is provided between the ground plane and a sole plane, and for clubs of smaller loft than the midrange club of Fig. 2, a negative slope angle (-B) is provided. The slope plane is a plane tangent to the sole 17 of the club head, and parallel to the central portion of the leading edge 16 of the club head. For simplicity in pointing out and distinctly claiming this feature, the first or vertical plane may be used as the reference, rather than the ground plane, to define the angle of the sole, which is then 90°-B.

Another important feature is a progressively greater width of the sole 17 for progressively shorter trajectory clubs of the set. That is achieved by maintaining a thickness T of the club head uniform for all clubs. As illustrated, the thickness T of the distance between the plane of the face 14 of the club head 10 and a parallel plane passing through the trailing edge thereof.

Still another important feature of the present invention is a crown on the sole 17 of each club, i.e., a slope for the sole 17 in a given club that is progressively decreased (i.e., made less positive) for clubs with a positive slope; more negative for the midrange club; and more negative for clubs with a negative slope) in successive sections of the club head taken in planes perpendicular to the club face on each side of a point P on the face of the club head, that point being selected at the anticipated point of impact with the ball. That point P is the center of what is often referred to as the "sweet spot" on the club face. The midrange club No. 5 shown in Fig. 2 illustrates that feature in Figs. 5, 6, 7 and 8. In Fig. 6, a section taken along a line 6-6 of Fig. 5 passes through the point P. That section clearly shows that the slope of No. 5 club is 0°. A section taken along the line 7-7 of Fig. 5 further out toward the toe 19 is shown in Fig. 7 to have a slope of −3°, for example. A similar section taken along the line 8-8 of Fig. 5 is shown in Fig. 8 to have a slope of −8°, for example. By comparing Figs. 6, 7 and 8 it may be seen that the sole has a slope that is progressively decreased (made more negative) in sections further out toward the toe 19. Similar sections could be shown along identically spaced lines on the heel side of the club head with the same effect. The result is a crown at the approximate center of the sole 17 which becomes more pronounced toward the trailing edge 18. That crown produces a rudder effect as there is a tendency for the trailing edge 18 of the club to drag in thick turf, even in clubs of lower loft, notwithstanding the fact that a smaller divot is taken. The rudder effect tends to maintain the face of the club normal to the direction of motion in the down swing so that, at the moment of impact, the club face is square with the direction in which it is traveling.

Yet another novel axes of a correlated club set is an extended upper-toe portion as illustrated by the portion 20 for the No. 5 iron in Fig. 5. In the past, the upper toe portions of
club heads have been rounded with almost the same radius of curvature as in the lower toe portion 21. The portion 20 is extended along a line normal to the axis of the shaft 12 to so provide more weight at the toe 19 as to balance the club about an axis approximately parallel to the club shaft 12 and passing through the point P. That axis may be rotated slightly about the point P to cross the shaft axis at the other end thereof and still be approximately parallel for purposes of this invention. A cavity 23 is cut in the back of the club head to elongate along a line substantially normal to the axis of the club shaft and passing through the extended portion 20 to leave a greater concentration of weight in the lower toe portion 21, and thereby improve the balance of the club about that line. The weight of the club head is then controlled by the depth of the cavity 23 without causing any change in the balance of the club head.

A related novel feature, but nevertheless one which can be employed to advantage independently, is the provision of a uniform length L of the club head, as measured along a horizontal plane 22 shown in FIG. 5 a distance Z above the ground plane. The measurement is made along a line parallel to the club shaft 22 from the point where the centerline of the shaft 12 intersects the plane 22 to a plane tangent to the toe 19 and perpendicular to both the ground plane and the face of the club head. The distance Z defines the point at which the center line of the shaft 12 first reaches the heel 15 in all clubs of the set; otherwise the different lie for each different club in a set would cause a different point of reference at the heel from which the length L to the toe is to be measured.

In the past, the club heads for the shorter irons have been made longer, perhaps to increase the weight of the club heads for uniform swing weight. However, the result is a different amount of rotational stability at the crucial moment of impact for each club about the axis passing through the point P in a direction approximately parallel to the shaft axis. This is so because the distance to the toe and heel from a given off-center point of impact is shorter on the clubs of longer trajectory, and the shorter that distance, the greater is the tendency for the club head to pivot about the off-center point of impact. In accordance with this invention, more uniform rotational stability is achieved by a uniform length for all clubs of a set, where length is measured from a point at which the shaft axis intersects a horizontal plane, at the same height Z from the ground plane for all clubs of a set, to a plane tangent to the club head at the toe, and perpendicular to both the ground plane and the striking face. To maintain a uniform swing weight, more metal can be removed from the back of the higher loft clubs by adjusting the depth of the cavity 23, as noted hereinbefore.

Still another related feature is the provision of a uniform height H measured from the sole plane to a plane parallel to the sole plane and tangent to the highest point 24 on the face 14 as shown in FIGS. 1 to 4. This dimension, like other dimensions X, Y, Z and T to be maintained constant, is of course independent of loft, and produce a correlated golf club set of uniform feel between clubs. The slope angle B of the sole is the only dimension which varies as a function of loft, besides lie, which is the angle C between the shaft axis and ground as shown in FIG. 5 for the No. 5 club. The following table illustrates the correlation between the loft, sole and lie angles A, B and C of an exemplary set:

<table>
<thead>
<tr>
<th>Club No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16°</td>
<td>-4°</td>
<td>58°</td>
</tr>
<tr>
<td>2</td>
<td>18° 07'</td>
<td>-3°</td>
<td>58° 50'</td>
</tr>
<tr>
<td>3</td>
<td>21° 15'</td>
<td>-2°</td>
<td>59° 40'</td>
</tr>
<tr>
<td>4</td>
<td>23° 30'</td>
<td>-1°</td>
<td>60° 30'</td>
</tr>
<tr>
<td>5</td>
<td>25° 52'</td>
<td>0</td>
<td>61° 10'</td>
</tr>
<tr>
<td>6</td>
<td>32°</td>
<td>+1°</td>
<td>62° 20'</td>
</tr>
<tr>
<td>7</td>
<td>36° 30'</td>
<td>-2°</td>
<td>63° 10'</td>
</tr>
<tr>
<td>8</td>
<td>41° 15'</td>
<td>+4°</td>
<td>64° 10'</td>
</tr>
<tr>
<td>9</td>
<td>45° 30'</td>
<td>+6°</td>
<td>65° 05'</td>
</tr>
<tr>
<td>10</td>
<td>51°</td>
<td>+8°</td>
<td>66° 05'</td>
</tr>
<tr>
<td>11</td>
<td>58°</td>
<td>+12°</td>
<td>65° 05'</td>
</tr>
</tbody>
</table>

However, as noted hereinbefore, the loft angles may be varied slightly, either individually, or uniformly as a set. In either case, the slope angles may be varied proportionately or retained the same as shown in the table since the degree of correlation is not critical. Changes in the lie angle C would be made for changes in the loft angle A in accordance with prior art practices.

In some correlated sets of golf clubs, the radius of the extended toe portion 20 may be purposely varied from club to club. In that case, the upper reference point for the height measurement is no longer valid. Therefore, an alternative method for achieving equivalent results (i.e., for maintaining a substantially uniform height) is to employ, as the upper reference, a point 26 where a line 27 in a plane common to the face 14 intersects a line 28 which is also in a plane common to the face 14. The line 27 is an extension of a straight edge on the club face in the central portion thereof. The line 28 is one tangent to the toe and in a plane that is perpendicular to both the face plane and the ground plane. This alternative method is regarded as fully equivalent, and both preferred and described below in a description of the upper reference plane as one virtually tangent to the club head at the upper end of the toe when all club heads are assumed to have a rounded corner with a uniform radius of the portion of the toe remote from the sole.

What is claimed is:

1. A set of correlated iron-type golf clubs, each club having a shaft connected to a head having a sole, toe and heel, and having a planar striking face extending upwardly from said sole between said toe and heel at a different acute loft angle measured with respect to a first plane passing through the axis of said shaft, said first plane being parallel to the leading edge of said club head along a central portion of said striking face, each club having a shaft so connected that said head as to provide a unique lie selected for the loft angle, said shaft being so positioned with respect to said striking face in each club of said set that said first plane is a uniform distance from the center of a sphere of a predetermined radius while said sphere is tangent to both said striking face and said second plane passing through said central portion of said leading edge, said second plane being perpendicular to said first plane.

2. A set of correlated golf clubs as defined in claim 1 wherein said predetermined radius is the radius of a golf ball.

3. A set of correlated golf clubs as defined in claim 1 wherein each club head has a uniform length measured in a third plane along a line parallel to said striking face, said third plane being parallel to said second plane and passing through said striking face at a predetermined uniform distance above said second plane, said length being measured from a point where said shaft axis intersects said third plane at said heel to a fourth plane perpendicular to said striking face and said second plane, said fourth plane being tangent to said club head at said toe.

4. A set of correlated golf clubs, each club as defined in claim 1, wherein said sole of each club head is at a different angle with respect to said first plane, said sole angle being measured in the same direction as for said loft angle from said first plane to a sole plane tangent to said sole, said sole plane passing through said central portion of said leading edge, where said sole angle is the smallest and less than 90° for a golf club having the smallest loft angle, and said sole angle is the largest and greater than 90° for a golf club having the greatest loft angle, and where each golf club of said set, when arranged in increasing order of loft angle, has a greater sole angle than golf clubs of said set of lower order.

5. A set of correlated golf clubs as defined in claim 4, wherein clubs of said set are arranged in order of increasing loft angle, and said set includes nine clubs starting with said club having said smallest loft angle, and where a golf club which is approximately in the middle of said nine clubs thus arranged in order has a sole angle of substantially 90°.
6. A set of correlated golf clubs as defined in claim 4 wherein each club of said set, when arranged in increasing order of loft angle, has a progressively greater sole width than golf clubs of said set of lower order, and further each of said club heads has a uniform thickness measured from said striking face to a plane parallel to said striking face and tangent to a trailing edge of said sole remote from said leading edge.

7. A set of correlated golf clubs as defined in claim 1 wherein each of said club heads has a uniform height measured from a sole plane to a plane parallel to said sole plane, said sole plane passing through said central portion of said leading edge and tangent to said sole, and virtually tangent to said club head at said toe when all club heads are assumed to have a rounded corner with a uniform radius at the portion of said toe remote from said sole.

8. A set of correlated iron-type golf clubs, each club having a shaft connected to a head having a sole between a toe and heel, and a planar striking face between said toe and heel, each club having a different loft angle between said striking face and a first plane passing through the axis of said shaft, said first plane being parallel to the leading edge of said club head along a central portion of said striking face, each club having a shaft so connected to said head as to provide a unique lie selected for the loft angle, said head having a uniform length measured in a second plane perpendicular to said first plane and parallel to said central portion of said leading edge, said second plane being spaced a uniform distance above a ground plane, said ground plane being perpendicular to said first plane and passing through said central portion of said leading edge, said length being measured from a point where said shaft axis intersects said second plane at said heel to a fourth plane perpendicular to said striking face and said third plane, said fourth plane being tangent to said club head at said toe.

9. A set of correlated iron-type golf clubs, each club having a shaft connected to a head having a sole, toe and heel, and having a planar striking face extending upwardly from said sole between said toe and heel at a different acute loft angle measured with respect to a first plane passing through the axis of said shaft, said first plane being parallel to the leading edge of said club head along a central portion of said striking face, each club having a shaft so connected to said head as to provide a unique lie selected for the loft angle, said sole of each club head being at a different angle with respect to said first plane, said sole angle being measured in the same direction as for said loft angle from said first plane to a sole plane tangent to said sole, said sole plane passing through said central portion of said leading edge, where said sole angle is the smallest of all the golf clubs having the smallest loft angle, and said sole angle is the largest and greater than 90° for a golf club having the greatest loft angle, and where each golf club of said set, when arranged in increasing order of loft angle, has a greater sole angle than golf clubs of said set of lower order.

10. A set of correlated iron-type golf clubs as defined in claim 9 wherein clubs of said set are arranged in order of increasing loft angle, and said set includes nine clubs starting with said club having said smallest loft angle, and where a golf club which is approximately in the middle of said nine clubs thus arranged in order has a sole angle of substantially 90°.

11. A set of correlated golf clubs as defined in claim 9 wherein each club of said set, when arranged in increasing order of loft angle, has a progressively greater sole width than golf clubs of said set of lower order, and further each of said club heads has a uniform thickness measured from said striking face to a plane parallel to said striking face and tangent to a trailing edge of said sole remote from said leading edge.

12. A set of correlated golf clubs as defined in claim 9 wherein each of said club heads has a uniform height measured above said sole plane to a plane parallel to said sole plane and virtually tangent to said club head at said toe when all club heads are assumed to have a rounded corner with a uniform radius at the portion of said toe remote from said sole.

13. A set of correlated iron-type golf clubs, each club of said set having a shaft connected to a head having a sole, toe and heel, and having a planar striking face extending upwardly from said sole between said toe and heel at a different loft angle measured with respect to a first plane passing through the axis of said shaft, said first plane being parallel to the leading edge of said club head along a central portion of said striking face, each club having a shaft so connected to said head as to provide a unique lie selected for the loft angle, each club of said set, when arranged in increasing order of loft angle, has a progressively greater sole width than golf clubs of said set of lower order, and further each club head of said set having a uniform thickness measured from said face to a plane parallel to said face and tangent to a trailing edge of said sole remote from said leading edge.

* * * * *
Disclaimer


Hereby enters this disclaimer to claims 1 and 2 of said patent.

[Official Gazette October 23, 1973.]
Disclaimer


Hereby enters this disclaimer to claims 1 and 2 of said patent.

[Official Gazette July 8, 1975.]