Fig. 13

Fig. 14

D = ANGLE OF LOFT
L = ANGLE OF LIE
G = TRUE ANGLE BETWEEN AXIS OF
    ROTATION AND PLANE OF CLUB FACE.
A = ANGLE BETWEEN CLUB SOLE LINE
    AND THE PROJECTION OF AXIS OF
    ROTATION ON PLANE OF CLUB FACE.
B = ANGLE BETWEEN THE SHAFT CENTER LINE
    AND A PERPENDICULAR TO THE AXIS OF
    ROTATION.

INVENTOR.
Rodger D. Brouwer

BY
H. C. Manning

ATTORNEY
My invention relates to golf clubs, and is directed particularly to a golf club having a uniquely shaped head which is adjustable with respect to its shaft in such a manner as to selectively simulate all the various clubs customarily used in the game of golf.

It is the principal object of my invention to provide a universal golf club of the above nature wherein the head will function in all adjustments of the same, viz., driver, brassie, spoon; 1, 2, 3, 4, 5, 6, 7, 8, and 9 irons; and putter, in each instance having the same correct angle of lie and angle of loft as its counterpart in a standard set of clubs.

Another object of my invention is to provide a universal golf club of the character described, wherein the adjustable head is provided with a plurality of striking faces, one of which acts as the driver, brassie and spoon face; another of which serves as the striking face for all iron positions; and the third of which serves for putting; and wherein, for all club settings, the club will have proper dynamic proportions so that for all shots, the center of mass of the head will be substantially directly behind the ball.

The improved club head will not only simulate a standard wood club, iron, and putter, but will also produce substantially the same results as said standard clubs. Thus a player may obtain powerful long "wood" shots, excellent "iron" shots, and accurate "putter" strokes.

It is still another object of my invention to provide a universal club of the character described, wherein the club and shaft are adjustably interconnected by means of a diagonally split sleeve disposed in a bore within the head, and including manually actutable means interconnecting the sleeve and the club shaft and operable to expand said sleeve in the club bore for locking the club head in various adjusted positions with respect to the shaft.

A further object of my invention is to improve the construction of adjustable golf clubs as now made and to facilitate the operation of adjustment thereof.

Other objects and structural details of my invention will be apparent from the following description when read in conjunction with the accompanying drawings forming part of this application, wherein:

Fig. 1 is a front view of the improved universal golf club shown adjusted to "spoon" position;

Fig. 2 is an end view of the same, taken along the line 2—2 of Fig. 1, in the direction of the arrows, with the setting indicator in the same "spoon" position;

Fig. 3 is a bottom view of the same, taken along the line 3—3 of Fig. 1 in the direction of the arrows, showing the club head with the indicating pointer in "spoon" position on;

Fig. 4 is a bottom view of the same with the iron face adjusted to "number 9" or "mashe" position;

Fig. 5 is a rear view of the same;

Fig. 6 is a longitudinal cross-sectional view through the club head in the "spoon" position, shown in Figs. 1 through 3;

Fig. 7 is a top view of the club head with the setting indicator in "spoon" position, showing in dotted lines the angle U between the driver face and the center line YY of the central club head element; and also the angle Q through which the axis XX of the lock bolt moves while the head passes from driver to iron positions so that said center line YY of the club head element generates a cone of revolution about said axis XX.

Fig. 8 is a detail side view of the locking sleeve and bolt attached to the adaptor shank;

Fig. 9 is a cross-sectional view similar to Fig. 6, of a modified form of locking device adapted to be attached to the club head, and employing a tightening nut formed with a handle integral therewith;

Fig. 10 is a similar cross-sectional view of another modified form of locking device attached to the club head and employing a handle and cam for engaging the end of the locking bolt;

Fig. 11 is a rear view of the same;

Fig. 12 is a detail rear view, taken along the broken line 12—12 of Fig. 10, in the direction of the arrows, showing the slotted hole and the indicating pointer on the end of the shaft shank;

Fig. 13 is a cross-sectional view similar to Figs. 6, 9, and 10 of another modified universal club head having a locking set screw in an annular groove at the end of the lock bolt for preventing said bolt from being pulled out of said head;

Fig. 14 is a schematic diagram illustrating the various relationships between the angle of loft, the angle of lie, and the axis of rotation of the club head relative to the shaft.

Referring now to the drawings, wherein like reference numerals denote corresponding parts throughout the several views, the numeral 10 indicates the club shaft (only partially shown), which preferably is of telescoping tubular construction so as to be collapsible for easy carrying and storage when the club is not in use. The lower end of the shaft 10 is secured in a tubular adaptor shank 11 which has been flattened and slightly bent lower end portion 13 terminating in a setting pointer 12.

Adjustably secured against the end portion 13 is a selectively adjustable club head 14 having a "wood" club face 15; an "iron" club face 16; and a "putter" face 17 having an inclined section 18.

Provision is also made of an interior lock bolt 19 having an integral enlarged head 20 at its inner end, and a removable cap nut 21 at its threaded outer end 22.

Welded to the lower end portion 13 of the adaptor shank 11 is a sleeve 23 comprising a diagonally cut tube having inclined abutting cam faces 25 and 26 (see Fig. 8), said tube 23 being surrounded by an outer sleeve 24 rigidly secured within the head 14.

An adaptor collar 27 is tightly mounted upon the shank of the bolt 19 in engagement with the head 20 on the inner end of said bolt. A shoulder 27a on the collar 27 abuts the inner end of the tube 23, and a reduced portion of said collar tightly fits within said tube. The lock bolt 19 extends through the collar 27 and the sleeves 23 and 24, and passes out through an opening in the end portion 13 of the tubular adaptor shank 11.

The inner portion of the club head 14 is provided with an inclined bore 28 which is press-fitted about the sleeve 24 (see Fig. 6). The lock bolt 19 and the sleeve 23 fit within the outer sleeve 24, and said bolt is longitudinally movable therein for locking the head 14 in adjustable position relative to the club shaft.

A box wrench 29 (illustrated in broken lines in Fig. 6) may be used for screwing on the cap nut 21, whereby the sections of the split cam sleeve 23 will be forced against each other for locking them within the sleeve 24,
thus securing the head 14 in adjusted position with respect to the shaft 10.

In order that the head 14 may readily be set into selected position for simulating the particular club desired, the head faces 15, 16 and 17 are provided with groups of index marks "P"; "S," "B," "D," and "1," "3," "5," "7," "9"; respectively; which marks may be selectively aligned with the indicating pointer 12. Thus, when the head is set in "S" position as indicated in Figs. 1, 2 and 3, the club simulates an ordinary "spoon" or a number "3" wood. Moreover, if a number "6" iron is desired, for example, the head will be set so that the pointer 12 is midway between the "5" and "7" "iron" index marks on the club face 17.

As clearly shown in the diagram of Fig. 14 of the drawing,

D represents the angle of loft,
L represents the angle of lie,
A represents the angle between the club head sole line and the projection of the axis of rotation of the club head on the plane of the club face,
G represents the true angle between the axis of rotation of the club head 14 and face thereof, and,
B represents the angle between the shaft center line and a perpendicular to the axis of rotation of the club head.

It has been found by research and calculation that the following three mathematical formulae hold true for the angles A, B and G as defined above:

**FORMULA #1**

\[
\tan A = \frac{\sin L_2 \sin D_3 (\cos L_2 - \cos L_3) - \sin L_1 \sin D_1 (\cos L_1 - \cos L_2) + \sin L_5 \sin D_5 (\cos L_5 - \cos L_6) + \sin L_4 \sin D_4 (\sin L_4 \cos D_4 - \sin L_4 \cos D_5) + \sin L_3 \sin D_3 (\sin L_3 \cos D_3 - \sin L_3 \cos D_4)}{\sin L_1 \sin D_1 - \sin L_2 \sin D_2}
\]

(form for optimum results, the angle G is about 12.2 degrees)

**FORMULA #3**

\[
\sin B = \cos G (\cos L \cos A - \sin L) (\sin D \tan G + \cos D \sin A)
\]

The optimum value of the angle B is about 28 degrees.

**Second form**

Fig. 9 illustrates a modification of the invention wherein, instead of the lock bolt 19, a cylindrical lock bolt 41 having an inner end slot 42 and a left hand threaded outer end 43, is provided, for securing the head in adjusted position.

Provision is also made of a handle 45 having an offset, integral internally-threaded cap nut 44 screwed upon the end 43 of the bolt 41, for manually tightening the club head in its selected adjusted positions. The slotted bolt 41 when removed from club head 14 may readily be adjusted by a screw driver, or even a coin, so that when the club head 14 is secured in position on the shaft 10, the end of the handle 45 will extend upwardly into alignment with the adjacent shaft 18 and shank 11. One advantage of this form of the invention is that it is not necessary to carry a separate wrench for locking the club head in adjusted positions.

Figs. 10, 11 and 12 illustrate another embodiment of my invention, wherein a cam-actuated lock bolt 50 is used for holding the club head in adjusted positions. In this embodiment, the bolt 50 has an enlarged and flattened rear end portion 51 and an inner threaded end 52. Screwed on the end 52 is an elastic stop nut 53 having a central fibre core 54.

Provision is also made of a cam handle 55, having an upper concave portion which embraces the adaptor shank 11 when in locking position, and a lower bifurcated end forming a pair of spaced side portions 56 and 57 which fit over the flattened outer end 51 of the bolt 50 and are linked thereto by means of a pin 58.

The end of the stop nut 53 bears against the adaptor collar 27 fitted within the diagonally-cut sleeve 23. The sleeve 60 has its outer end rigidly secured to the curved end portion 13 of the adaptor shank 11, as by welding. As can best be seen in Fig. 12, the sleeve 60, as well as the shank end portion 13, are provided with rectangular openings through which the flattened rear end portion 51 of the bolt 50 may slide.

The side portions 56 and 57 are shaped to provide rounded cam edges 59 which engage against the end of the sleeve 60 and force the bolt 50 to the right when the handle 55 is moved to its uppermost locked position.

It will be understood that the elastic stop nut 53 will be so adjusted when the lock bolt 50 is removed from the club head 14 that when the handle 55 is in the locked position shown in Fig. 10, the sliding cam edges of the cooperative sleeves 23 and 60 will be sufficiently actuated to lock the head in playing position. The elastic stop nut 53 allows easy adjustment, as may be required from time to time to overcome wearing of the locking parts. This modification of the invention also has the advantage of not requiring separate tools.

**Fourth form**

Fig. 13 illustrates still another form of the invention, similar to the first embodiment shown in Figs. 1-6, but in Fig. 13, the bolt 26 has an annular recess 70 in its head 71, within which extends a reduced pin 72 of a slotted set screw 73 fitting in a tapped hole 74 in the adjacent face 75 of the club head 14. The reduced pin 72 on the set screw positively prevents accidental separation of the club head 14 from the shank 11.

**Operation**

Considering now the operation of the universal golf club, it is to be noted that the "iron" and "putter" faces 16 and 17, respectively, are substantially parallel to the center line YY or axis of the club head 14 (see Figs. 1 and 7). The "wood" club face 15 is preferably slightly convex and forms a small angle U with the center line YY, as can be seen in Fig. 7, for the purpose of minimizing "slicing" and compensating for the torsional twist of the shaft at the time of ball impact.

When the cap nut 21 is turned by the box wrench 29, the wader of the split tube 23 will spread apart and frictionally engage the outer shell 24 to firmly lock the club head in adjusted position.

As shown in Figs. 1 and 6, the bore 28 within which the locking mechanism operates has an axis XX defining an angle A with the center line YY of the club head 14. Thus, as the club head is turned about the axis XX, the club head center line YY generates a cone of revolution about said XX axis.
Since the center line HH of the club shaft 10 is not perpendicular to the cone axis XX, but is located at an angle exceeding 90 degrees (Fig. 1), the cone of revolution will not remain in the same position as the club head 14 pivots about the axis XX. Instead, the cone of revolution moves about the club shaft axis HH through the angle Q (Fig. 7). This brings the required playing face into proper position for the correct line of ball flight.

By the proper choice of the proportions of the club head 14 and of the angles A, B and E, which approximates angle G, substantially as illustrated, it will be understood that upon revolving said club head about the axis XX, the club faces 15, 16, 17 will go through driver, brassie, spoon positions; all iron positions; and the putter position; while at the same time automatically effecting the proper loft and lie angles for any selected club.

Moreover, the club structure is such that the proper dynamic weight proportions are accomplished for all clubs, i.e., for the heaviest woods with the wood club face, and of the greatest mass of the club head will be directly behind the ball. This results in a universal powerful long driving club having all the advantages of a full set of conventional golf clubs.

While I have described several preferred embodiments of my invention, it is to be understood that this disclosure is for the purpose of illustration only, and that various omissions or changes in the shape, proportion and arrangement of parts, as well as the substitution of other equivalent elements for those herein shown and described, may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

Having thus fully described the invention, what is claimed as new and for which it is desired to secure Letters Patent is:

1. A universal golf club comprising a head having a plurality of ball-striking faces for simulating a plurality of conventional club heads, said faces lying in planes substantially parallel to the longitudinal center line of said head, adjustable means for securing the lower end of the club shaft to the rear end of said head, said head having an axis of rotation inclined with respect to said central line, the relation of said axis to said central line being such that said central line passes through a cone of revolution about said axis as said head is rotated for adjustment, the magnitude and location of the angle between said axis and each of said striking faces being such that as said head and said central line generate the cone of revolution, each striking face in turn will pass through the correct corresponding angle of lie and angle of loft for the selected conventional club head being simulated, and means for advantageously securing said club head in any desired selected angular position to obtain the correct angle of lie and angle of loft for the conventional club head being simulated.

2. A universal golf club comprising a head having a plurality of ball striking faces for simulating a plurality of conventional club heads, said striking faces lying in planes substantially parallel to the longitudinal center line of said head, means for securing the lower end of the club shaft to the rear end of said head, said head having a bore, the axis of which is inclined with respect to said central line, the relation of said bore to said central line being such that said central line passes through a cone of revolution about the axis of said bore, the magnitude and location of the angle of said bore with respect to each of the striking faces of said club head being such that as said head generates a cone of revolution about said axis, each striking face will pass through the correct corresponding angle of lie and angle of loft for the selected conventional club being simulated, and means within said bore for advantageously securing said club head in any desired selected angular position to obtain the correct angle of lie and angle of loft for the conventional club head being simulated.

3. The invention as defined in claim 1, in which the angle between the club head sole line and the projection of the axis of rotation of said club head on the plane of the chosen club head face is designated by A, and is expressed by the formula:

$$\tan A = \sin L_1 \sin D_2 \left( \cos L_1 - \cos L_2 \right) - \sin L_1 \sin D_1 \left( \cos L_2 - \cos L_3 \right)$$

$$+ \sin L_2 \sin D_1 \left( \sin L_2 \cos D_1 - \sin L_3 \cos D_2 \right)$$

where the angles of lie $L_1$, $L_2$, and $L_3$ and loft $D_1$, $D_2$, and $D_3$ are corresponding successive values taken from a standard set of conventional golf clubs.

4. The invention as defined in claim 1, in which the angle between the axis of rotation of said club head and the plane of the chosen club head face is expressed by the formula:

$$\tan G = \sin L_1 \sin D_1 - \sin L_2 \sin D_2$$

in which the angles of lie $L_1$ and $L_2$ and angles of loft $D_1$ and $D_2$ are corresponding successive values taken respectively from a standard set of conventional golf clubs.

5. The invention as defined in claim 1, in which the angle between the shaft center line and a perpendicular to the axis of rotation of said club head is designated by "B" and is expressed by the formula:

$$\sin B = \cos G \cos L_1 \cos D_1 - \sin L_1 \tan D_1 \sin A$$

where $A$ is the angle between the club head sole line and the projection of the club head axis of rotation on the plane of the chosen club face, where $G$ is the angle between the axis of rotation of said club head and the plane of said chosen club head face, and where the angle of lie $L_1$ and the angle of loft $D_1$ are corresponding values taken from a standard set of conventional golf clubs.

6. A universal golf club as defined in claim 1, comprising a head having a "wood" simulating face, an "iron" simulating face and a "putter" simulating face, said faces being substantially parallel with a longitudinal center line of said club head, an upstanding shaft, adjustable means for interconnecting the rear of said club head with the lower end of said shaft to permit selective twisting of said head with respect to said shaft, said interconnecting means comprising a cylindrical bore in said club head, the axis of which is angularly related to said central longitudinal center line, a split sleeve cam adjustable fitted in said bore, and a locking bolt extending through said split sleeve cam for forcing the sections of said split sleeve cam against said bore to lock said head in adjusted position.

7. The invention as defined in claim 6, wherein said bolt is locked by a nut at the outer side of said shaft.

8. A universal golf club as defined in claim 7, wherein said nut has a lever connected thereto and swingable against said shaft, said lever having means operable to force the sections of said split sleeve cam into locking engagement with the bore when said lever is moved into alignment with said shaft.

9. A universal golf club as defined in claim 7, wherein said nut has a laterally-extending lever integral therewith and swingable into alignment with said shaft.

10. A universal golf club as defined in claim 6, wherein the lower end of said shaft is provided with a pointer, and wherein said head is provided with indicia markings cooperative with said pointer to allow easy setting of said club head with respect to said shaft to selectively indicate the particular golf club of a conventional standard set being simulated.
11. A universal golf club as defined in claim 1, comprising a head having a plurality of ball-striking faces lying in plane substantially parallel with a longitudinal center line of said head, said head having a bore located on an axis inclined with respect to said center line, a bolt in said bore, means to adjust the angles of "loft" and "lie" of said club head, means to lock such bolt in adjusted position in said bore, said club head being provided with indicia which may be brought into register with a pointer on the lower end of said club shaft to indicate the adjustment of said head.

12. The invention as defined in claim 1, in which said club head is provided with faces corresponding to a set of conventional wooden clubs, iron clubs and putter.