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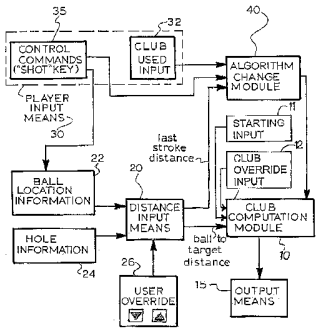
(54) Title: DYNAMIC GOLF CLUB SELECTION SYSTEM



(57) Abstract: A system for selecting a golf club for the next stroke of a golf player including: a distance input means (20) for providing distance data from a current ball location to a predetermined target; a club computation module (10) that executes an algorithm that utilises the distance data as a variable parameter to suggest a suitable club for the next stroke; output means (15) for the presentation of the suggested club; an input means for previous stroke data including the type of club used and the stroke distance prior to the next club selection; an algorithm change module utilises the previous stroke data as variable input data to modify the algorithm used in the club computation module (40) to select the club for the next stroke.

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DYNAMIC GOLF CLUB SELECTION SYSTEM

Field of the Invention

This invention relates to golfers' aids to help in the selection of golf clubs to be used for particular golf shots during play of rounds of golf.

Background of the Invention

In the past there have been proposed a number of golfers' aids to assist golfers in selecting particular golf clubs to be used for particular shots during play. The simplest have been printed lists or tables showing the distance that the golf ball will travel when struck by particular golf clubs. Information provided by signage or markers on the golf course, and in printed matter supplied to players such as on a score card or map displaying the layout of the course, includes distances for the relevant hole. The player, or a caddy, consults these data and, knowing the position of the ball on the golf course, the player then can choose the appropriate club to use. There is considerable guess work both in estimating distances and in club selection using these aids.

It has also been proposed to automate some of the functions of distance determination and club selection by providing mechanical or electronic aids. For example, several electronic systems have been proposed for determining distances, particularly by inputting the particular position on the course of the ball to be struck and utilising player input distance data or utilising downloaded data or utilising stored data to compute and display distance information, such as the distance remaining from the ball to the target (the relevant green or, more accurately, the hole provided at the green). Some examples of such systems are shown in GB 2263548 and AU 2001226956 (WO01/97926).

Some of these prior documents mention the possibility of utilising the data concerning the distance from the ball to the target to suggest a golf club for the player to use e.g. AU57626/90. However, either these documents are silent about how this club suggestion or recommendation is to be made (e.g. US 5,245,537, US 5,507,485 and US 6,705,942) or the system retrieves stored data concerning distances that particular golf clubs can be expected to achieve. For example, AU 61666/96 (WO 96/40387) proposes storing distances that the particular player in the past has struck the ball using each golf club and averaging those distances to later provide club selection suggestions or recommendations for particular distances to the respective targets. Such systems might provide only marginally better club selection suggestions or recommendations, or possibly equivalent or even "worse" club selection suggestions than manual systems

because changing circumstances are either not taken into account or are only crudely or slowly averaged over a considerable period of time and taken into account in producing the club selection suggestions.

The above references to and descriptions of prior proposals or products are not intended to be, and are not to be construed as, statements or admissions of common general knowledge in the art in Australia or elsewhere.

It is an object of the present invention to provide a system for providing to a player a golf club suggestion or recommendation for the next golf stroke to be played by the player.

It is a preferred object of the present invention to provide such a system which can assimilate the player's performance characteristics to provide better golf club suggestions, preferably regularly, and most preferably after each golf stroke during play of a round of golf, to better accommodate the player's on-going performance in the generation of the golf club selection suggestion.

Summary of the Invention

According to the present invention there is provided a system for providing to a player a suggestion or recommendation of a golf club to select and use for the next golf stroke to be played by the player, the system including:

distance input means for providing distance data from a current golf ball location to a predetermined target,

a club computation module operative to execute a computation algorithm so as to compute a suggested club for the player to select and use for the next golf stroke, the club computation module utilising the distance data as a variable parameter in the computation algorithm,

output means for presentation of the suggested club selection that has been computed by the club computation module,

stroke input means for input of golf stroke data, the golf stroke data including the particular golf club used for a golf stroke prior to the next club selection suggestion to be computed, the golf stroke data further including the prior stroke distance being the distance that the golf ball travelled for the prior golf stroke, and

an algorithm change module operative to modify the computation algorithm executed by the club computation module by utilising the golf stroke data for the prior golf stroke played (including both the prior golf club used and the prior stroke distance) as variable input data for the modification of the computation algorithm, the modification

of the computation algorithm accommodating in the computation algorithm the player's performance as evidenced by the prior golf stroke data to improve the relevance of the suggested club selection computed by the modified computation algorithm.

By modifying or updating the computation algorithm utilising the prior stroke data, the computation algorithm can be personalised to a particular player by utilising data for strokes played with different clubs, but without it being necessary for numerous strokes to be played with each and every club before the computed club selection suggestions become truly customised for the particular player. Also, possibly, and in the preferred embodiment preferably, the system has the ability to be progressively customised or personalised to the particular player even after playing only a relatively small number of strokes, e.g. during one particular round of golf. In particular, by operating the system so that the algorithm change module modifies the computation algorithm utilising data for the last stroke played, the computation algorithm can be modified in "real time" including during playing of a round of golf, even after playing only a few golf strokes or perhaps a few holes. This enables the system to rapidly accommodate changed conditions such as significantly different weather conditions or perhaps changed performance of the player (e.g. due to technique changes following tuition or practice, or changed level of well being).

In the preferred embodiment, the computation algorithm utilises a mathematical function, which expression when used in this specification covers multiple mathematical functions, relating each particular individual golf club to the distance that the respective golf club will strike the golf ball and, in operation, the algorithm computes the mathematical function to output the suggested selection of the golf club for a particular distance from the golf ball to the target. The mathematical function or functions are not fixed or invariable functions but include computation parameters which are modifiable by the operation of the algorithm change module. These computation parameters may be constants in a mathematical formula solved by the computation algorithm. However, these computation parameters are "constants" only in the sense that they are determined by the algorithm change module and set at constant values only for one particular iteration of the computation algorithm to generate a suggested club suggestion. After the next stroke has been played, the golf stroke data for the next stroke including the particular golf club used and the stroke distance are utilised by the algorithm change module to change, if necessary, the constants of the mathematical function or formula prior to the next computation of suggested club selection.

In this preferred embodiment, upon the system first being used by a particular golf player and upon that player's handicap being input to the system, the club computation module is operative to access a set of stored mathematical functions which respectively relate each golf club to a respective golf stroke distance for each of a number of golf player handicaps and to implement the particular mathematical function for that player's handicap that has been accessed.

In this preferred embodiment, the mathematical function is preferably a mathematical formula for generating a required relationship between a Club factor and golf stroke distance, the formula taking the form:

$$\text{Club factor} = m/(\text{Distance} - c)$$

where m and c are computation parameters which are held constant for a particular club suggestion computation of the club computation module but which can be varied by the algorithm change module for other club suggestion computations,

Distance is the distance data which is input by the distance input means, and

Club factor is a computed variable related to the particular golf clubs available to the player and which determines the club suggestion provided by the output means.

The algorithm change module may be operative to average or normalise computation parameters utilised by the mathematical function over several prior golf strokes so that preceding abnormally long or abnormally short golf stroke distances will not singly excessively affect operation of the club computation module in its computation of the suggested club selection. The averaging function of the algorithm change module may comprise a weighted averaging process in which golf stroke data for more recent prior golf shots are given higher weighting than for older prior golf shots. Also, the algorithm change module may perform a data weighting process which comprises allocating greater weighting to golf stroke data associated with use of particular golf clubs which have more predictable and consistent golf stroke distances, e.g. the "middle" or 5, 6 and 7 irons.

The stroke input means may be operative to enable the player to input data concerning a particular club used for a golf stroke including input of a golf club different to the suggested golf selection presented by the output means for that golf stroke, whereby the golf stroke distance utilised by the algorithm change module will accurately relate to the particular golf club used.

The system may further include player input means which includes a control command input which the player can activate at the location from which a particular golf

stroke is to be played and can activate again at the location where the golf ball after playing that particular golf stroke has come to rest, whereby the distance traversed between the two locations where the control command input was activated can be used by the stroke input means to compute the golf stroke distance and input that data to the algorithm change module.

The algorithm change module may be operative to check whether the prior golf stroke distance falls within a predetermined tolerance range for the particular golf club used, the algorithm change module being operative to reject golf stroke distances that fall outside the tolerance range and fail to implement the algorithm change as a result.

The algorithm change module may be operative to check if the prior golf club used is one of a set of certain excluded golf clubs which are subject to substantial variability in player performance, e.g. the drivers and woods, and if so to exclude the relevant golf stroke data from utilisation by the algorithm change module, the club computation module nevertheless being operative to calculate and provide a suggested club selection after the prior golf stroke including a selection from the set of excluded clubs.

Preferably the distance input means provides to the club computation module the distance data derived from current golf ball location and from particular golf hole information, the golf hole information including the length of the golf hole from tee to green and, optionally further including tee location, and optionally further including pin location on the green.

Preferably the ball location information provided to the distance input means is determined automatically by the system which includes measuring means operative to measure the distance travelled from the location where the prior golf stroke was played to the location where the golf ball rests after the golf stroke has been played. In one embodiment the system may include an input means by which the player can input a command to start the distance calculation from that particular point where the command was input and then, after playing the golf stroke and moving in a reasonably direct line to the point where the golf ball has come to rest, by which the player can input a further command which initiates determination by the system of the distance travelled by the golf ball for that particular golf stroke.

The system may further include a user override operatively associated with the distance input means and by which the player can selectively modify the operation of the distance input means which provides ball to target distance data to the club computation

module so as to thereby force computation and output of a golf club suggestion for a distance dictated by the player. The user override may be manually adjustable by the player to adjust the ball to target distance by selectively incrementing or decrementing the ball to target distance to be utilised by the club computation module.

Brief description of the drawings

Possible and preferred features of the present invention will now be described with particular reference to the accompanying drawings. However it is to be understood that the features illustrated in and described with reference to the drawings are not to be construed as limiting on the scope of the invention. In the drawings:

Fig. 1 is a schematic block diagram of a golf club selection system according to an embodiment of the present invention,

Fig. 2 is a flow chart illustrating the club computation and algorithm change processes according to an embodiment of the present invention,

Fig. 3A is a table and Fig. 3B is a graphical representation showing typical golf club versus distance relationships for players having different handicaps, these data being useable as default or starting points for the system of the present invention,

Fig. 4A is a table and Fig 4B is a graph showing how golf shots during an actual golf round can be used to modify the computation algorithm utilising a system according to an embodiment of the present invention, and

Fig. 5A is a table and Fig. 5B is a graph showing how actual golf shots during a round can change the computation algorithm but with a refined process to avoid excessive variation due to extraordinary golf strokes.

Detailed description of embodiment

The illustrated system is for providing to a player a golf club selection suggestion or recommendation for the next golf stroke to be played. This suggestion is generated by the computation module 10 and the suggested club selection that has been computed is presented to the player by the output means 15 which may for example comprise a display such as an LCD display carried by the player or mounted by the player's buggy or golf cart. The display can be conventional in construction and operation (e.g. an LCD display) and would be understood by a person skilled in designing and constructing a system according to this invention. It will also be appreciated that the output display 15 can provide other information to the player, such as a graphical display of each particular golf hole including the one being played and including its layout and location of features and hazards for example. Alphanumeric data can be displayed such as distances, par, scoring

data (strokes taken, stableford points, etc) and can also provide prompts to the player as will be mentioned as appropriate points in this description.

A primary input to the club computation module is provided by the distance input means 20 which provides distance data from the current ball location to the predetermined target, the target normally being the pin or hole provided at the green of the particular golf hole being played, or perhaps the front edge of the green (enabling the golfer to make an adjustment if necessary to the club selection to allow for variations in the actual location of the pin marking the hole at different locations on the green).

As shown schematically in Fig. 1 the distance from the ball to the target can be determined by the distance input means 20 from location information 22 and particular golf hole information 24. The golf hole information 24 would include the length of the hole from tee to green as a minimum but could also include more refined information including tee location (men's tee, ladies' tee, and whether the tees are located forward, centre or rear of the teeing area) and pin location on the green. The hole information can also include information concerning the shape and perhaps even contours, of the golf hole, particularly if a sophisticated location information system is being used (e.g. GPS position location). The hole information 24 can be input and stored for a particular golf course as a whole in one operation, e.g. being downloaded to the system from a data carrier such as a computer disk, downloaded from an internet site, input prior to commencement of the game from a database provided by the golf course management, etc. Alternatively, the hole information 24 can be manually input, e.g. by the player upon reaching the tee of each hole using a numeric key pad for example provided by the system.

The ball location information 22 utilised by the distance input means can also be provided by any suitable system, including known kinds of systems as illustrated by some of the prior published patent specifications referred to earlier. In a relatively simple system, the ball location information can be determined automatically by the system and provided to the distance input means. One automatic location information system can include an odometer or the like associated with the golf buggy or golf cart which measures the distance travelled from the tee to the point where the golf ball rests after the tee stroke has been played, or the distance travelled from the ball on the fairway to the next location of the ball after the fairway shot was played. By locating the buggy at the tee, or at the location of the ball on the fairway, and inputting to the system a command to start the distance calculation from that particular point using player input means 30 (e.g.

by pressing a key on a keypad 35 to indicate that a "shot" is to be played from this point) and then, after playing the stroke, moving the buggy or cart in a reasonably direct line from the point where the stroke was played to the point where the ball has come to rest, the distance of that particular stroke can be automatically determined. Where the ball has come to rest, the player can again input their command, e.g. by pressing the "shot" key 35 again, to end the distance calculation and feed that distance data to the distance input means 20.

Another kind of automatic ball location system could be a GPS system or a local radio location system. The operation of such systems for determining ball location and hence determining stroke distances and distance from ball to target can be understood from the preceding description or from prior art documents, and details of these systems do not form part of the novelty of the present invention.

In a possible refinement of the system illustrated in Fig. 1, although not a refinement which is necessary, there may be provided a user override 26 associated with the distance input means 20. The user override may comprise operative functions enabling user modification of the operation of the distance input means which provides ball to target distance for use by the club computation module 10. For example, the default target for a golf shot would normally be the green, or more particularly the pin marking the hole on the green, and the club suggestion generated would be based on this default target. However, the player may wish to call for a club suggestion to lay up a golf shot short of the green, e.g. before a hazard located between the player and the green. The user override 26 may enable the user to input a different target, namely an area short of the nearest point of the hazard so that the system can provide a club selection suggestion based on this alternative target.

In the case of the use of an odometer to provide the ball location information, the distance from the point where the ball was struck, e.g. from the tee, to the point where the ball has come to rest would normally be assumed by the system to be a straight golf shot with the ball approximately centred on the fairway. To allow for a misdirected shot, such as a hooked or sliced shot, the distance of the shot as determined by the odometer, although accurate, might lead to a significantly incorrect computation of the ball to target distance. The user override 26 may be used by the player to manually adjust the ball to target distance, e.g. by incrementing or decrementing the computer distance manually (via the input numeric keyboard or via increment (up) or decrement (down) keys provided by the system) so as to thereby obtain a more accurate club suggestion. Likewise the user

override 26 may be used by the player to allow for stroke distance effects anticipated as a result of the lie of the ball. For example, if the ball is off the fairway in slightly longer grass, less back spin and more roll of the ball can be expected so that the user can decrement the computed distance to target to induce the system to suggest a more lofted club.

However, these user override facilities and functions are not essential since the player can simply make such decisions whether or not to accept the system's club suggestion or not. In particular, the player does not need to override the system to force a more accurate suggestion - the player can simply select a club different to the one suggested and can input to the system the actual club selected and used for the shot, as will be further described later.

The club computation module 10 is operative to execute a computation algorithm to compute the suggested club for the player to use by utilising the ball to target distance data as a variable parameter in the computation algorithm. The computation algorithm in the preferred embodiment comprises a mathematical function (or set of mathematical functions) relating the particular golf club used to the expected distance that that club will strike the golf ball. The mathematical function is preferably a formula relating the distance to the club. As shown in Fig. 3A, typically players having the handicaps indicated across the top of the table will on average hit a golf ball the distances indicated in the respective columns using the clubs at the left of the table. Fig. 3B provides a graph relating the typical distance that the golfer can be expected to hit the golf ball by each club indicated along the horizontal axis. Also Figs. 3A and 3B include distance figures and graphical representations for atypical types of golfers, indicated by "Type B" and "Type D" columns and graphs. Such atypical types can be catered for with the present invention. When the system of the present invention is first used by a particular player, the system may have a starting input 11 to enable the player to input the player's handicap and, if relevant and provided by the system, the player "type", and the system will initially adopt and use a mathematical formula which will generate the respective curve illustrated in the graph in Fig. 3B to relate the distance to the club selection.

It has been empirically determined that a suitable mathematical formula for generating the required relationships between distance and club selection is:

$$\text{Distance} = (m/\text{Club factor}) + c$$

where m and c are computation parameters which will vary the shape and location of the graphical relationship, these parameters being held constant for a particular club

suggestion computation but which can be varied for other club suggestion computations as will be described later. The "Club factor" is a variable which is related to the particular golf clubs available to the player.

The converse of this equation is:

$$\text{Club factor} = m/(\text{Distance} - c)$$

Upon first use of the system by a player who has input that player's handicap and, if provided, the player "type", by using starting input 11, the constants m and c will be set using the default values to generate the club factor to distance relationships as shown in Fig. 3. The distance from ball to target when input by the distance input means 20 will then be used as the variable in the equation to compute the club factor which will be converted to the particular golf club to be suggested and displayed, e.g. by using a look up table containing the relationships in the first two columns of Fig. 3A. This is the club computation function A illustrated in the flow chart of Fig. 2 performed by the club computation module 10.

The flow chart of Fig. 2 illustrates the calculation and modification of suggested club selections as play of a golf round progresses. As shown in the flow chart of Fig. 2, the player can accept the club suggestion and play the golf stroke using that suggested club. This will be the default assumption of the system if the player moves from the location where the shot was played to the location where the ball has come to rest and the distance of that stroke is being determined by the system. However, as shown in Fig. 2 at B, the system enables the player to select and use a different club to the one suggested and can input that selection to the system (using the club used input 32 in Fig. 1) so that when the system determines the distance of the ball has travelled, that distance will be accurately related to the actual club used.

In a preferred embodiment in which the actual distance to target is displayed, the system may provide a club override input 12 by which the player can input to the computation module 10 a proposed club different to the one suggested. In response, the module 10 can solve the first equation above, Distance = (m/Club factor) + c, using the latest computation constants m and c to display a distance that the system predicts the player will strike the ball from that present location. This functionality can enable the player to effectively consult the system for possible alternative club uses, for example if there is an uphill lie of the ball, a downhill lie of the ball, a head or following wind, so that the player can then better decide which club to select and use.

As shown in the flow chart of Fig. 2 at C, the club computation module 10 may provide a "suggestion" that the player finish playing the hole or "chip out" if the distance remaining from the ball to the target (the green, or pin at the hole on the green) is less than, say, 40 metres. That is, no club suggestion is made in this situation.

After the player has played the stroke, the player moves to the point where the ball has come to rest. If the ball location information is being determined by using an odometer associated with the buggy or golf cart, the player should take a reasonably direct line of travel to the ball, although slight deviations need not make significant differences to the effectiveness and utility of the system in providing useful club suggestions. If desired, the system may be operable to continually display by the output means 15 updating suggested club selections as the player moves to the location where the ball lies. By repetitively executing the club computation algorithm while the player is moving towards the ball, the changing displayed club selections can educate the player to better estimate or judge stroke distances that the player could hypothetically achieve. Similarly the system could continually display the remaining distance from the player to the target as the player moves. This can help the player become a better judge of distances, an ability useful for example if use of the system in tournaments or competitions is illegal. Also the distance information can be passed to other players who may not be using a system of the invention for their assistance. On reaching the ball, the player provides a control command to the system as shown at 35 in Fig. 1 (operation D in Fig. 2). This can be the operation of the "shot" key or button on the player input means 30 that was mentioned earlier. Operation of the shot key informs the system of the location of the ball so that the ball location information module 22 operates to determine the distance that the ball travelled for the last stroke (operation E in Fig. 2). As shown in Fig. 1, the last stroke distance is supplied to the algorithm change module 40, which has also been input with the actual golf club used obtained from the club used input 32.

As shown by operation F in second part of the flow chart of Fig. 2, the algorithm change module can firstly check whether the last stroke distance falls within a predetermined tolerance range for the particular club. This function can be provided to ensure that extraordinarily long or extraordinarily short distance strokes will not be processed and adopted by the system as reflecting normal capabilities of the player. For example, if the golf ball landed on a pathway and bounced onward to travel an exceptional distance, that distance will not be adopted and used by the algorithm change module to update the club computation algorithm. Likewise if the player plays a poor

shot or needs to play a short stroke to return to the fairway following a misdirected earlier shot, such short distance strokes will not be adopted and used to modify the club computation algorithm.

Furthermore, as shown at operation G in the flow chart of Fig. 2, the algorithm change module may include an operation in which the nature of the club used is checked so that a set of certain clubs can be excluded from consideration in modifying the computation algorithm. In particular, the woods and drivers used by golfers can be very erratic and produce much variation in stroke distances so that such clubs can be excluded from use in the algorithm change module. It will be noted, however, that the club computation algorithm will nevertheless operate to generate suggestions to select a wood or driver where appropriate, but such suggestions will be based on an algorithm modified to reflect the more consistent abilities of the player as demonstrated by distances that iron clubs only have been struck.

The algorithm change module 40 functions to modify the club computation algorithm utilised by the club computation module 10 by utilising data for the last stroke played, namely the last club used and the last stroke distance. As shown at operation H in the Fig. 2 flow chart, these two data are used to calculate new constants m and c in the equation used in the preferred embodiment to relate the Club factor to the Distance. These newly calculated constants m and c can then be used in the computation algorithm (operation A) for utilising the ball to target distance to generate the next club suggestion.

Figs. 4A and 4B illustrate a system of the present invention in use upon commencing a new round of golf. The current equation has predicted the club/distance relationships as per the column marked "start". Four shots are executed as follows and the changes to the chart are as shown.

1st Shot	1 Wood	210 metres, produces distance table as in Shot 1 column.
2nd Shot	8 Iron	98 metres, produces distance table as in Shot 2 column.
3rd Shot	3 Iron	147 metres, produces distance table as in Shot 3 column.
4th Shot	5 Iron	120 metres (a poor shot), produces distance table as in Shot 4 column.

Recalculating the constants solely on the basis of the immediately preceding golf stroke, directly produces an immediate reaction in the next suggested golf club selection which tends to provide an over reaction as can be seen with the final 4th poor shot.

To explain this in more detail, as shown in the table and graph of Figs. 4A and 4B, at the start of a new round of golf, the player will be using a system which has a formula

or equation utilising constants m and c computed from previous games played by that player (or utilising default formula and equation constants if the system is being used for the first time), leading to the club versus distance relationships indicated by the column headed "start". If the first shot or stroke was a "1 wood" struck 210 metres, this can result in recalculation of the equation constants m and c by the algorithm change module leading to a set of club versus distance relationships in the column headed "shot 1". In the resulting graph marked "Shot 1" in Fig. 4B the relationship between Distance and Club factor is dropped throughout the entire curve in the Y direction to predict shorter stroke distances expected as a result of the first stroke played. The modified equation using the re-calculated constants m and c will be used by the club computation module 10 to suggest the next club to the player. Likewise, Shots 2 and 3 result in successive modifications of the formula used in the club computation algorithm. In this illustration of Fig. 4, the first stroke (Shot 1) using the "1 wood" is being used to tune or refine the algorithm for the particular player's performance, although as mentioned earlier, if desired, iron clubs only may be used for modifying the club suggestion algorithm. Likewise each of Shots 2 and 3 modifies the algorithm for the next successive shots to be played.

However, as shown in Fig. 4, if, say, the fourth shot played with a "5 iron" was a poor shot, (although not so short as to be filtered or excluded by the algorithm change module which first tests stroke distance to see if it is within a tolerance range – operation F in Fig. 2) the algorithm change module may nevertheless excessively change the constants of the club prediction algorithm as shown by the substantial shift of the lowermost curve marked "Shot 4" in the graph of Fig. 4B. The next club selection suggestion, therefore, could be inaccurate by one or possibly even more Club factors in its next suggestion since the club suggestion algorithm is now based on the abnormally poor "Shot 4".

To minimise such adverse effects on prediction accuracy or usefulness, the algorithm change module may include a function to average or normalise the equation constants over a number of golf strokes, not merely the last stroke played. This is shown in the flow chart of Fig. 2 as the final function or operation I of the algorithm change module prior to next operation of the club computation module. By averaging a number of recent shots, a single poor (short) shot or single extremely good (long) shot will not grossly affect and prejudice the club prediction usefulness. The optimum number of preceding strokes and resulting calculations of the constance m and c to be used in the

averaging process can be empirically determined. If desired, the "averaging" may comprise a weighted averaging process in which more recent shots are given higher weighting than older prior shots. Another weighting process could comprise giving a greater weighting to equation constants m and c computed following use of more predictable clubs used, e.g. the "middle" irons such as the 5, 6 and 7 irons. In this way, more variable, or erratic clubs have less effect in modifying the club computation algorithm.

By utilising averaging or weighted averaging of formula constants the system more accurately accommodates the player's actual abilities and performance to thereby make the club suggestions more accurate and useful. As shown in Fig. 5, the same four stroke distances as used in the example of Fig. 4, including the poor fourth shot, produce less fluctuation of the prediction curve. In particular, the first "Shot 1" (210 metres stroke using a "1 wood") produces by averaging or weighted averaging with prior "1 wood" stroke distances a club prediction formula or equation which yields predicted distances in the column in Fig. 5A marked "Shot 1" and a curve in the graph of Fig. 5B marked "Shot 1". Thus the "1 wood" distance prediction is shifted from 225 metres to 219 metres, not immediately to 210 metres which was the actual distance. After Shots 2 and 3, the constants of the formula or equation have stabilised the distance predictions. However, by use of an averaging or weighted averaging of the calculated equation constants m and c, the poor fourth shot does not produce such a drastic change in the prediction curve which could lead to the next club suggestion being inaccurate to a significant extent.

It will be seen that the system according to the particular embodiment of the present invention as described and illustrated enables a suggestion or recommendation of a club to select and use for the next golf stroke to be played using a dynamic calculation process. The club selection is a closed loop system that is determined by the golfer and the golfer's current performance. That is, the system actually "learns" how the golfer is performing and modifies the club selection computation accordingly. In particular, the golfer's performance is being continually recorded by the system.

The golfer can alter a club selection proposed by the system, e.g. depending on features including hazards on the course, the lie of the ball, club favouritism. The system does not dictate the golfer's style of play or choices and the performance of the system is not affected by changes that the player may make to the club selection.

To increase accuracy and predictability and hence utility of the system, refinements of the system may be provided, including for example:

(a) use of iron clubs only for modifying the computation algorithm, perhaps even with weighting of more consistent clubs, since woods and drivers can be erratic and produce considerable variation,

(b) the actual club used by the player, not necessarily suggested by the system, is used to modify the algorithm as well as the actual distances covered,

(c) the golfer's performance is averaged over a series of shots, with or without weighting, in order to normalise the calculation and avoid undue influence by a bad shot or abnormally good shot,

(d) shots must be within a predictable range before being taken into consideration and used in the modification of the algorithm.

By providing a dynamic calculation of the club selection suggestion, a golfer can start with a previously unused system containing a standard configuration and after only a small number of shots, the system will begin to compensate for and accommodate the player's performance and abilities. The calculated constants used in the formula of the preferred embodiment are continually modified and stored in non-volatile memory. Upon commencement of a subsequent round of golf, the club suggestion determination can be initially based on the player's last round but, depending on weather, course conditions, and player related variables, the system quickly adjusts to the actual current performance and conditions.

It will be appreciated that the system utilising the present invention can incorporate a number of other functions, some of which have been mentioned in passing such as graphical display of hole layout, location of hazards, keeping score. Other functions can also be incorporated and provided as will be understood, e.g. from proposals in the prior patent specifications referred to earlier. Such additional functions could include for example communication functions with a central location and database, e.g. for centralised golf competition monitoring and recording, for player coaching at a later date, for player performance monitoring to review handicap, or for voice communication. The system in addition to scoring information can also incorporate betting information. The system may include a database for storing statistics of the particular round of golf (and preceding rounds) e.g. for player analysis or for analysis by a player's coach, for example simulated replay of the game to test effects of different club selections, etc. The system may be used in a "test mode" in which the particular golf course to be played in the future can be played in simulation, enabling the player to train for the future golf round e.g. with better course familiarity and hence better club selection

during the actual round. Since these functions are not directly related to the invention itself, they will not be described in detail.

It is to be understood that various alterations, modifications and/or additions may be made to the features of the possible and preferred embodiment(s) of the invention as herein described without departing from the spirit and scope of the invention as defined in the claims.

Claims:

1. A system for providing to a golf player a suggestion or recommendation of a golf club to select and use for the next golf stroke to be played by the player, the system including:

distance input means for providing distance data from a current golf ball location to a predetermined target,

a club computation module operative to execute a computation algorithm so as to compute a suggested club for the player to select and use for the next golf stroke, the club computation module utilising the distance data as a variable parameter in the computation algorithm,

output means for presentation of the suggested club selection that has been computed by the club computation module,

stroke input means for input of golf stroke data, the golf stroke data including the particular golf club used for a golf stroke prior to the next club selection suggestion to be computed, the golf stroke data further including the prior stroke distance being the distance that the golf ball travelled for the prior golf stroke, and

an algorithm change module operative to modify the computation algorithm executed by the club computation module by utilising the golf stroke data for the prior golf stroke played (including both the prior golf club used and the prior stroke distance) as variable input data for the modification of the computation algorithm, the modification of the computation algorithm accommodating in the computation algorithm the player's performance as evidenced by the prior golf stroke data to improve the relevance of the suggested club selection computed by the modified computation algorithm.

2. A system as claimed in claim 1 wherein the computation algorithm utilises a mathematical function, relating each particular individual golf club to the distance that the respective golf club will strike the golf ball and, in operation, the algorithm computes the mathematical function to output the suggested selection of the golf club for a particular distance from the golf ball to the target, the mathematical function including computation parameters which are modifiable by the operation of the algorithm change module.

3. A system as claimed in claim 2 wherein the computation parameters include constants in a mathematical formula solved by the computation algorithm, the computation parameters being determined by the algorithm change module and set at constant values only for one particular iteration of the computation algorithm to generate the suggested club suggestion, and, after the next stroke has been played, the golf stroke

data for the next stroke including the particular golf club used and the stroke distance are utilised by the algorithm change module to change, if necessary, the constants of the mathematical formula prior to the next computation of suggested club selection.

4. A system as claimed in claim 2 or 3 wherein, upon the system first being used by a particular golf player and upon that player's handicap being input to the system, the club computation module is operative to access a set of stored mathematical functions which respectively relate each golf club to a respective golf stroke distance for each of a number of golf player handicaps and to implement the particular mathematical function for that player's handicap that has been accessed.

5. A system as claimed in any one of claims 2 to 4 wherein the mathematical function is a mathematical formula for generating a required relationship between a Club factor and golf stroke distance, the formula taking the form:

$$\text{Club factor} = m/(\text{Distance} - c)$$

where m and c are computation parameters which are held constant for a particular club suggestion computation of the club computation module but which can be varied by the algorithm change module for other club suggestion computations,

Distance is the distance data which is input by the distance input means, and

Club factor is a computed variable related to the particular golf clubs available to the player and which determines the club suggestion provided by the output means.

6. A system as claimed in any one of claims 2 to 5 wherein the algorithm change module is operative to average or normalise computation parameters utilised by the mathematical function over several prior golf strokes so that preceding abnormally long or abnormally short golf stroke distances will not singly excessively affect operation of the club computation module in its computation of the suggested club selection.

7. A system as claimed in claim 6 wherein the averaging function of the algorithm change module comprises a weighted averaging process in which golf stroke data for more recent prior golf shots are given higher weighting than for older prior golf shots.

8. A system as claimed in claim 6 or 7 wherein the algorithm change module performs a data weighting process which comprises allocating greater weighting to golf stroke data associated with use of particular golf clubs which have more predictable and consistent golf stroke distances.

9. A system as claimed in any one of the preceding claims wherein the stroke input means is operative to enable the player to input data concerning a particular club used for a golf stroke including input of a golf club different to the suggested golf selection

presented by the output means for that golf stroke, whereby the golf stroke distance utilised by the algorithm change module will accurately relate to the particular golf club used.

10. A system as claimed in any one of the preceding claims, the system including player input means which includes a control command input which the player can activate at the location from which a particular golf stroke is to be played and can activate again at the location where the golf ball after playing that particular golf stroke has come to rest, whereby the distance traversed between the two locations where the control command input was activated can be used by the stroke input means to compute the golf stroke distance and input that data to the algorithm change module.

11. A system as claimed in any one of the preceding claims, wherein the algorithm change module is operative to check whether the prior golf stroke distance falls within a predetermined tolerance range for the particular golf club used, the algorithm change module being operative to reject golf stroke distances that fall outside the tolerance range and fail to implement the algorithm change as a result.

12. A system as claimed in any one of the preceding claims wherein the algorithm change module is operative to check if the prior golf club used is one of a set of certain excluded golf clubs which are subject to substantial variability in player performance, and if so to exclude the relevant golf stroke data from utilisation by the algorithm change module, the club computation module nevertheless being operative to calculate and provide a suggested club selection after the prior golf stroke including a selection from the set of excluded clubs.

13. A system as claimed in any one of the preceding claims wherein the distance input means provides to the club computation module the distance data derived from current golf ball location and from particular golf hole information, the golf hole information including the length of the golf hole from tee to green and, optionally further including tee location, and optionally further including pin location on the green.

14. A system as claimed in any one of the preceding claims wherein the ball location information provided to the distance input means is determined automatically by the system which includes measuring means operative to measure the distance travelled from the location where the prior golf stroke was played to the location where the golf ball rests after the golf stroke has been played.

15. A system as claimed in claim 14 wherein the system includes an input means by which the player can input a command to start the distance calculation from that

particular point where the command was input and then, after playing the golf stroke and moving in a reasonably direct line to the point where the golf ball has come to rest, by which the player can input a further command which initiates determination by the system of the distance travelled by the golf ball for that particular golf stroke.

16. A system as claimed in any one of the preceding claims and further including a user override operatively associated with the distance input means and by which the player can selectively modify the operation of the distance input means which provides ball to target distance data to the club computation module so as to thereby force computation and output of a golf club suggestion for a distance dictated by the player.

17. A system as claimed in claim 16 wherein the user override is manually adjustable by the player to adjust the ball to target distance by selectively incrementing or decrementing the ball to target distance to be utilised by the club computation module.

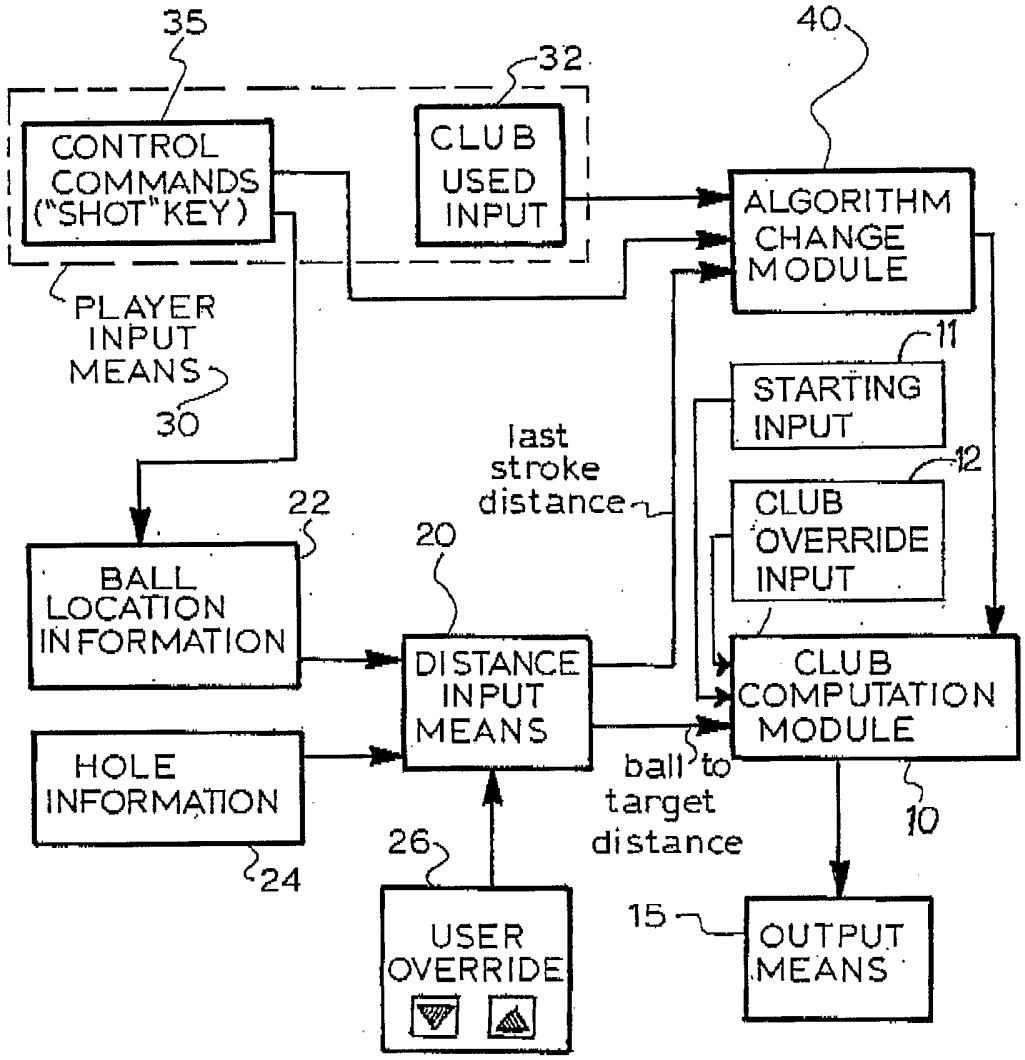
35
32
40
CONTROL COMMANDS ("SHOT" KEY)
CLUB USED INPUT
ALGORITHM CHANGE MODULE
PLAYER INPUT MEANS
30
11
STARTING INPUT
last stroke distance
12
CLUB OVERRIDE INPUT
22
20
BALL LOCATION INFORMATION
DISTANCE INPUT MEANS
CLUB COMPUTATION MODULE
HOLE INFORMATION
ball to target distance
10
24
26
15
USER OVERRIDE
OUTPUT MEANS

Fig. 1

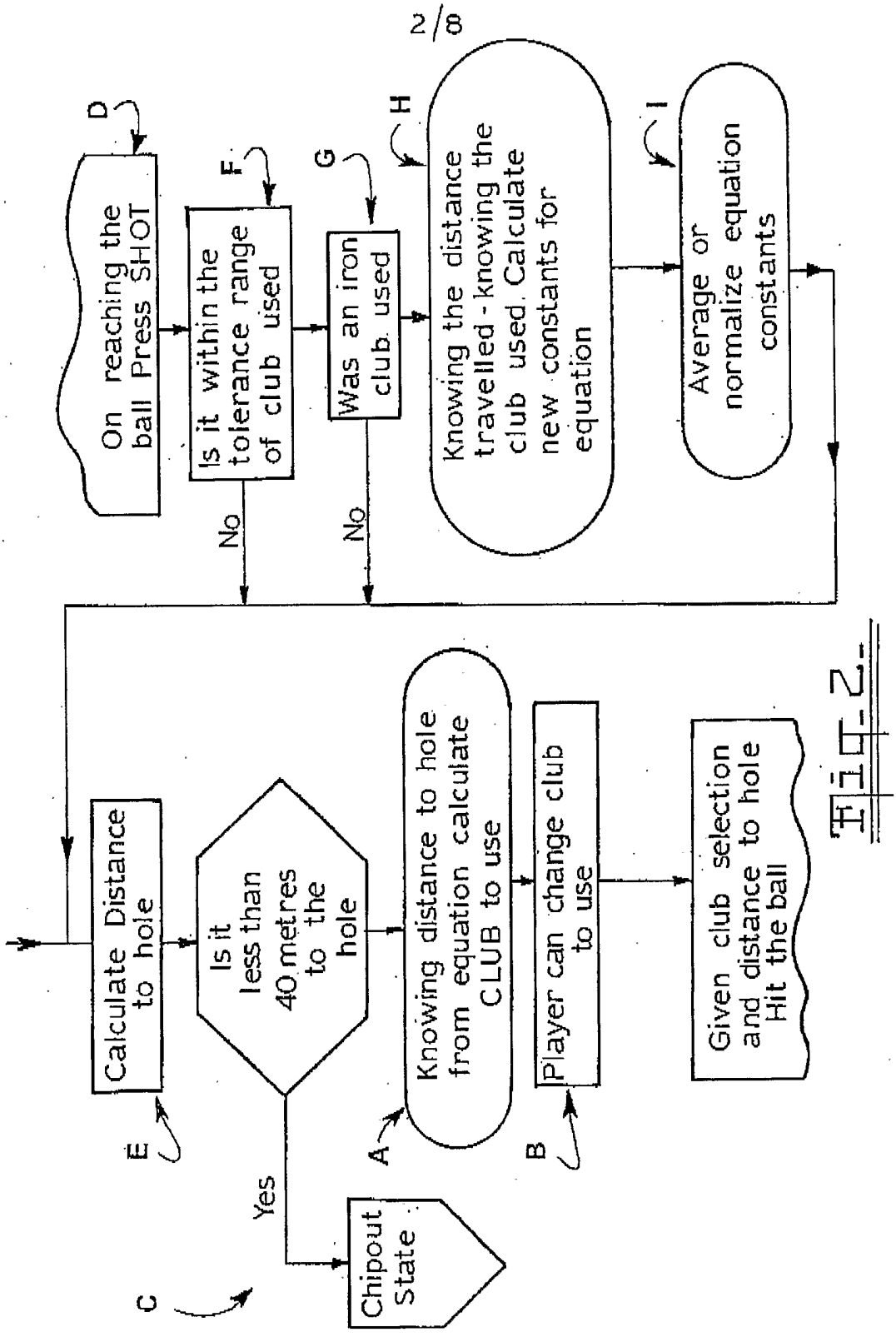
Calculate Distance to hole
E
Is it less than 40 metres to the hole
Yes
C
Chipout State
No
Knowing distance to hole from equation calculate CLUB to use
A
Player can change club to use
B
Given club selection and distance to hole Hit the ball
On reaching the ball Press SHOT
D
Is it within the tolerance range of club used
F
No
Was an iron club used
G
Knowing the distance travelled - knowing the club used. Calculate new constants for equation
H
Average or normalize equation constants
I

FIG-2-

CLUB FACTOR	CLUB	18	20	16	2	36	B	D
0	1 Wood	220	200	240	265	160	145	250
1	2 Wood	203	186	221	247	148	137	226
2	3 Wood	188	173	204	231	137	129	205
3	5W/11	173	161	188	216	127	122	185
4	2 Iron	160	150	173	203	118	116	167
5	3 Iron	149	140	160	190	110	110	150
6	4 Iron	138	131	148	178	102	105	135
7	5 Iron	127	122	136	168	95	100	120
8	6 Iron	118	114	126	158	89	95	107
9	7 Iron	109	107	116	149	82	91	95
10	8 Iron	101	100	107	140	77	87	83
11	9 Iron	93	94	98	132	71	83	73
12	P	86	88	90	124	66	79	63
13	W	79	82	82	117	62	76	53

Fig. 3A

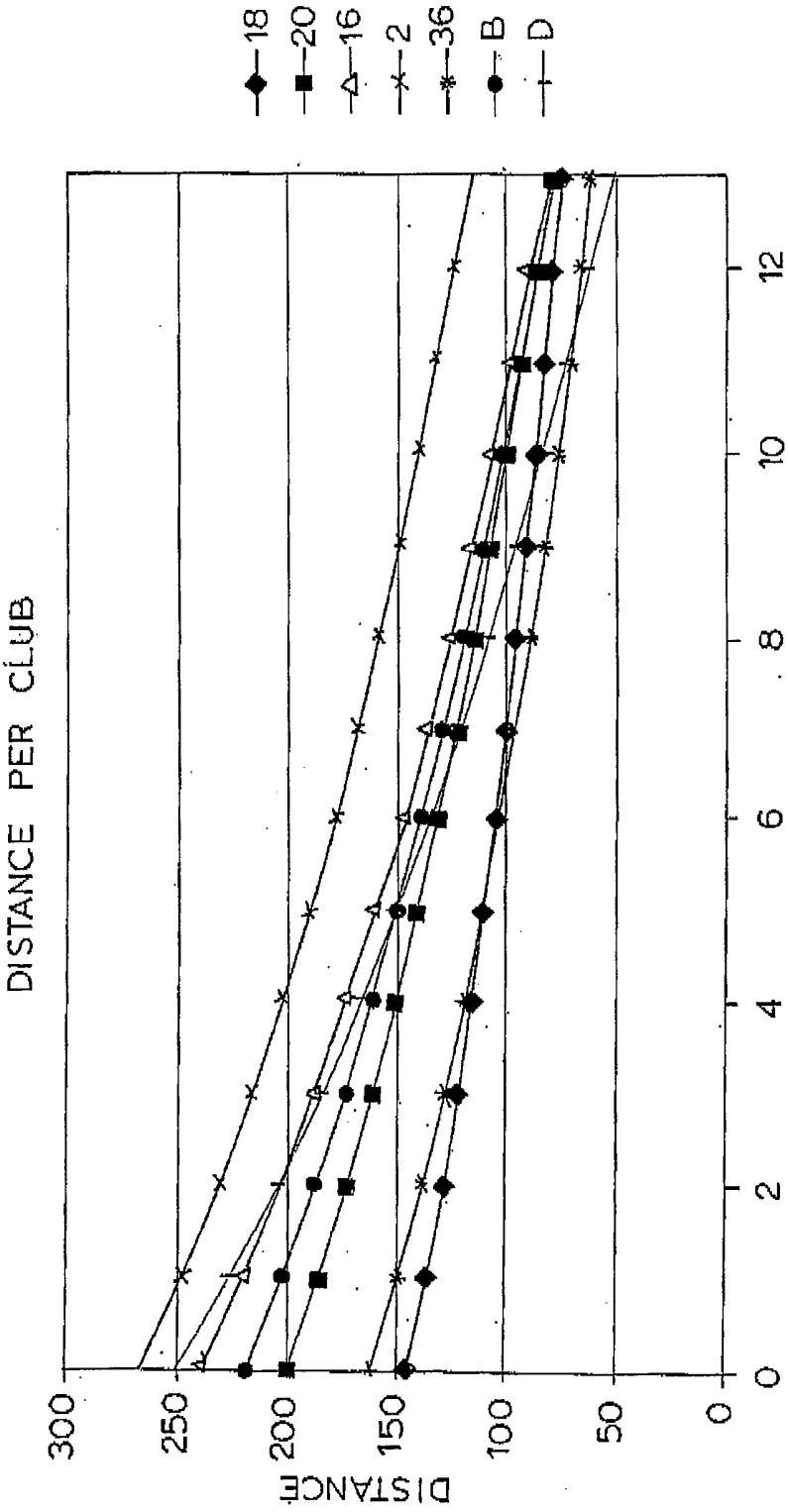
18
20
16
2
36
B
D
DISTANCE PER CLUB
DISTANCE
300
250
200
150
100
50
0
0
2
4
6
8
10
12
CLUB FACTOR

Fig 3B

CLUB	CLUB FACTOR	Start	Shot 1	Shot 2	Shot 3	Shot 4
1W	0	225	210	213	219	201
2W	1	207	194	197	202	186
3W	2	191	180	182	186	173
5W/11	3	177	167	168	172	160
21	4	163	155	156	159	149
31	5	151	144	144	147	139
41	6	140	134	133	136	129
51	7	129	125	124	126	120
61	8	120	116	114	116	112
71	9	111	108	106	107	105
81	10	102	101	98	99	97
91	11	94	94	91	91	91
PW	12	87	87	84	84	84
SW	13	80	81	77	77	79

FIG. 4A

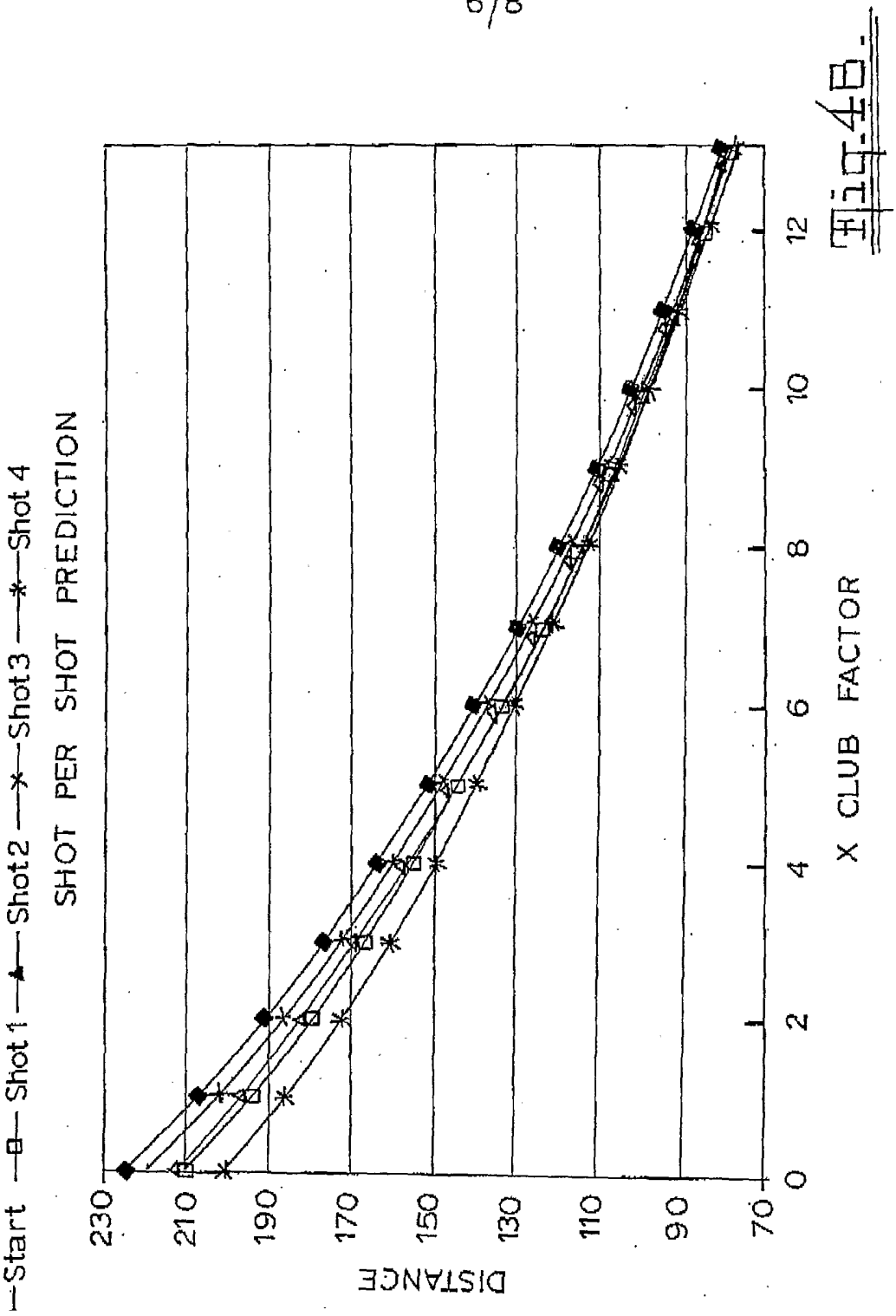
SHOT PER SHOT PREDICTION
Start
Shot 1
Shot 2
Shot 3
Shot 4
DISTANCE
230
210
190
170
150
130
110
90
70
0
2
4
6
8
10
12
X CLUB FACTOR

Fig-4B.

CLUB	CLUB FACTOR	Start	Shot 1	Shot 2	Short3	Shot 4
1W	0	225	219	217	217	212
2W	1	207	202	201	200	196
3W	2	191	187	185	185	181
5W/1I	3	177	173	172	171	168
2I	4	163	160	159	158	155
3I	5	151	149	147	146	144
4I	6	140	138	136	136	134
5I	7	129	128	126	126	124
6I	8	120	118	117	116	115
7I	9	111	110	109	108	107
8I	10	102	102	100	99	99
9I	11	94	94	93	92	92
PW	12	87	87	86	85	85
SW	13	80	80	79	78	78

Fig.5A.

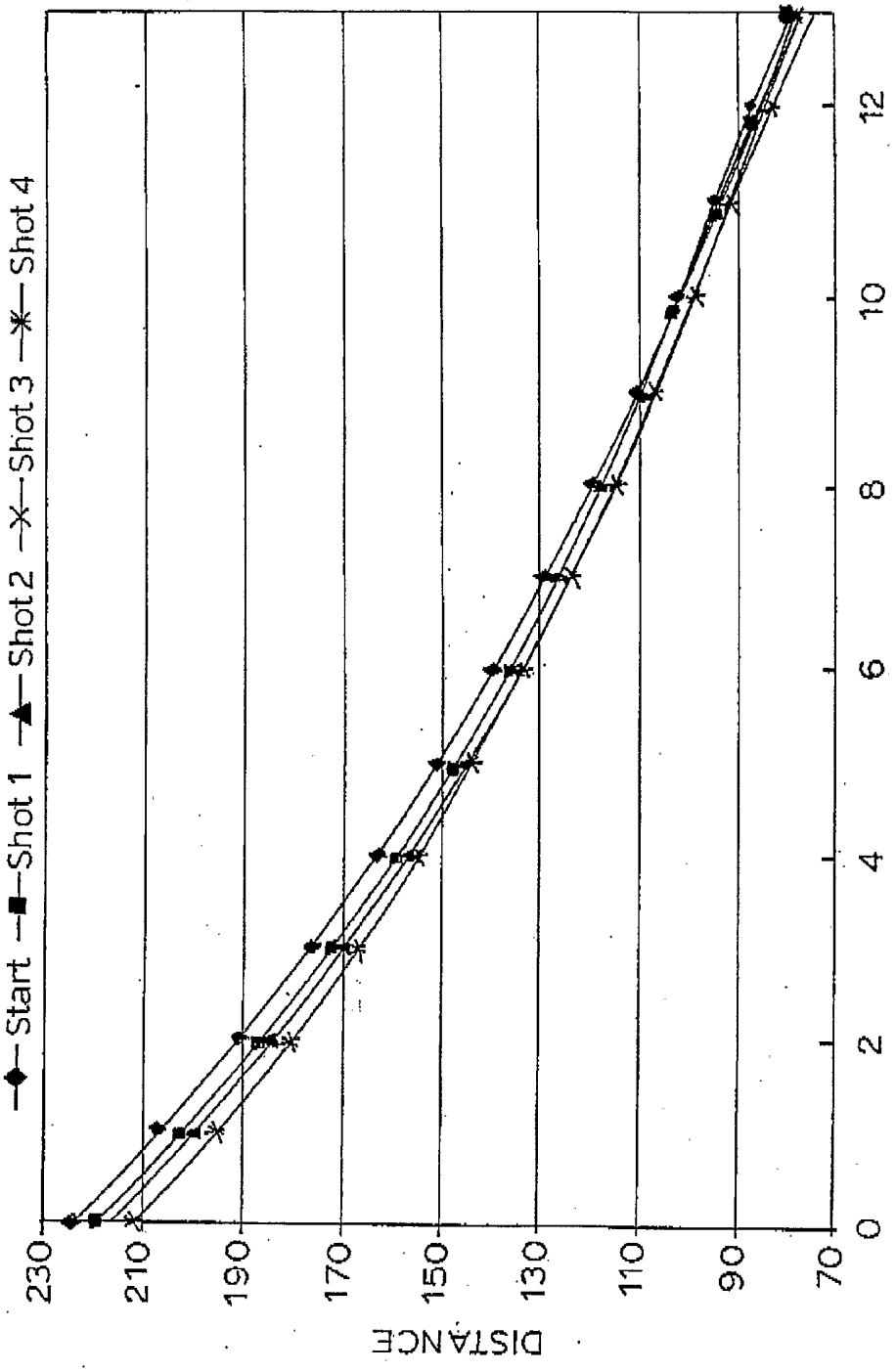
Start
Shot 1
Shot 2
Shot 3
Shot 4
DISTANCE
230
210
190
170
150
130
110
90
70
0
2
4
6
8
10
12
X CLUB FACTOR

FIG.5B.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/000777

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: A63B 57/00, 71/06

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)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI & USPTO: golf club, select+, choos+, pick+, identif+, suggest+, recommend+, program, algorithm, software, comput+, processor, pda,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0281846 A2 (CORMIER) 14 September 1988 entire document	1-17
X	US 2002/0161461 A1 (LOBB et al) 31 October 2002 entire document	1-17
X	US 5810680 A (LOBB et al) 22 September 1998 entire document	1-17
X	US 5245537 A (BARBER) 14 September 1993 entire document	1-17

[X] Further documents are listed in the continuation of Box C [X] 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 application or patent 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
6 July 2005	14 JUL 2005
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **MANO RAMACHANDRAN** Telephone No : (02) 6283 2166

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/000777

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5507485 A (FISHER) 16 April 1996 entire document	1-17
X	US 5283732 A (MAURITZ) 1 February 1994 entire document	1-17
X	WO 1994/004982 A1 (CARROL) 3 March 1994 entire document	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2005/000777

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
EP	0281846	JP	63288174	US	4815020
US	2002161461				
US	5810680				
US	5245537				
US	5507485	AU	23643/95	WO	9530157
US	5283732				
WO	9404982	AU	50159/93		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX