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(54) GAME DEVICE, GOLF GAME DEVICE SHOT RESULT DECISION METHOD

(75) Inventors: **Koji Okamoto**, Tokyo (JP); **Hachitaro Sato**, Tokyo (JP)

Correspondence Address:
RANKIN, HILL, PORTER & CLARK LLP
4080 ERIE STREET
WILLOUGHBY, OH 44094-7836 (US)

(73) Assignee: **KONAMI DIGITAL ENTERTAINMENT CO., LTD.**, Tokyo (JP)

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(57) **ABSTRACT**

A game apparatus is provided that can reduce the number of times that a player of the game has to performs unnecessary manual operations. A shot direction and a golf club determined by automatic determination means **53** can be modified by manual modification means **55.** Shot position determination means **51** determines whether or not a shot motion should be made at the same position continuously twice. When the shot position determination means **51** determines that the shot motion was the second shot made at the same position, the automatic determination means **53** determines the shot direction and club, which has been stored in memory means **57** at the time of a previous play, as a shot direction and a club for a next play.

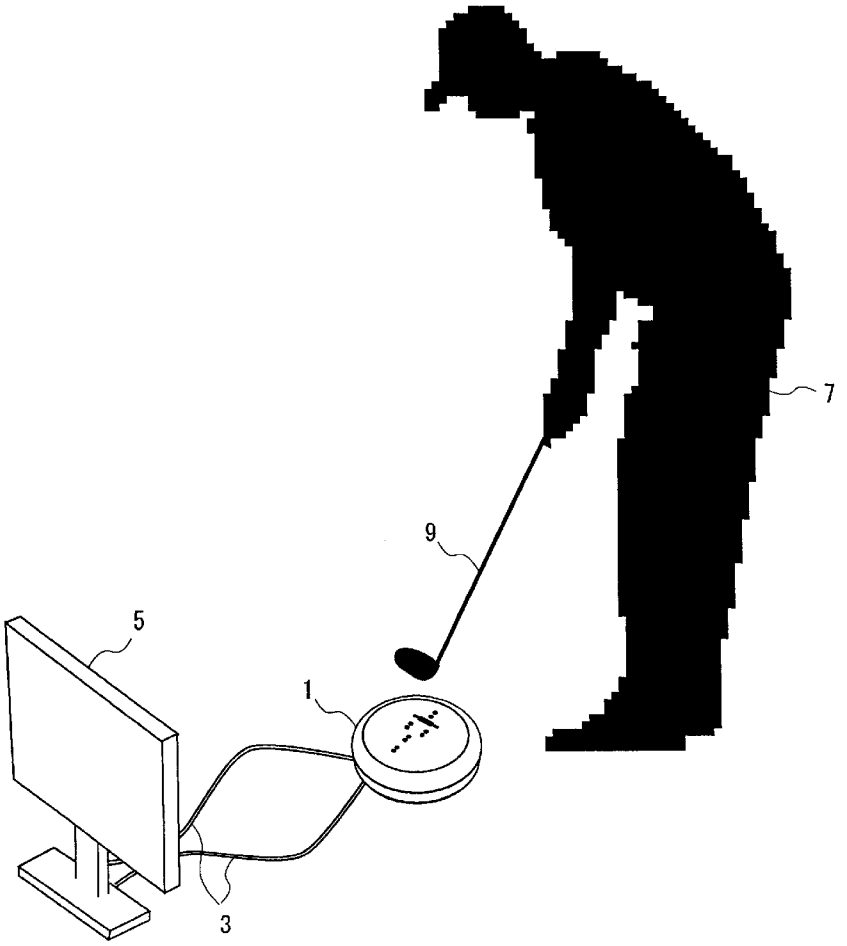


FIG.1

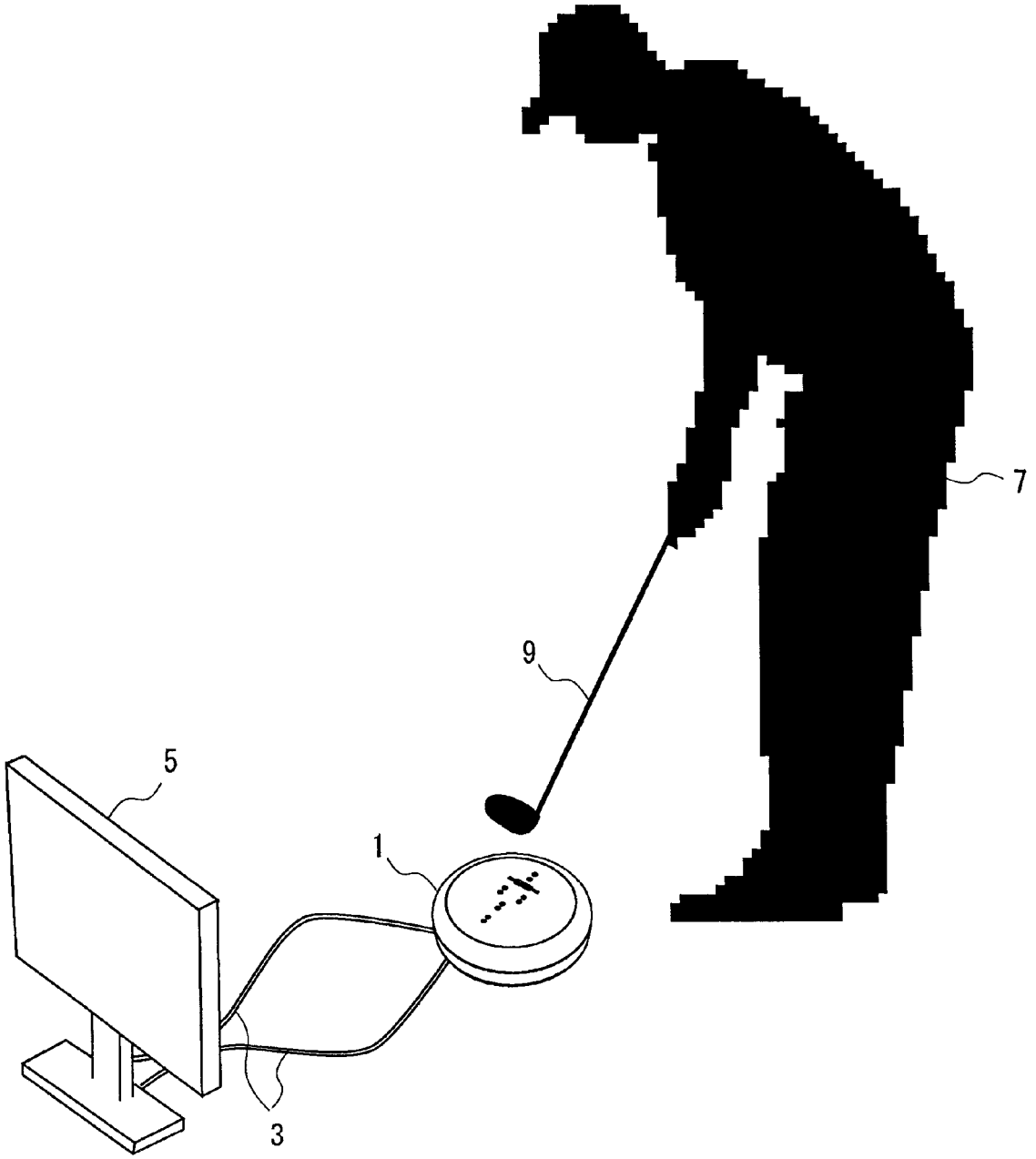


FIG.2

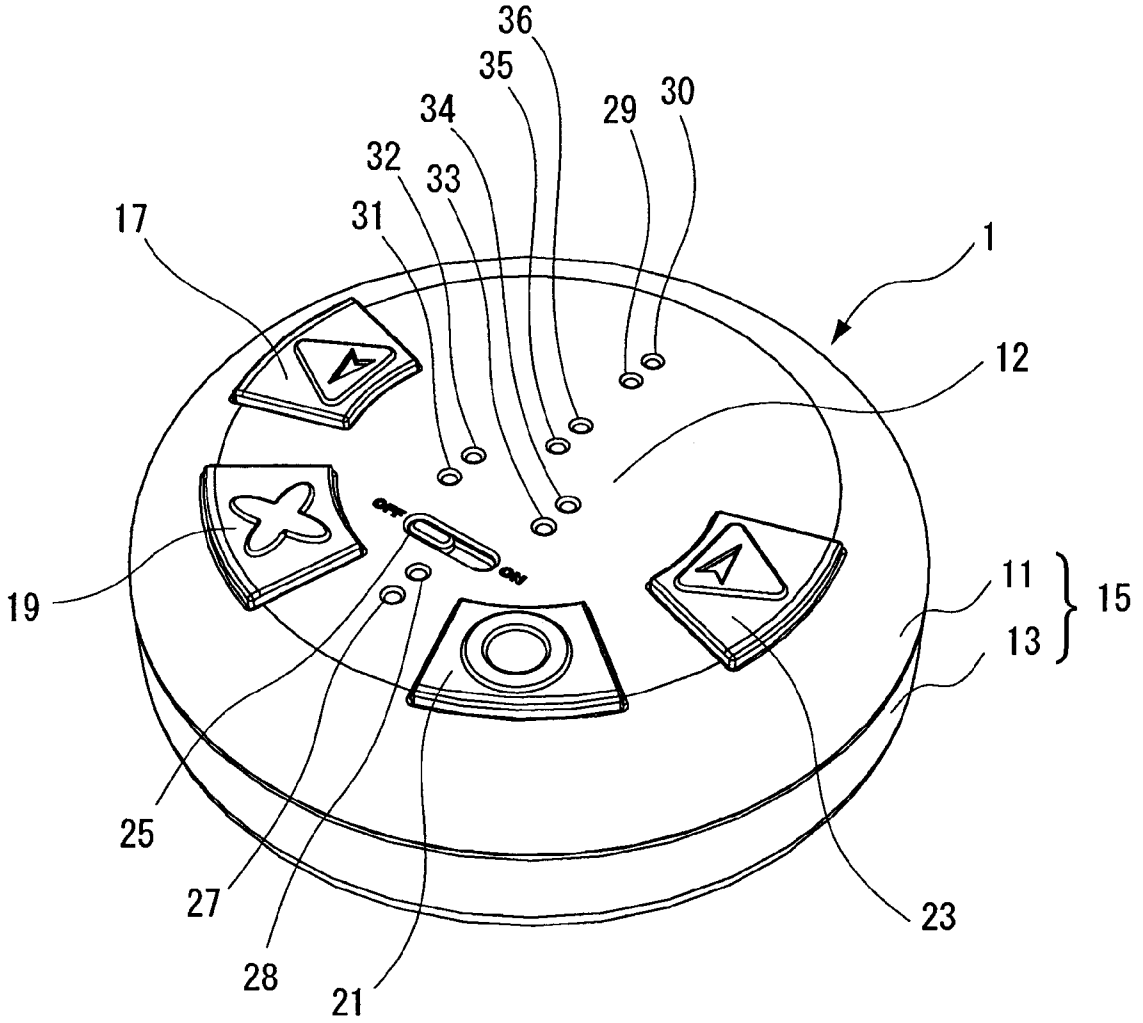


FIG.3

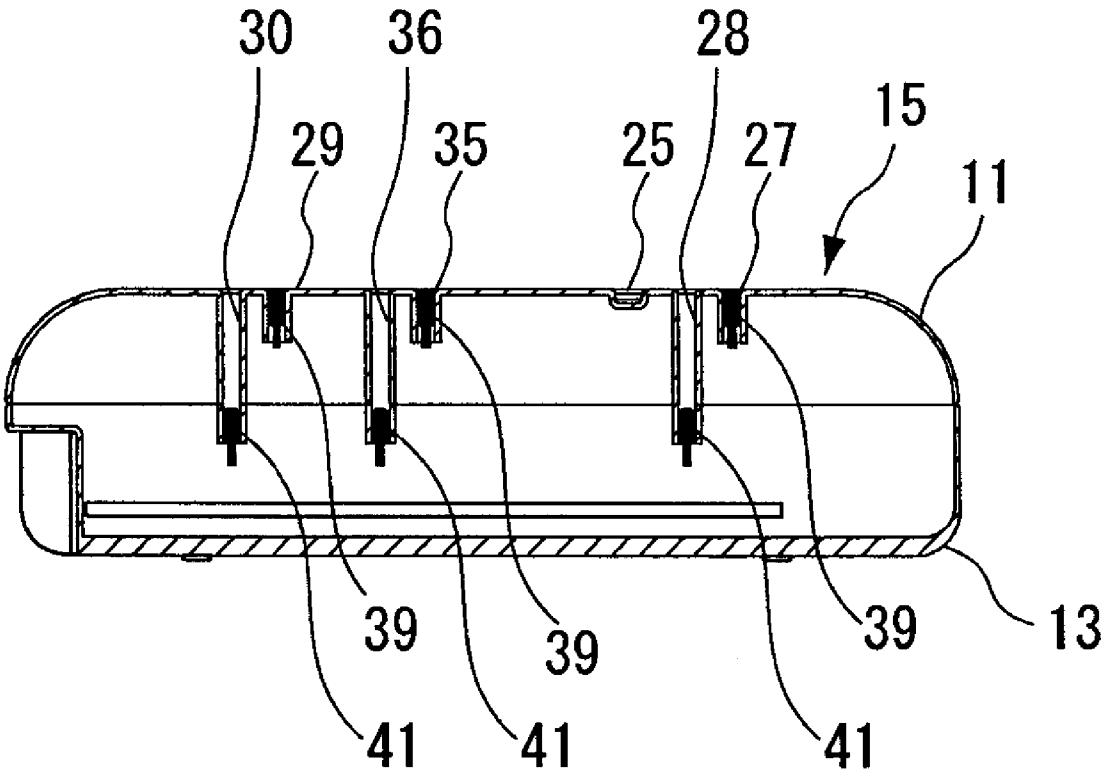


FIG.4

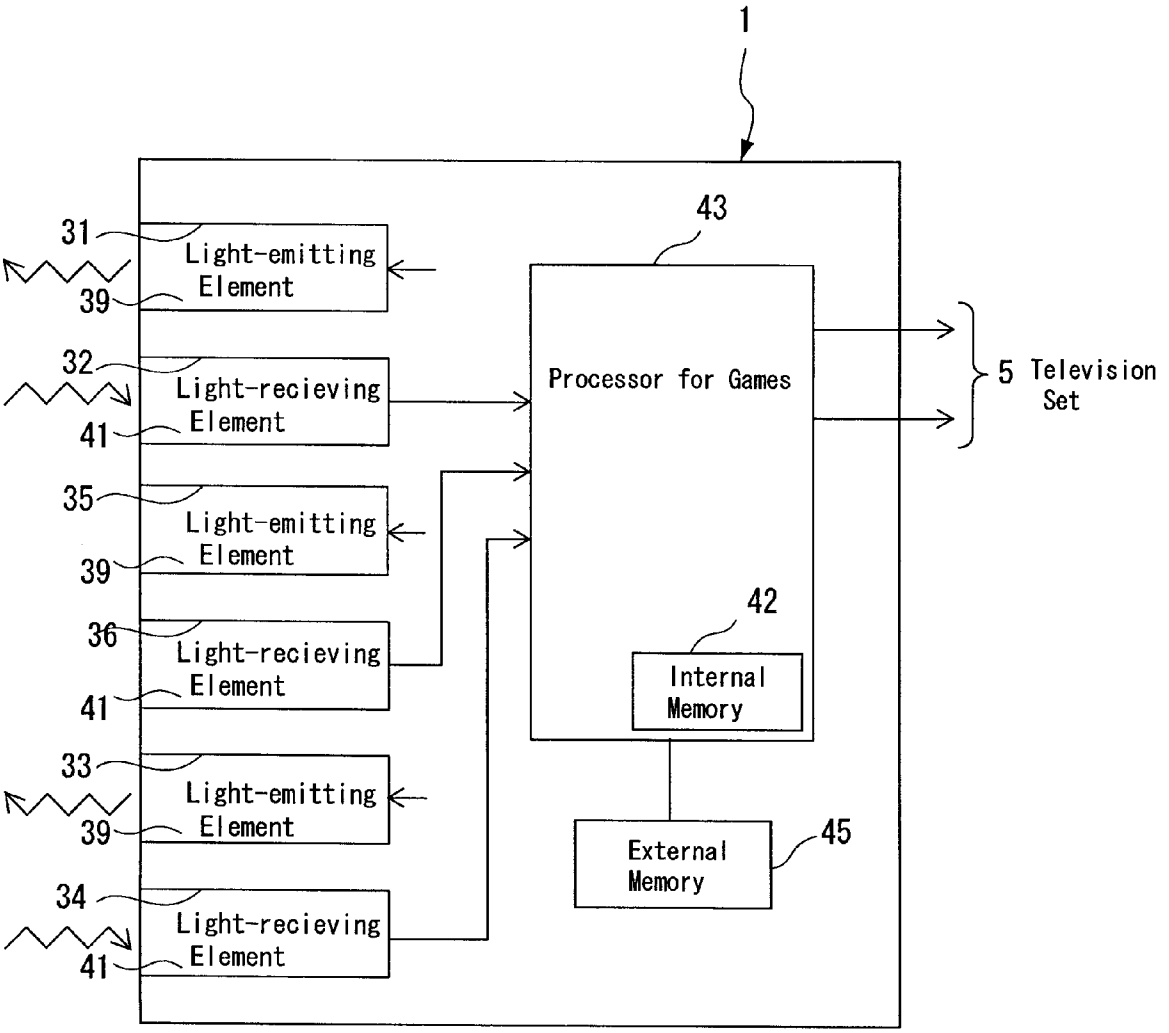

1
31
Light-emitting Element
39
32
Light-recieving Element
41
35
Light-emitting Element
39
36
Light-recieving Element
41
33
Light-emitting Element
39
34
Light-recieving Element
41
43
Processor for Games
42
Internal Memory
External Memory
45
5 Television Set

FIG.5

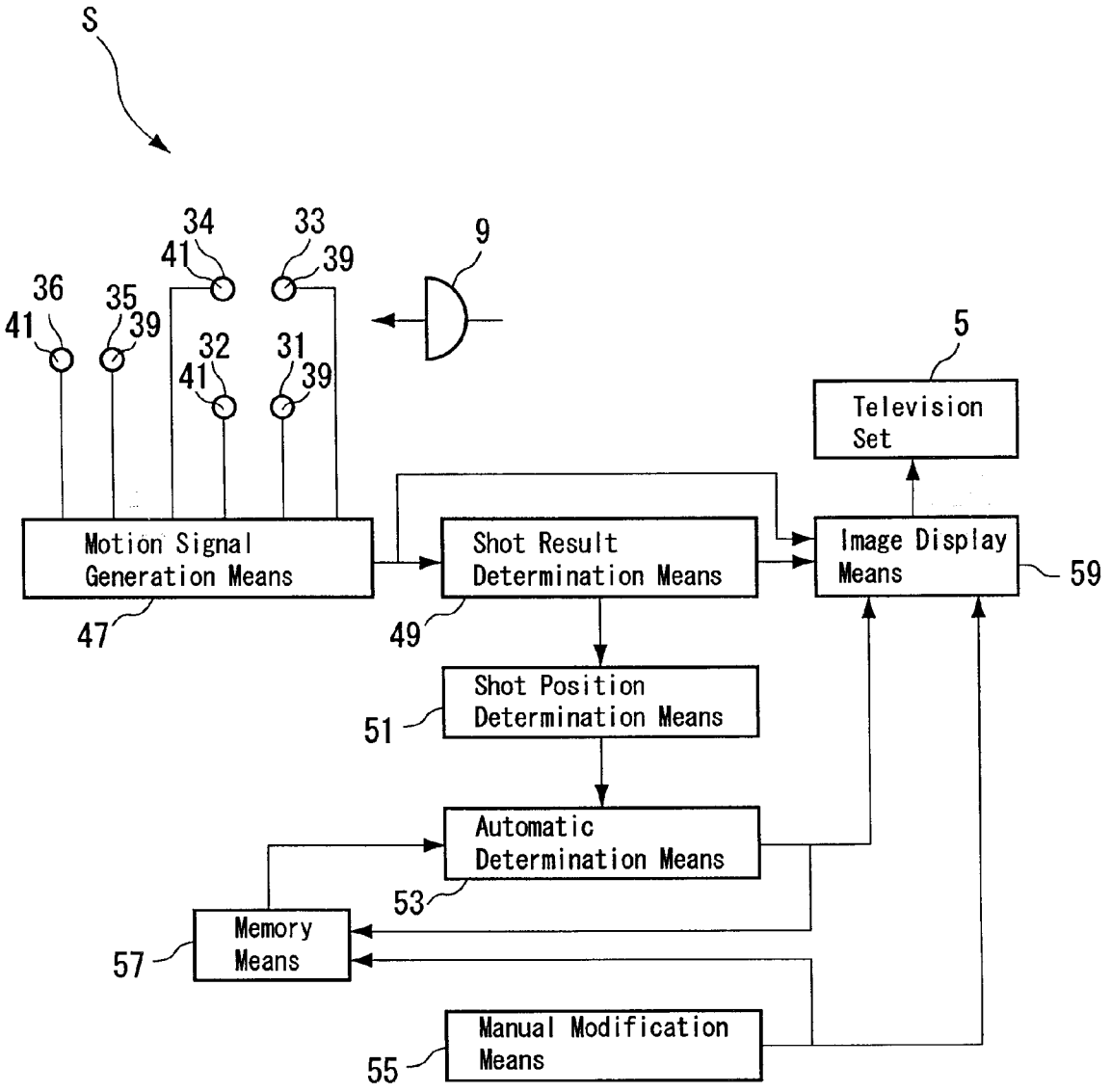

S
34
33
41
39
9
36
35
41
39
32
31
41
39
5
Television Set
Motion Signal Generation Means
Shot Result Determination Means
Image Display Means
59
47
49
Shot Position Determination Means
51
Automatic Determination Means
53
Memory Means
57
Manual Modification Means
55

FIG.6

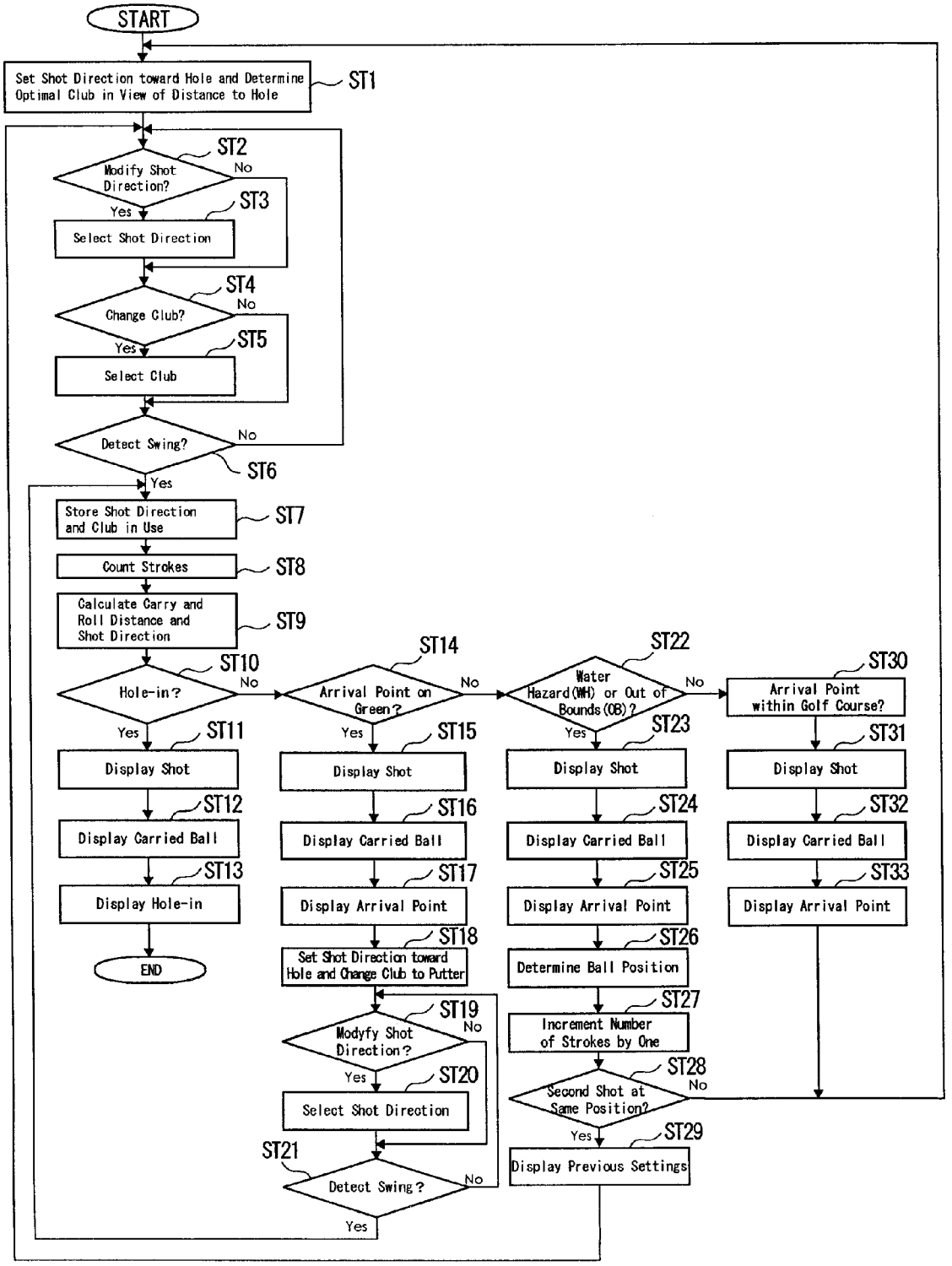

START
Set Shot Direction toward Hole and Determine Optimal Club in View of Distance to Hole
ST1
Modify Shot Direction?
ST2
No
Yes
Select Shot Direction
ST3
Change Club?
ST4
No
Yes
Select Club
ST5
Detect Swing?
No
ST6
Yes
Store Shot Direction and Club in Use
ST7
Count Strokes
ST8
Calculate Carry and Roll Distance and Shot Direction
ST9
Hole-in?
ST10
No
Yes
Display Shot
ST11
Display Carried Ball
ST12
Display Hole-in
ST13
END
Arrival Point on Green?
ST14
No
Yes
Display Shot
ST15
Display Carried Ball
ST16
Display Arrival Point
ST17
Set Shot Direction toward Hole and Change Club to Putter
ST18
Modyfy Shot Direction?
ST19
No
Yes
Select Shot Direction
ST20
Detect Swing?
ST21
No
Yes
Water Hazard(WH) or Out of Bounds(OB)?
ST22
No
Yes
Display Shot
ST23
Display Carried Ball
ST24
Display Arrival Point
ST25
Determine Ball Position
ST26
Increment Number of Strokes by One
ST27
Second Shot at Same Position?
ST28
No
Yes
Display Previous Settings
ST29
Arrival Point within Golf Course?
ST30
Display Shot
ST31
Display Carried Ball
ST32
Display Arrival Point
ST33

FIG.7

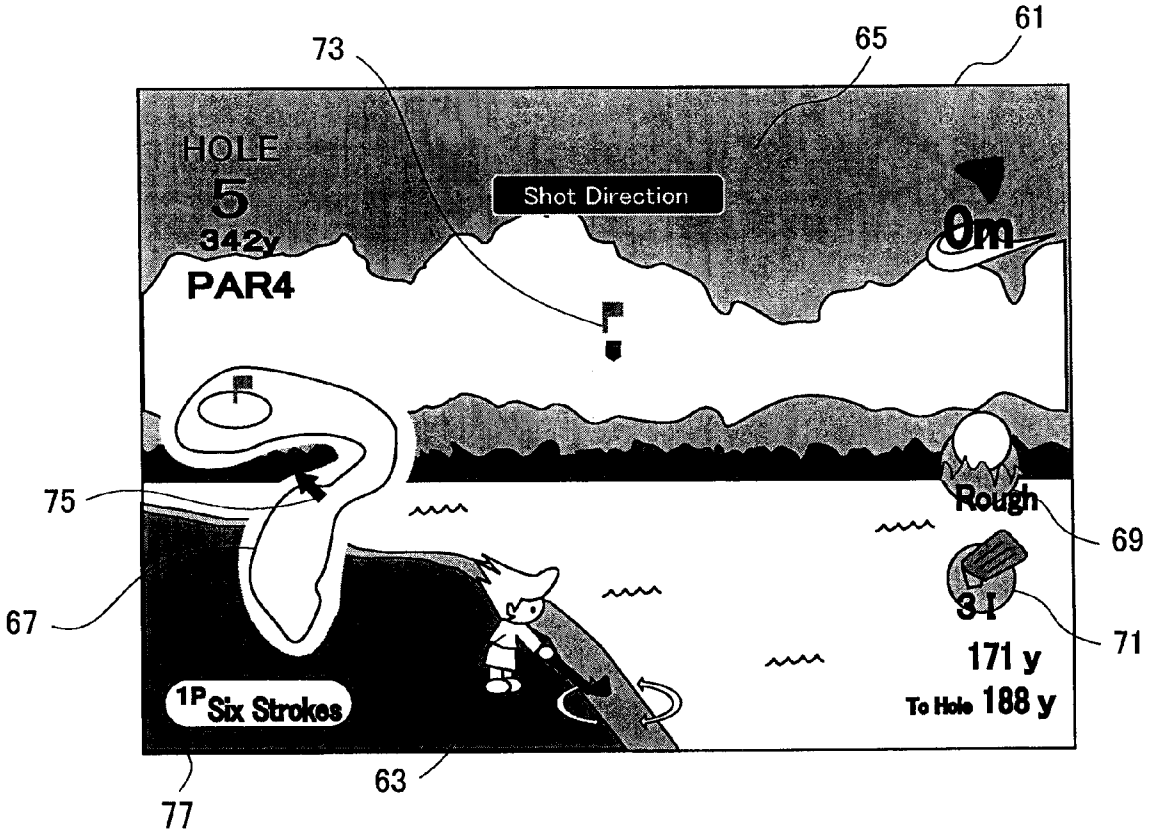

73
65
61
HOLE
5
342y
PAR4
Shot Direction
0m
75
Rough
69
67
3 I
71
171 y
To Hole 188 y
1P Six Strokes
63
77

FIG.8

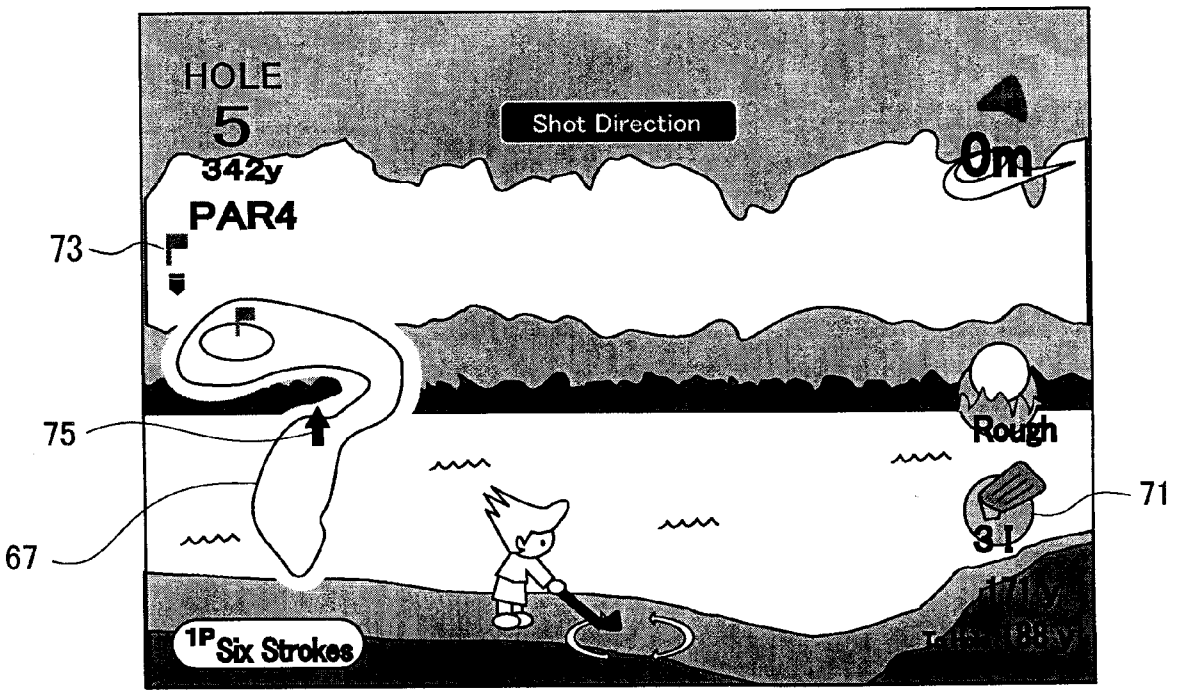

HOLE
5
342y
PAR4
Shot Direction
0m
Rough
3 I
1P Six Strokes
73
75
67
71

FIG.9

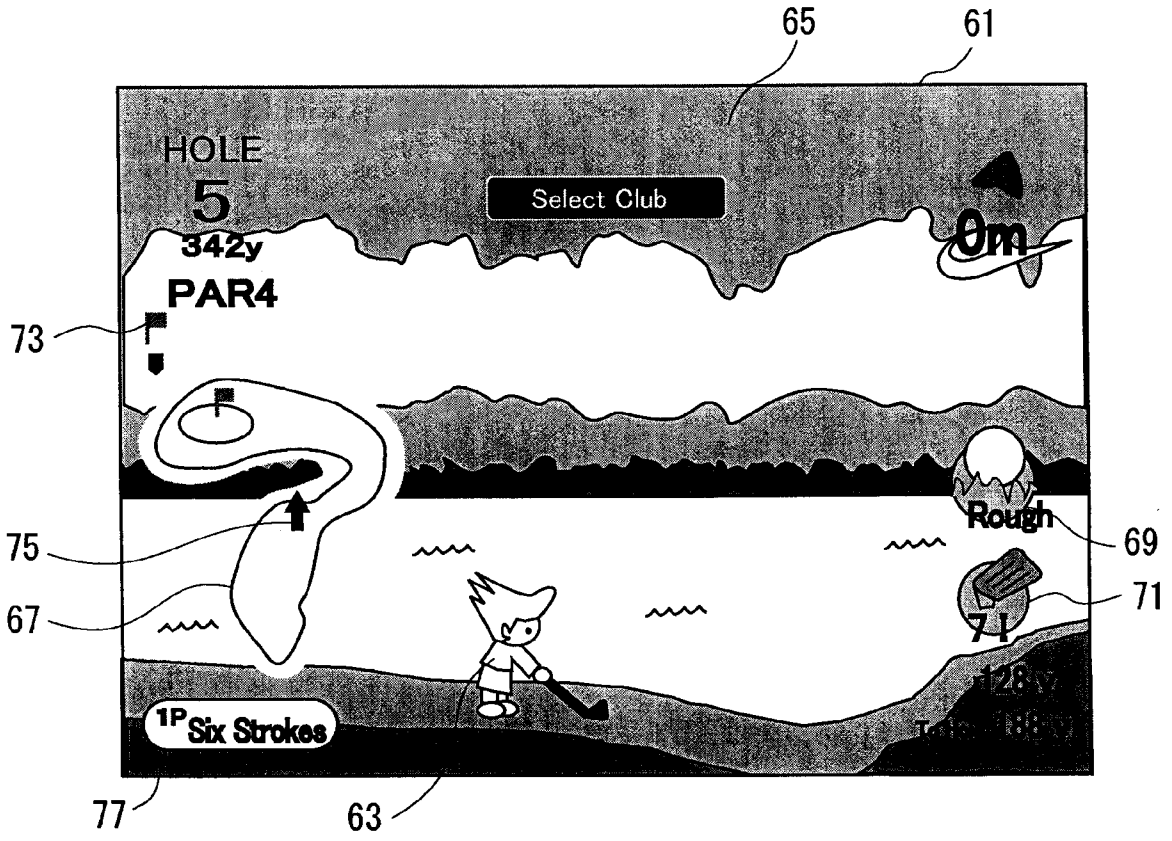

65
61
HOLE
5
342y
PAR4
Select Club
0m
73
Rough
69
75
71
67
7I
1P Six Strokes
77
63

FIG.10

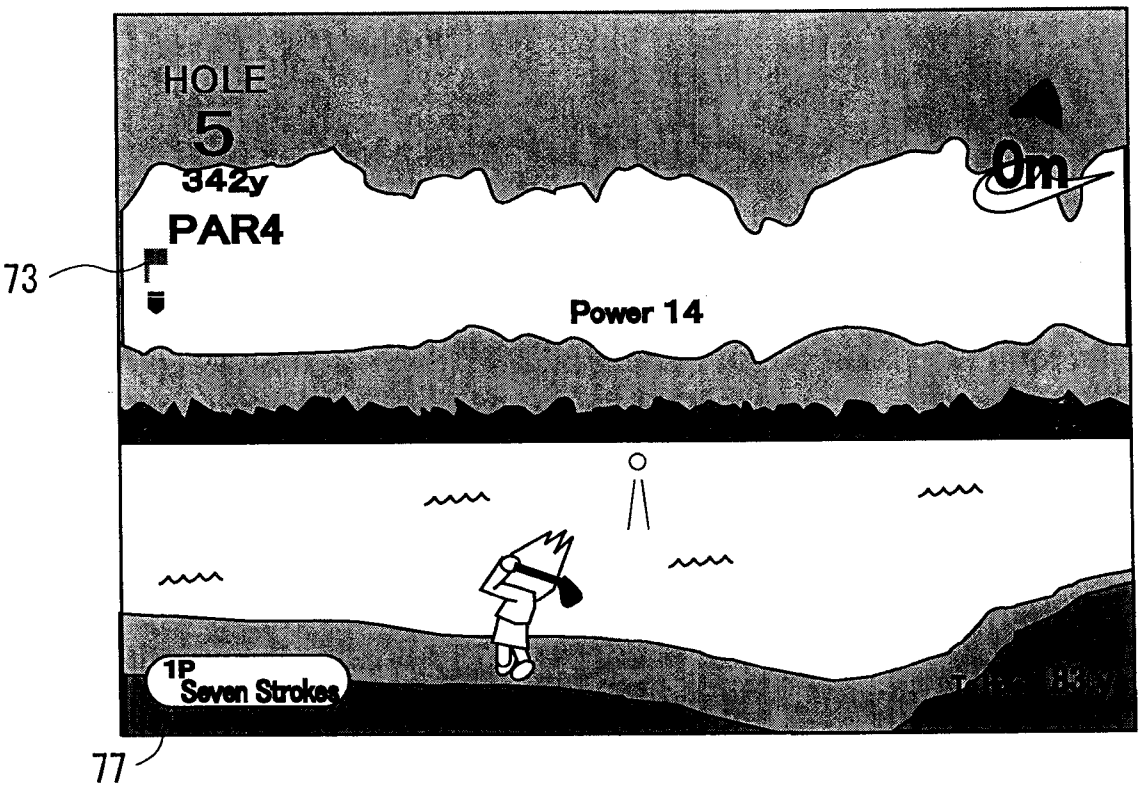


FIG.11

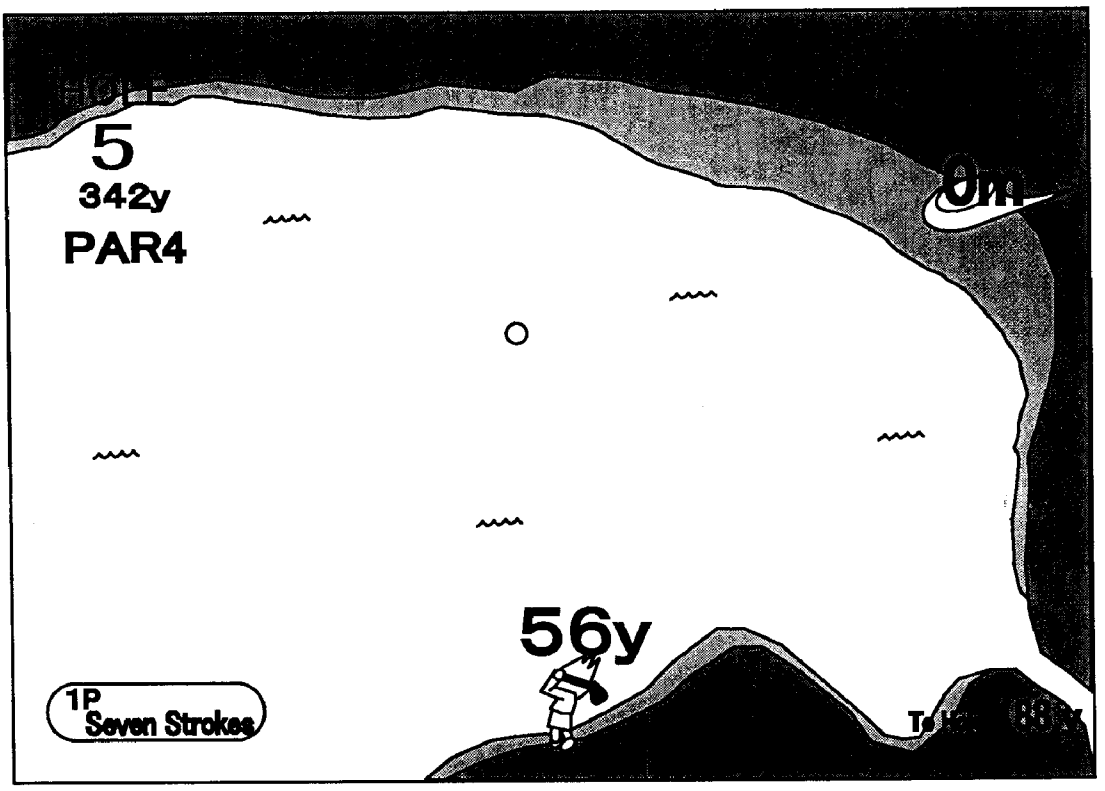


FIG.12

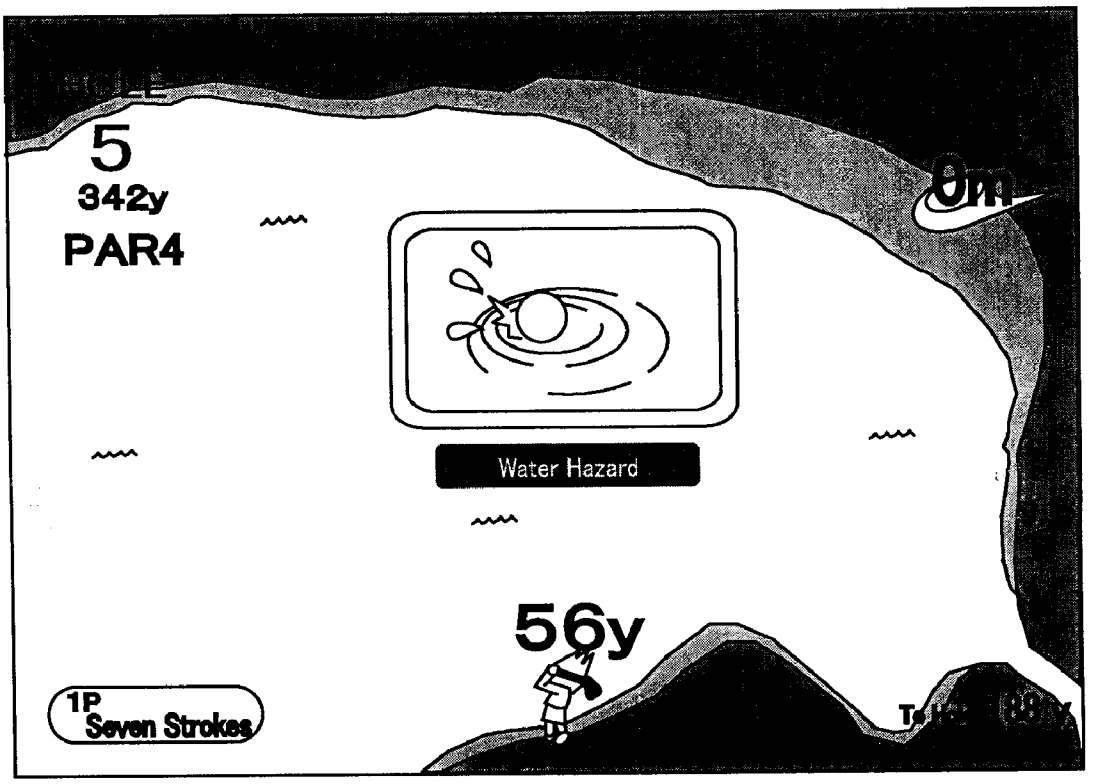


FIG.13

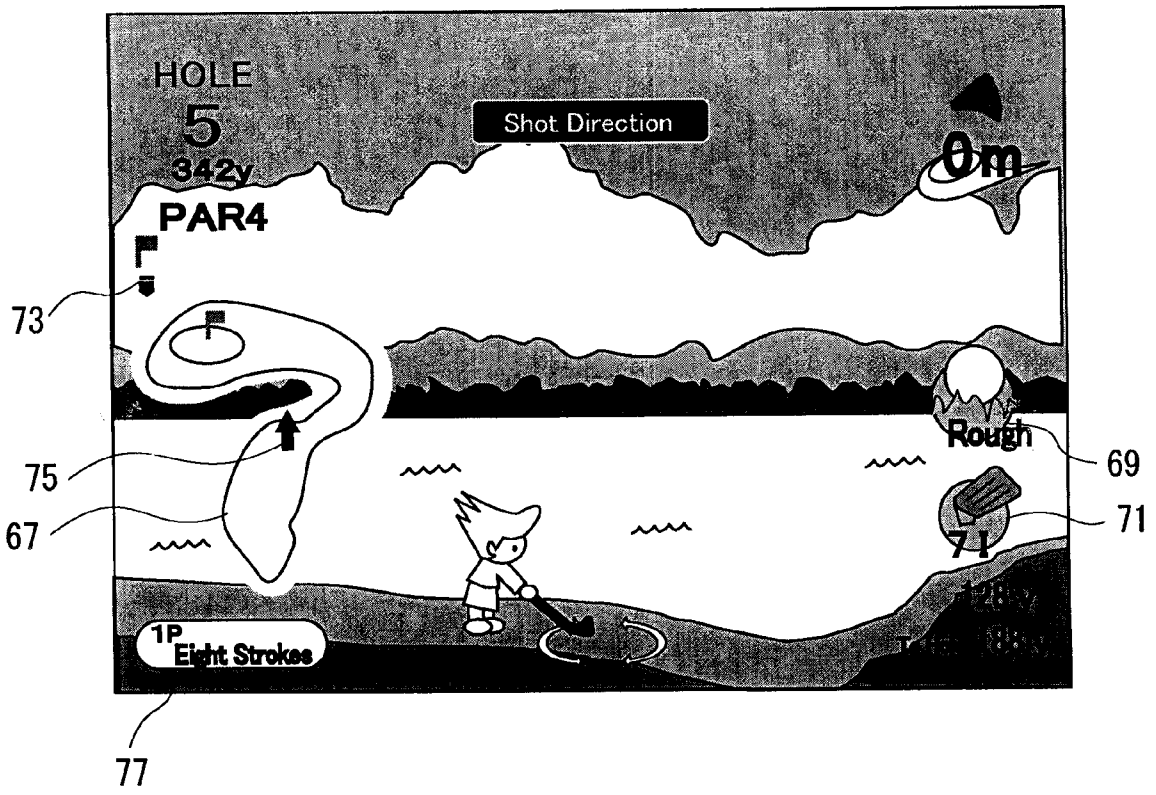

HOLE
5
342y
PAR4
Shot Direction
0m
Rough
1P
Eight Strokes
73
75
67
69
71
71
77

FIG.14A

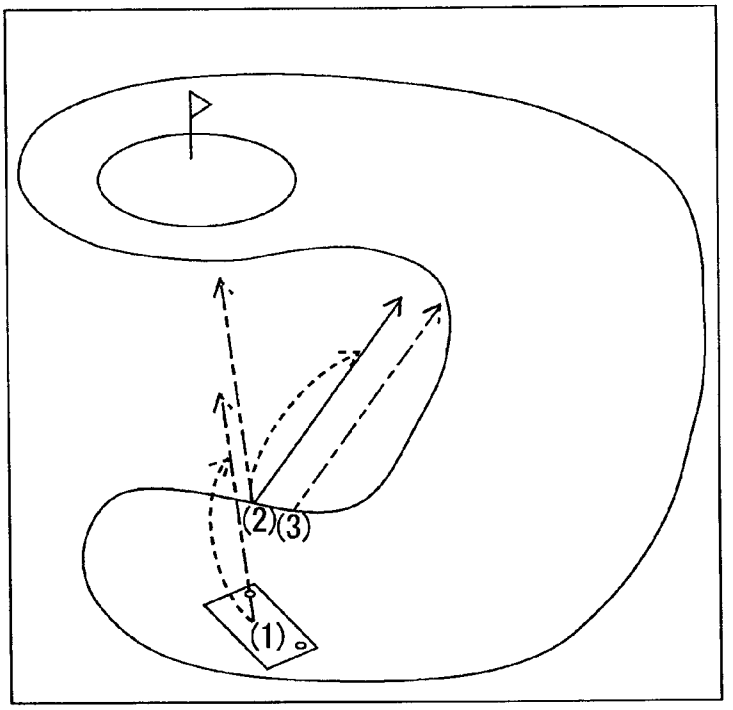
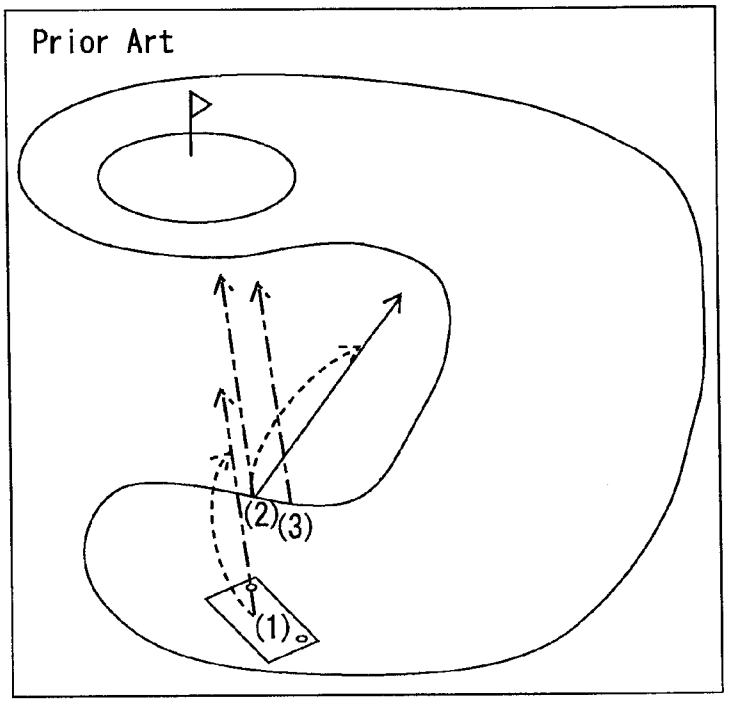


FIG.14B



——— Automatically Determined Direction
——— Manually Determined Direction
---------- Ball Shot

GAME DEVICE, GOLF GAME DEVICE SHOT RESULT DECISION METHOD

TECHNICAL FIELD

[0001] The present invention relates to a game apparatus that automatically determines and manually modifies settings for carrying on the game, and more specifically to a golf game apparatus that automatically determines a shot direction and a club to use, a method of determining a shot result for the game apparatus, and a program for implementing the method in a computer.

BACKGROUND ART

[0002] Some of publicly known game apparatuses are constructed to carry on the game by moving a movable object, such as a ball which is displayed on a screen, based on an input from an input device operated by a game player. Typical examples of such game apparatus include a golf game apparatus, a fishing game apparatus, and a baseball game apparatus. This kind of game apparatus determines, based on the input from the input device, whether or not the arrival point that the movable object such as a ball has reached is in a target area or is out of the target area. Automatic determination means automatically determines settings for carrying on the game at least including a moving direction of the movable object before the input has been made. It is possible to manually modify the automatically determined settings for carrying on the game. Japanese Patent Publication No. 2001-190836 discloses a typical example of a golf game apparatus of this kind. FIG. **6** of the publication shows an example flowchart of a program to be used with the golf game apparatus, in which selection of a club and determination of a shot direction are made during a process of shots. Further, a commercially available golf game apparatus for TV games automatically determines the shot direction toward a hole and the golf club to be used for each shot, and displays the determined shot direction and the selected club on a screen. In this apparatus, it is also possible to manually modify the shot direction and the golf club to be used.

DISCLOSURE OF THE INVENTION

Problems to Be Solved by the Invention

[0003] For example, the conventional golf game apparatus, which is a typical example of the game apparatus of this kind, is adapted to automatically determine the shot direction (the moving direction of the movable object) toward the hole and the golf club to be used, based on predetermined settings, and also to manually modify them for each shot, even though a shot has resulted in an out-of-bounds (OB) in which the ball has gone out of a course, or a water hazard (WH) in which the ball has fallen into a pond or the sea. However, when the game player is inexperienced or very young, such player often has to repeatedly hit the ball at the same shot position since the player cannot readily carry the ball onto a right course. Even in such a situation, with the conventional apparatus, the game player, who wants to modify the automatic settings, has to manually modify the settings for each shot. With an apparatus for a virtual or simulation golf game in which the player actually swings an imitated golf club, a body of the game apparatus, in which manually-operated switches are disposed, is placed at the foot of the player, and the player has to bend over to operate the switches for each time. The more the player has to manually operate the switches, the more the player gets tired.

[0004] Therefore, an object of the present invention is to provide a game apparatus and a golf game apparatus capable of reducing the number of times that the player has to perform unnecessary manual operations.

[0005] Another object of the present invention is to provide a game apparatus and a golf game apparatus capable of alleviating a physical burden on the game player.

[0006] Still another object of the present invention is to provide a golf game apparatus which can reduce the number of times that the player has to perform a manual operation in order that the player gets out of such situation as an out-of-bounds (OB) and water hazard.

[0007] A further object of the present invention is to provide a shot result determination method for the golf game apparatus that can reduce the number of times the player has to perform a manual operation in the course of determining shot results, and a program for implementing the method.

Means of Solving the Problems

[0008] With a game apparatus of the present invention, a game is carried on by moving a movable object displayed on a screen based on an input from an input device operated by the game player. Accordingly, the game apparatus of the present invention comprises determination means, automatic determination means, manual modification means, and memory means. The determination means determines, based on the input from the input device, whether or not an arrival point that the movable object has reached is in a target area or is out of the target area. Here, in the golf game, the "target area" means an area where a hole is located or an interim target area on the course before arriving at the hole position (a place where an OB or water hazard is not caused). The "out-of-the-target area" means an area out of the target, where an OB and water hazard is typically caused. The automatic determination means automatically determines settings for carrying on the game at least including a moving direction of the movable object before the input has been made. The manual modification means allows the settings for carrying on the game automatically determined by the automatic determination means to be modified manually. The memory means stores settings for carrying on the game. Especially in the present invention, the automatic determination means determines the settings for carrying on the game for a previous play which have been stored in the memory means should be used as the settings for carrying on the game for a next play when the determination means determines that the arrival point determined for the previous play is out of the target area and that for the next play the movable object has to be moved from the same point as that for the previous play.

[0009] According to the present invention, when the game player wants to make an input via the input device with the same settings for carrying on the game as those for the previous play in order to move again the movable object from the same position as that for the previous play, or when the player wants to change the settings for the previous play just a little bit, the automatic determination means deter-

mines the settings for carrying on the game for the previous play as those for the next play. Accordingly, the number of times that the player has to perform a manual operation can be reduced. Thus, the burden imposed on the game player, who otherwise manually modifies the settings for carrying on the game, can be alleviated.

[0010] Especially, when the input device includes a game tool to be operated by the game player in a three dimensional space, and a body of the game apparatus, which includes therein at least the manual modification means, is disposed at the foot of the game player, and if the body of the game apparatus includes one or more switches to be operated by the game player to manually modify the settings for carrying on the game, the game player has to bend over each time the settings are manually modified. The present invention significantly eases the burden of the game player in such a case.

[0011] More specifically, the game apparatus of the present invention includes a game tool to be operated by the player in a three dimensional space, a body of the game apparatus that includes one or more switches for settings and that is provided separately from the game tool, and a control unit that is disposed inside the body of the game apparatus and includes image display means for controlling how the movable object is displayed on the screen. The game is carried on stage by stage, namely, one stage of the game is executed with each operation of the game tool. In this case, the control unit comprises motion signal generation means, the automatic determination means, the manual modification means, the memory means, and the determination means. The motion signal generation means detects a motion of the game tool and outputs a motion signal in accordance with the detected motion. The automatic determination means automatically determines, for each stage, the settings for carrying on the game, at least including a moving direction of the movable object moving on the screen according to the motion signal. The manual modification means allows the settings for carrying on the game automatically determined by the automatic determination means to be modified manually. The memory means stores the settings for carrying on the game at the time that the motion signal is outputted. The determination means determines, at least based on the motion signal and settings for carrying on the game, whether the arrival point that the movable object has reached is in the target area or is out of the target area. In this case, the automatic determination means determines the settings for carrying on the game for a previous play which have been stored in the memory means should be used as the settings for carrying on the game for a next play when the determination means determines that the arrival point determined for the previous play is out of the target area and that for the next play the movable object has to be moved from the same point as that for the previous play.

[0012] The present invention is effective in setting a direction of a shot in a golf game apparatus, a direction of casting of a fly into an area where a large number of fish are supposed to be in a fishing game apparatus, a direction of an initial stroke (which satisfies the requirement that the ball should pass through the initial gate without fail) in a gate-ball-simulated game apparatus, and a direction of a serve in a tennis game apparatus.

[0013] Especially when the present invention is applied to a golf game apparatus, the golf game apparatus comprises an input device, automatic determination means, manual modification means, motion signal generation means, shot result determination means and image display means. The input device is operated by the game player in order to input a shot motion of a golf club. This input device may be a controller for games which has an ordinary screen to be operated by pressing a plurality of switches, or it may be a controller for games which does not have a screen. Further, it may be a combination of a game tool which imitates a golf club and a device inside the body of the game apparatus.

[0014] The automatic determination means determines an optimal club for each shot (which is one of the settings for carrying on the game for one stage) in accordance with a shot direction toward a hole and a distance to the hole for each shot. The determination of the shot direction and the optimal club as describe above is one of the settings for carrying on the game for the game. The shot direction towards the hole basically represents the shortest distance from the shot position to the hole. What have been determined may be usually or temporarily displayed on the screen. Or the screen image may be turned in the shot direction so that the player can recognize the shot direction toward the hole. Or a player character may be indicated on the screen so that the player can recognize the shot direction toward the hole, judging from the way the player character faces. Further, what kind of a club has been selected may be indicated on the screen with a character or a picture. Or, it may be indicated by changing an image of the club that the player holds so that the player can recognize the selected club. Further, it may be announced by voice.

[0015] The manual modification means allows the shot direction and the club determined by the automatic determination means to be modified manually. The switches arranged on the input device and so on can be used as a manual control portion for manual operation. When the input device is constituted by the combination of the golf club for games (game tool) and the body of the game apparatus, what is necessary is just to dispose the manual control portion on the golf club for games, and/or the body of the game apparatus.

[0016] The motion signal generation means outputs the motion signal in accordance with the shot motion of the golf club inputted with the input device. The motion signal includes information on timing, velocity and/or acceleration of the shot motion. When the golf club for games (game tool) operated by the player in the three dimensional space is used as the input device, the motion signal further includes information on any one of the shot motions such as a swing direction and an angle.

[0017] The shot result determination means determines an arrival point that a ball has reached and a shot result based on the motion signal (information on the shot that is included in this signal). The shot result determination means determines the arrival point that the ball has reached and the shot result (hole-in, green-on, course-on, course-out such as OB or water hazard, etc.) in view of the course conditions and predetermined settings (such as a direction of winds). In short, the shot result determination means constitutes the above-mentioned determination means of the present invention, namely, determines whether the arrival point that the ball has reached is in the target area (hole-in, green-on, course-on) or is out of the target area (course-out such as OB and water hazard etc.).

[0018] The image display means has various kinds of functions for displaying on a screen how the game is being carried on. For example, the image display means has a function of displaying on the screen an image of the golf course, the shot direction and the club determined by the automatic determination means or the manual modification means, and a scene in which the ball is moving to the arrival point that has been determined by the shot result determination means and so on.

[0019] The golf game apparatus of the present invention further comprises memory means for storing the shot direction and the club at the time that the previous shot motion was made, and shot position determination means for determining whether or not the shot motion should be made at the same position. The memory means may store at least the shot direction and club that were determined before the shot motion was made for the previous play. The shot position determination means determines whether or not a next shot position should be made at the same position as that for the previous play based on the result determined by the shot result determination means. For example, if the determined result is that an OB has been caused, a next shot motion is made at the same position as that for the previous play. If the determined result is that a water hazard has been caused twice continuously, the shot position after the second water hazard has been caused is determined as the same position as that for the previous play.

[0020] In the game apparatus of the present invention, the automatic determination means has a function of determining that the shot direction and the club for a previous play that have been stored in the memory means should be used for a next play when the shot position determination means determines that a next shot motion should be made at the same position as that for the previous play. Accordingly, the automatic determination means, with such function as described above, allows the shot direction and/or the club, for which settings were manually modified to avoid an OB or water hazard etc. at the time that the shot motion was made for the previous play, to be used again for a shot motion for the next play when it is determined that a subsequent shot motion should be made at the same position as that of the previous play due to the OB or water hazard, etc. Therefore, when the game player wants to make a shot motion again in the same situation as previous play, or wants to modify the settings for the previous play just a little bit, the number of times that the player has to perform the manual operation can be reduced. In a conventional manner, a shot direction toward the hole and a club are automatically determined for each shot motion, and manual operation is always required in order to restore the settings thereof to those for the previous play. Consequently, it leads to increased operational burden on the game player. Especially if a golf club for games is used and one or more switches for manual operation (manual modification means) are disposed at the foot of the game player, the player has to bend over each time to manually modify the settings, suffering more physical burden. The present invention can ease such burden.

[0021] A shot result determination method for the golf game apparatus automatically determines an optimal club in accordance with a shot direction toward a hole and a distance to the hole at first, while it allows the automatically determined shot direction and the club to be modified manually, and finally determines a shot result for each shot based on the shot motion inputted from the input device, the shot direction and the club which have been determined automatically or manually. In this case, the method of the present invention stores the shot direction and the club at the time the previous shot motion was made, and automatically determines the shot direction and the club stored at the time of the previous play as a shot direction and a club for a next play when a subsequent shot motion should be made at the same position as that for the previous play.

[0022] Alternatively, a program for a golf game apparatus, which determines a shot result, causes a computer to execute: a function of automatically determining an optimal club in accordance with a shot direction toward a hole and a distance to the hole; a function of allowing the automatically determined shot direction and the club to be modified manually; and a function of determining a shot result for each shot based on a shot motion inputted from the input device and the shot direction and the club determined automatically or manually. Especially, the program of the present invention further causes the computer to execute a function of storing the shot direction and the club at the time that the previous shot motion was made, and a function of determining automatically the shot direction and the club stored at the time of the previous play as a shot direction and a club for a next play when a subsequent shot motion should be made at the same position as that for the previous play. It is needless to say that this program may be recorded on a recording medium.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] FIG. **1** illustrates how a golf game apparatus for a virtual or simulation game is used according to an embodiment of the present invention as applied to such a virtual or simulation game apparatus.

[0024] FIG. **2** is a perspective view of a body of the game apparatus used in the embodiment shown in FIG. **1**.

[0025] FIG. **3** is a cross-sectional view of the body of the game apparatus shown in FIG. **2**, in which most of the internal mechanism is omitted from the illustration.

[0026] FIG. **4** is a block diagram showing principal components of a circuit installed inside the body of the game apparatus according to this embodiment.

[0027] FIG. **5** is a block diagram showing function-implementing means having various kinds of functions to be implemented inside a processor for games, and illustrates the relationship of a light-emitting element, a light-receiving element and a game tool.

[0028] FIG. **6** is a flowchart of an example algorithm used in implementing in a computer each of the function-implementing means of the golf game apparatus according to the present embodiment.

[0029] FIG. **7** illustrates an example of a screen.

[0030] FIG. **8** illustrates another example of a screen.

[0031] FIG. **9** illustrates a further example of a screen.

[0032] FIG. **10** illustrates a further example of a screen.

[0033] FIG. **11** illustrates a further example of a screen.

[0034] FIG. **12** illustrates a further example of a screen.

[0035] FIG. **13** illustrates a further example of a screen.

[0036] FIG. **14**A and FIG. **14**B are explanatory illustrations showing how the processing according to the present invention is different from the conventional one.

BEST MODE FOR IMPLEMENTING THE INVENTION

[0037] Now an embodiment of the present invention will be described in detail with reference to the drawings. In this embodiment, the present invention is applied to a golf game apparatus. FIG. **1** illustrates how a game apparatus for a virtual or simulation game is used in an embodiment of the present invention as applied to a game apparatus for a virtual or simulation game. In this figure, a body **1** of the game apparatus having switches, omitted from the illustration, is connected directly to a television set **5** via a cord **3**, and a game tool **9** that imitates a golf club (golf club for games) to be operated (swung) by a player **7** is used as a part of an input device.

[0038] FIG. **2** is a perspective view of the body **1** of the game apparatus used in this embodiment. FIG. **3** shows a cross-sectional view of the body **1** of the game apparatus, in which most of the internal mechanism is not illustrated. The body **1** of the game apparatus includes a casing **15** which is formed by combining an upper half-portion **11** and a lower half-portion **13**. The half-portions, upper and lower, have been formed by vertically splitting the casing **15** into two portions, upper and lower. A circuit is disposed inside the casing **15**, including a microcomputer as its principal component. Four pushbutton switches **17** to **23** (that is, **17**, **19**, **21** and **23**) are arranged on the surface of the upper half-portion **11** so that the switches can be pressed down. In addition, a sliding-type power switch **25** is disposed in an area **12** of the upper half-portion **11** that is surrounded by the four pushbutton switches **17** to **23**. These pushbutton switches **17** to **23** are operated when making an important selection in the course of the game, such as selection of a game type, a golf course, and golf club type. Ten through-holes **27** to **36**, which are paired up two by two, are formed in the area **12** of the upper half-portion **11**. Namely, the through-holes **27** and **28**, through-holes **29** and **30**, through-holes **31** and **32**, through-holes **33** and **34**, and through-holes **35** and **36** are paired respectively. Light-emitting elements **39** are respectively disposed inside the through-holes **27**, **29**, **31**, **33**, and **35**. Light-receiving elements **41** are respectively disposed inside the through-holes **28**, **30**, **32**, **34**, and **36**. In the present embodiment where the game apparatus is used for a simulated golf game apparatus, only the light-emitting elements **39** and light-receiving elements **41** disposed respectively inside the through-holes **31**, **32** and the through-holes **33**, **34** and the through-holes **35**, **36** are actually used for detecting the operation (operation timing) of the game tool **9**. As shown in FIG. **3**, the light-receiving elements **41** are disposed lower than the light-emitting elements **39** (in the vicinity of the lower half-portion **13**). In other words, the vertical length of each of the through-holes **28**, **30**, **32**, **34**, and **36** receiving the light-receiving elements **41** is longer than the vertical length of each of the through-holes **27**, **29**, **31**, **33**, and **35** receiving the light-emitting elements **39**. In view of the light-emitting element **39**, the shorter the distance of the light-emitting element **39** and the game tool **9** equipped with a light-reflecting plate is, the more light will be reflected. In view of the light-receiving element **41**, if the light-receiving element **41** is located too high (if the location thereof is of the same height as the light-emitting element **39** or higher than that), the light-receiving element **41** also receives lights other than the light emitted from the light-emitting elements **39** and reflected by the game tool **9**. Consequently, a signal outputted from the light-receiving elements **41** includes much noise to cause an erroneous detection. A desirable distance in the vertical direction (up and down direction) between the light-receiving element **41** and the light-emitting element **39** is varied depending on various factors such as the height of a zone which is located above the body **1** of the game apparatus through which the game tool **9** passes, a quantity of light emitted from the light-emitting element **39**, an emission angle range of the light emitted from the light-emitting element **39** (angular range where the light emitted from the light-emitting element **39** intersects the zone), a light-receiving angle range (angular range in which light reflected from the game tool **9** through the through-holes **27**, **29**, **31**, **33**, and **35** can be received) of the light-receiving element **41** disposed on the bottom of each of the through-holes **28**, **30**, **32**, **34**, and **36**, and a reflectance of the light reflecting material mounted on the game tool **9**.

[0039] FIG. **4** is a block diagram showing principal components of a circuit installed inside the body **1** of the game apparatus according to this embodiment. Power circuits of the light-emitting elements **39** etc. are omitted from the illustration. What has been developed exclusively for game apparatus can be applied as a processor **43** for games having an internal memory **42** which stores information acquired from a signal outputted from the light-receiving element **41**. An example of such processor **43** for games (including a microcomputer) is shown in U.S. Pat. No. 3,467,382, and is publicly known. However, the processor for games available for carrying out the present invention is not limited to what is disclosed in the foregoing patent publication. A program necessary for running the processor **43** for games is stored in an external memory **45**. Circuits for processing a video signal and an audio signal are included inside the processor **43** for games. Therefore, an output from the processor **43** for games is outputted directly to a television set **5**. It is needless to say that a circuit may be constructed without using such processor **43** for games.

[0040] FIG. **5** is a block diagram showing function-implementing means having various kinds of functions to be implemented inside the processor **43** for games, and also illustrates a relationship of the three light-emitting elements **39**, the three light-receiving elements **41** and the game tool **9**. The three light-emitting elements **39** and the three light-receiving elements **41** are arranged in such a manner that they are respectively located at the triangular vertexes. One of the light-emitting elements **39** and one of the light-receiving elements **41** which are adjacent to each other are paired. The paired light-emitting elements **39** and the light-receiving elements **41** are arranged so that light emitted from the paired light-emitting element **39** may be reflected by the game tool **9** and received by the paired light-receiving element **41**. As with the technique used in this embodiment, it is publicly known that light-receiving elements **41** are respectively disposed at three triangular vertexes and are adopted to produce outputs to detect the speed and moving direction of the game tool **9**. Therefore, a detailed description is omitted.

[0041] The function-implementing means shown in FIG. **5** includes motion signal generation means **47**, shot result determination means **49**, shot position determination means **51**, automatic determination means **53**, manual modification means **55**, memory means **57**, and image display means **59**, all of which constitute a control unit.

[0042] The motion signal generation means **47** includes the three light-emitting elements **39** that emit out light in a three dimensional space S in which the game tool **9** is operated, and the three light-receiving elements **41** that receive reflected light which has been emitted from the corresponding light-emitting elements **39** and reflected by the light reflecting material mounted on the surface of the game tool **9**. When the game tool **9** passes over the body **1** of the game apparatus, three light receiving signals are respectively outputted with time difference from the three light-receiving elements **41**. (The motion signal generation means **47** generates a motion signal including information on the motion of the game tool **9** (information on timing at which the game tool **9** was swung, operational velocity and moving direction of the game tool) based on the three light receiving signals. The moving velocity and moving direction of the game tool **9** can be known by identifying generation time intervals of the three light receiving signals. The moving direction etc. of the game tool **9** can be known from a light-receiving time difference of the two light-receiving elements **41** received within two light-receiving element receiving holes **32** and **34** that are located side by side in a direction orthogonal to the moving direction of the game tool **9**. The operation timing and moving velocity at which the game tool **9** is swung can be known by the generation time and generation interval of the light receiving signals in the two light-receiving elements, which are arranged at some interval in the moving direction of the game tool **9**.

[0043] The shot result determination means **49** determines an arrival point that the ball has reached and a shot result based on the motion signal (information on the shot that is included in the signal). In short, the shot result determination means **49** constitutes the determination means of the present invention which determines whether the arrival point that the ball has reached is in a target area or is out of the target area, at least based on the motion signal and the settings for carrying on the game (shot direction and selected club). It is needless to say that the shot result determination means **49** may be constructed to determine the arrival point that the ball has reached and the shot result (hole-in, green-on, course-on, course-out such as OB or water hazard, etc.) in view of the course conditions and predetermined settings (such as a direction of winds). Results determined by the shot result determination means **49** is transmitted to the image display means **59**, and the image display means **59** displays an image on the screen of the television set **5** in accordance with the determined result.

[0044] The shot position determination means **51** determines whether or not a next shot position should be the same as that for the previous play based on the result determined by the shot result determination means **49**. For example, if the determined result is that an OB has been caused, a next shot motion is made at the same position as that for the previous play, and if the determined result is that a water hazard has been repeated twice, the shot position after the second water hazard has been caused should be the same as that for the previous play.

[0045] The automatic determination means **53** determines an optimal club in accordance with a shot direction toward a hole and a distance to the hole. The shot direction towards the hole basically represents the shortest distance from the shot position to the hole. What has been determined is displayed on the screen of the television set **5** as will be explained later. It is arbitrary how to display what have been determined. A mark of a flag may be displayed in the shot direction on the screen. The screen image may be turned toward the shot direction so that the player can recognize the shot direction toward the hole. Or, a player character may be indicated on the screen so that the player can recognize the shot direction toward the hole, judging from the way the player character faces. Further, what kind of a club has been selected may be indicated on the screen with a character or a picture. Or, it may be indicated by changing an image of the club that the player holds so that the player can recognize the selected club. Further, it may be announced by voice.

[0046] The manual modification means **55** allows the shot direction and the club determined by the automatic determination means **53** to be modified manually. Switches disposed on the input device (switches **17** to **23** shown in FIG. **2**) and so on can be used as a manual control portion for manual operation. As with this embodiment, when the input device is constituted by a combination of a golf club for games (a game tool) and a body of the game apparatus, the manual control portion may be arranged on the golf club for games, and/or the body of the game apparatus.

[0047] The shot direction and the club which were determined by automatic determination means **53** and the manual modification means **55** are stored in the memory means **57**. The memory means **57** may store at least the shot direction and the club which were determined before the shot motion was made for the previous play.

[0048] FIG. **6** is a flowchart showing a program algorithm to be used for executing in a computer each of the function implementing means of the present embodiment. FIGS. **7** to **13** illustrate screen displays for explaining what will be done in accordance with the program when the water hazard is repeated twice. FIG. **7** illustrates a scene in which the ball is put on the edge of a pond after the first water hazard has been caused. As shown in the screen of FIG. **7**, a player **63**, a background **65**, a course view **67**, a ball-position information indicator **69** that indicates what circumstances the ball is placed in, and a club information indicator **71** that indicates a type of the selected club are displayed on the screen. In FIG. **7**, a shot direction indication mark **73** with a picture of a flag is displayed on the screen in order to show the shot direction automatically determined by the automatic determination means **53**. The shot direction is also indicated by an arrow **75** in the course view **67**. The current number of strokes is indicated on a number-of-strokes indicator **77**.

[0049] In step ST**1** of FIG. **6**, an optimal club is determined at first in accordance with the shot direction toward the hole and the distance to the hole. The foregoing determination is executed by the automatic determination means **53** shown in FIG. **5**. Next, it is determined in step ST**2** whether or not the automatically determined shot direction is to be modified. When the shot direction is to be modified,

the process goes to step ST3 where the shot direction is modified with a selected direction. This modification is executed by the manual modification means **55** shown in FIG. **5**. FIG. **8** shows a screen which is displayed after the shot direction has been modified. The background is moved and the arrow **75** which indicates the shot direction on the course view **67** is also moved. The shot direction indication mark **73**, which shows the automatically determined shot direction, remains on the screen in order to show the location of the hole.

[0050] When the shot direction is not modified, the process goes to step ST4 from step ST2. In step ST4, it is determined whether or not the club is to be changed. When club is to be changed, the process goes to step ST5 where the club is changed. Actually, the club is changed by pressing any one of switches **17** to **23** disposed on the body of the game apparatus shown in FIG. **2**. When comparing FIG. **9** with FIG. **8**, it is known that the club-information indicator **71** indicates that the club has been changed from iron **3** to iron **7**.

[0051] When the club is not changed in step ST4, the process goes to step ST6. In step ST6, it is determined whether or not the game player has swung the game tool (golf club for games) **9**. If a swing is detected, the currently-determined shot direction and the club in use are stored in the memory means **57**. Next, the number of strokes is counted in step ST **8**, and the carry and roll distance, namely, the moving distance and direction of the ball is calculated in step ST9. Then the shot result is determined in steps ST10, **14** and **22**. FIG. **10** shows a screen display right after the swing has been detected, in which the number of strokes indicated by the number-of-strokes indicator **77** is increased by one.

[0052] When it is determined in step ST22 that the shot resulted in a water hazard, such a shot image as shown in FIG. **10** is displayed in step ST23, an image of the flying ball as shown in FIG. **11** is displayed in step ST24, and an image of the arrival point of the ball as shown in FIG. **12** is displayed in step ST25.

[0053] When a water hazard is caused as shown in FIG. **12**, it is determined in step ST26 that a next shot should be made at the same ball position as that for the previous play. The number of strokes is added by one in step ST27 (one count as a penalty due to the water hazard). FIG. **13** shows such a situation as described above. The number-of-strokes indicator **77** is increased by one as shown in FIG. **13**. Then it is determined in step ST28 whether or not a shot of this time should be made again at the same position as that for the previous play (whether or not the ball should be put on the same position again). Since FIG. **13** shows a situation in which the shot should be made again at the same position as that for the previous play, the process goes to step ST29, and the shot direction and the selected club that are displayed on the screen are identical to those that were determined for the previously play. As is clear by comparing FIG. **9** with FIG. **13**, the shot direction and the type of the club that are determined by the automatic determination means are identical to those that were determined for the previous play.

[0054] How to determine the shot direction in accordance with the above-mentioned steps will now be explained using FIG. **14**A. First, if the initial shot position is on the course as indicated with (**1**), the shot direction towards the hole is automatically determined in step ST1 and then displayed. If the shot is made in the foregoing situation, and the shot results in a water hazard, the ball position (the shot position) is moved to a position (**2**). Even at this time, the shot direction is initially determined automatically toward the hole in step ST1. Then the shot direction is manually modified to the direction as indicated with a solid line. If the second shot ends up in a water hazard again, the ball position (the shot position) for a next play is moved to a position (**3**). Although the positions (**2**) and (**3**) are indicated in the figure as if they were arranged side by side, they in fact overlap in the same position on the actual screen of the game. At this time, the shot direction is determined to be identical to what was determined for the previous play in the steps ST28 and **29** so that the shot direction for the previous play may be displayed again on the screen. Although a direction of the dashed line (**3**) shown in the figure is indicated as if it were in parallel with the solid line (**2**), it in fact overlaps the solid line (**2**) on the actual screen of the game. FIG. **14**B illustrates a shot result that is determined by the conventional method of determining the shot direction. Conventionally, even when the shot of the previous play, whose shot direction has been modified, is made at the position (**2**) and ends up in a water hazard, the shot direction for a next play is determined to be in the direction toward the hole from the position (**3**). Accordingly, the player has to select the shot direction and the club again. When a shot results in an OB, the process proceeds in a similar manner as described above.

[0055] Returning to FIG. **6**, if it is determined that the shot ends up in a hole-in, the process proceeds from step ST10 to steps ST11, ST12, and ST13, and then the game is over. If the shot result is determined that the ball has landed on the green, the process proceeds from step ST14 to steps ST15, ST16, and ST17 to display an image, and then goes to step ST18. In step ST **18**, the shot direction is automatically determined toward the hole, and a putter club is automatically selected. The shot direction can be modified in steps ST19 and ST20, but the putter club cannot be changed. When a swing is detected in step ST21, the process goes to step ST7. When the shot result is determined that the ball has landed on the course other than those mentioned above, the process proceeds from step ST30 to steps ST31, ST32 and ST33, and returns to step ST1. Even when a water hazard or OB is caused, if a next shot is the first stroke to be made at that position, the process proceeds from step ST28 to step ST1. If the next shot does not end up in a water hazard or OB, the process goes through ordinary steps.

[0056] In the program algorithm shown in FIG. **6**, the automatic determination means is implemented in steps ST1, ST18, and ST29. The manual modification means is implemented in steps ST2 to ST5, and steps ST19 and ST20. The shot result determination means is implemented in steps ST10, ST14, ST22, ST30 and so on. Further, the shot position determination means is implemented in step ST **28**. The motion signal generation means is partially implemented in steps ST6 and ST21. The memory means is partially implemented in step ST **7**. The image display means is implemented in most of the remaining steps.

[0057] As described above, according to the apparatus or the shot result determination method of the present embodiment, the automatic determination means **53** has a function of determining the shot direction and the club that have been stored in the memory means **57** at the time of the previous

play as those for the next play when the shot position determination means **51** determines that a next shot motion should be made at the same position as that of the previous play, or should be made at the same position continuously (twice). Accordingly, the shot direction and/or the club, of which the settings were manually modified at the time that the shot motion was made for the previous play in order to avoid OB or water hazard etc., can be used again for a shot motion for the next play when it is determined that a shot motion should be made repeatedly at the same position as that for the previous play due to the OB or water hazard, etc. Therefore, when the game player wants to make a shot motion again in the same situation as previous play, or wants to modify the settings for the previous situation just a little bit, the number of times that the player has to perform the manual operation can be reduced.

[**0058**] Although the above-mentioned embodiment is applied to a game apparatus for a virtual or simulation game in which a golf club for games (game tool) is actually swung, the present invention is not limited to this, and may be applied to a golf game apparatus of other types with which the player carries on the game by pressing a switch disposed on a game controller and so on.

[**0059**] Further, the present invention is not limited to a golf game as long as it is a game which determines settings for carrying on the game for the previous play as those for a next play, and may be applied to fishing, gate-ball, billiards, soccer, baseball, tennis and the like.

INDUSTRIAL APPLICABILITY

[**0060**] A game apparatus of the present invention, accordingly, has such advantage that the number of times that the player has to perform the manual operation can be reduced when the player wants to input from an input device again in the same situation as the previous play, or wants to modify settings just a little bit compared with those for the previous situation, in order to move a movable object from the same position again.

[**0061**] The golf game apparatus of the present invention allows the shot direction and/or the club, of which the settings were modified manually at the time that the shot motion was made for the previous play in order to avoid an OB or water hazard, to be used again as those for a shot motion for the next play, if a shot motion has to be made from the same position as that for the previous play due to the OB or water hazard, etc. Thus, the number of times that the player has to perform the manual operation can be reduced when the game player wants to make a shot motion in the same situation as previous play again, or wants to modify the settings for the previous situation just a little bit.

[**0062**] Further, the present invention can reduce physical burden on the game player who has to bend over to manually modify the settings using the body of the game apparatus which is placed at the foot of the player.

1. A game apparatus for playing a game that includes a control unit for carrying on the game by moving a movable object displayed on a screen based on an input from an input device operated by a game player, the control unit comprising:

determination means for determining, based on the input, whether an arrival point that the movable object has reached is in a target area or is out of the target area;

automatic determination means for automatically determining settings for carrying on the game at least including a moving direction of the movable object before the input has been made;

manual modification means for allowing the settings for carrying on the game automatically determined by the automatic determination means to be modified manually; and

memory means for storing the settings for carrying on the game;

wherein the automatic determination means determines that the settings for carrying on the game for a previous play which have been stored in the memory means should be used as the settings for carrying on the game for a next play when the determination means determines that the arrival point determined for the previous play is out of the target area and that for the next play the movable object has to be moved from the same point as that for the previous play.

2. The game apparatus according to claim 1, wherein

the input device is a game tool to be operated by the player in a three dimensional space;

the control unit is disposed inside a body of the game apparatus, the body including one or more switches and being provided separately from the game tool;

the control unit further includes image display means for controlling how the movable object is displayed on the screen and motion signal generation means for detecting a motion of the game tool and outputting a motion signal in accordance with the detected motion;

the automatic determination means is constructed to automatically determine the settings for carrying on the game at least including the moving direction of the movable object, which moves on the screen in accordance with the motion signal, for each stage in which one motion of the game tool is made;

the memory means is constructed to store the settings for carrying on the game at the time that the motion signal is outputted; and

the determination means is constructed to determine, at least based on the motion signal and the settings for carrying on the game, whether the arrival point that the movable object has reached is in the target area or out of the target area.

3. The game apparatus according to claim 2, wherein

the game tool is operated by the game player in order to input a shot motion of a golf club;

the control unit further includes shot position determination means for determining whether or not the shot motion should be made at the same position;

the determination means includes shot result determination means for determining, based on the motion signal, the arrival point that a ball as the movable object has reached, and a result of the shot;

the automatic determination means has a function of determining an optimal club in accordance with a shot direction toward a hole and a distance to the hole;

the manual modification means has a function of allowing the shot direction and the club determined by the automatic determination means to be modified manually;

the motion signal generation means has a function of outputting the motion signal in accordance with the shot motion of the golf club inputted with the game tool;

the memory means has a function of storing the shot direction and the club at the time that the shot motion is made; and

the automatic determination means further has a function of determining the shot direction and the club that have been stored in the memory means at the time of the previous play as those for the next play when the shot position determination means determines that a next shot motion should be made at the same position as that for the previous play.

4. The game apparatus according to claim 3, wherein

the shot result determination means has a function of determining whether an OB or water hazard is caused when the ball has reached a point out of the target area;

the automatic determination means determines the shot direction and the club for a next play when the shot position determination means determines that a next shot motion should be made at the same position as that for the previous play after the shot result determination means has determined that an OB or water hazard is caused.

5. The game apparatus according to claim 3, wherein the image display means has a function of displaying on the screen the shot direction and the club determined by the automatic determination means or the manual modification means, and a scene in which the ball is moving to the arrival point that has been determined by the shot result determination means.

6. A game apparatus for playing a game, which carries on the game by moving a movable object displayed on a screen based on an input from an input device operated by a game player, the game apparatus comprising:

determination means for determining, based on the input, whether an arrival point that the movable object has reached is in a target area or is out of the target area,

automatic determination means for automatically determining settings for carrying on the game at least including a moving direction of the movable object before the input has been made,

manual modification means for allowing the settings for carrying on the game automatically determined by the automatic determination means to be modified manually, and

memory means for storing the settings for carrying on the game,

wherein the automatic determination means determines the settings for carrying on the game for a previous play which have been stored in the memory means should be used as the settings for carrying on the game for a next play when the determination means determines that the arrival point determined for the previous play is out of the target area and that for the next play the movable object has to be moved from the same point as that for the previous play.

7. The game apparatus according to claim 6, wherein

the input device includes a game tool to be operated by the game player in a three dimensional space;

a body of the game apparatus that includes therein at least the manual modification means is disposed at the foot of the game player; and

the body of the game apparatus includes one or more switches to be operated by the game player when the settings for carrying on the game are modified manually.

8. A shot result determination method for a golf game apparatus, which automatically determines an optimal club according to a shot direction toward a hole and a distance to the hole, allows the automatically determined shot direction and the club to be modified manually, and determines a shot result for each shot based on a shot motion inputted from an input device and the shot direction and the club determined automatically or manually, the method comprising the steps of:

storing the shot direction and the club at the time that the previous shot motion was made, and determining automatically the shot direction and the club stored at the time of the previous play as a shot direction and a club for a next play when a subsequent shot motion should be made at the same position as that for the previous play.

9. A program for a golf game apparatus that determines a shot result, the program causing a computer to execute:

a function of automatically determining an optimal club according to a shot direction toward a hole and a distance to the hole;

a function of allowing the automatically determined shot direction and the club to be modified manually; and

a function of determining a shot result for each shot based on a shot motion inputted from an input device and the shot direction and the club determined automatically or manually,

the program further causing the computer to execute:

a function of storing the shot direction and the club at the time that the previous shot motion was made, and

a function of determining automatically the shot direction and the club stored at the time of the previous play as a shot direction and a club for a next play when a subsequent shot motion should be made at the same position as that for the previous play.

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