The present invention relates to an apparatus for measuring golf club swing speed. The swing speed measuring apparatus automatically indicates golf club swing speed by detecting a state where optical signals, such as infrared rays, output from a transmitting device thereof are blocked by a golf club. To this end, a receiving device of the swing speed measuring apparatus calculates the golf club swing speed by dividing a distance between the optical signals by a time interval taken between when the optical signals are blocked, and outputs the calculated swing speed. In particular, the transmitting and receiving devices are manufactured as separate devices. The present invention is configured such that a meaningless swing motion such as a case where a user slowly swings the golf club around the ball to take a proper stance or posture can be excluded and an actual swing motion can be distinguished accordingly.
Fig. 4

S41
Does first optical signal receiving unit receive optical signals?

No

S42
Does second optical signal receiving unit receive optical signals?

No

S43
Indicate that alignment has been made (e.g., LED On)

S44
Indicate that alignment has not yet made (e.g., LED Off)
Fig. 5

![Diagram showing the flow of operations from receiving control unit to calculation unit to speed display unit.]

22-1: Change in receiving state of optical signals (Time when state change occurs = t1)
22-2: Change in receiving state of optical signals (Time when state change occurs = t2)

Calculation of swing speed:

\[ v = \frac{D}{t_2 - t_1} \]

Display of swing speed

Fig. 6

Receiving state at first optical signal receiving unit

Receiving state at second optical signal receiving unit

1: State where optical signals are received
0: State where optical signals are not received
Fig. 7

Start

S71

Backward speed ≥ Minimum speed?

Yes

No

S72

Display swing tempo at regular time intervals

S73

Is swing speed output due to normal swing?

Yes

No

S74

Does predetermined time elapsed?

S75

Stop displaying swing tempo

End
APPARATUS FOR MEASURING GOLF CLUB SWING SPEED

CROSS-REFERENCE TO RELATED APPLICATION(S)


[0002] 1. Field of the Invention

[0003] The present invention relates to an apparatus for measuring golf club swing speed, and more particularly, to an apparatus for measuring golf club swing speed wherein a transmitting device for transmitting an optical signal and a receiving device for receiving the optical signal are separately installed and golf club swing speed can be automatically displayed by detecting a state where the optical signal such as an infrared ray signal is blocked by a golf club.

[0004] 2. Description of the Prior Art

[0005] As golf has become popular, a number of apparatuses capable of allowing a golfer to simply practice playing golf have been developed. Among these apparatuses, there is an apparatus for correcting golfer’s swing posture or an apparatus for measuring swing speed and then notifying the speed to the golfer. In particular, since swing power, a flight distance of a golf ball and the like can be approximately known by measuring gold club swing speed, the apparatus helps to check and enhance the user’s current proficiency in golf. However, the related art apparatus for measuring golf club swing speed has several problems.

[0006] First, in a case where a means for measuring golf club swing speed is included in a golf club itself, there is inconvenience in that a user should possess a golf club mounted with such a means. In particular, if the practice golf club is different from a golf club used in an actual golf game in the field in view of their weights, structures or the like, there may be a problem in that its swing feeling is different from that of a club used in the field.

[0007] Second, in a case where golf club swing speed is measured using additional sensors which are not installed in the golf club, it is inconvenient or impossible to measure swing speed due to their installation positions and structures.

[0008] For example, since the reflection angle of the signal is not uniform in a structure in which a signal is vertically transmitted from the ground and the signal reflected from the club head of the golf club is then sensed, it is very difficult to sense the reflected signal and it is also highly impossible for the structure to erroneously operate. Further, since the apparatus for measuring swing speed is large and used in a fixed mode in a structure in which an optical signal transmitted from a sensor installed on the ground is blocked by a golf club, it is difficult to adjust the installation position when the apparatus is installed. Thus, it is inconvenient to actually use the apparatus. That is, since an apparatus using a related art sensor is configured such that a sensor is physically fixed, there are problems in that a user can use the apparatus at a fixed place and it is very inconvenient to install and use the apparatus. Accordingly, the apparatus is not practical.

[0009] Furthermore, in case of an apparatus in which signal transmitting and receiving parts are integrally formed with each other, a portion adjacent to a hitting point may be easily damaged and a position where a golf ball is actually placed cannot be changed. Therefore, the apparatus cannot be properly employed in a variety of user’s practice circumstances.

SUMMARY OF THE INVENTION

[0010] Accordingly, the present invention is conceived to solve the aforementioned problems. It is an object of the present invention to provide an apparatus for measuring golf club swing speed wherein a transmitting device for transmitting an optical signal and a receiving device for receiving the optical signal are separately installed and can be easily installed and used in accordance with a variety of user’s necessity and installation positions.

[0011] The apparatus for measuring golf club swing speed according to the present invention comprises a transmitting device for outputting optical signals through a plurality of optical signal transmitting units and a receiving device for receiving the optical signals output from the optical signal transmitting units through a plurality of optical signal receiving units, which are separated from each other. When the receiving state of the optical signals is changed by means of the golf club swing, the receiving device calculates the golf club swing speed by dividing a predetermined value D corresponding to a distance between the optical signals by a time interval (Tg) taken between when a receiving state of the optical signals is changed, and outputs the calculated swing speed.

[0012] Preferably, the optical signals are infrared rays.

[0013] Further, there are many cases where a user slowly moves a golf club toward or away from a golf ball to take a proper stance or posture before actually swinging the golf club. It is preferred that changes in the receiving state of the optical signals due to such a meaningless swing motion be excluded. To this end, the swing speed may be calculated and output only when it is within a predetermined range.

[0014] In particular, since the transmitting and receiving devices are configured as separate devices, they should be aligned with each other at positions where they can properly transmit and receive the optical signals to and from each other. To this end, the receiving device checks whether the optical signals are received in all the optical signal receiving units and indicates whether the receiving device is aligned with the transmitting device. Such an alignment state may be indicated using light-emitting diodes (LEDs) or display units.

[0015] In the meantime, the user generally takes a back swing motion before he/she performs a normal swing motion. At this time, the time interval taken from a point of time when the back swing is started to the point of time when the golf ball is hit may vary according to the user. Thus, this time interval may be information that is very useful in finding out an optimal swing tempo.

[0016] To this end, the receiving device may be configured in such a manner that swing tempo is indicated at regular time intervals when the optical signals are blocked while the golf club is swung in a back swing direction. Preferably, the swing tempo can be indicated through some methods of continuously flickering light-emitting diodes (LEDs) used to display the swing tempo at regular time intervals, displaying...
either numbers counted at the regular time intervals or elapsed time, outputting a specific sound through speakers, or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

[0018] FIG. 1 is a view schematically showing a state where the present invention is used;
[0019] FIG. 2 is a view schematically showing the configuration of the present invention;
[0020] FIG. 3 is a block diagram showing the configuration of the apparatus according to a preferred embodiment of the present invention;
[0021] FIG. 4 is a flowchart illustrating the operation of aligning a transmitting device and a receiving device with each other according to an embodiment of the present invention;
[0022] FIG. 5 is a diagram illustrating the overall operation of the receiving device according to an embodiment of the present invention;
[0023] FIG. 6 is a view showing a change in state where an optical signal is received; and
[0024] FIG. 7 is a flowchart illustrating the process of outputting a swing tempo since the back swing has been started according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0026] Referring to FIG. 1, an apparatus 10 for measuring golf club swing speed (hereinafter referred to as “swing speed measuring apparatus”) comprises a transmitting device 21 and a receiving device 22. The transmitting and receiving devices 21 and 22 are separately installed in the swing speed measuring apparatus 10. The transmitting device 21 sends a plurality of optical signals 4 and 5, and the receiving device 22 receives the optical signals 4 and 5.

[0027] A user 1 can install the swing speed measuring apparatus 10 and measure the golf club swing speed at any time and place. That is, if the user swings a golf club 2, the head of the golf club passes between the transmitting and receiving devices 21 and 22. Then, the receiving device 22 senses a state where the optical signals 4 and 5 are blocked by the club head, and the swing speed is automatically calculated and indicated.

[0028] At this time, in order for a golf ball 3 not to block the optical signals 4 and 5, the golf ball 3 is preferably placed out of the way of the optical signals 4 and 5 as shown in FIG. 1.

[0029] Referring to FIG. 2, a plurality of optical signal transmitting units 21-1 and 21-2 for outputting the optical signals 4 and 5 are provided at one side of the transmitting device 21. To measure swing speed, at least two optical signal transmitting units should be provided, and thus, an embodiment of the swing speed measuring apparatus in which two optical signal transmitting units 21-1 and 21-2 are provided will be hereinafter explained. However, three or more optical signal transmitting units may be provided for the applications including measuring swing speed according to several intervals, measuring golf ball speed at the time of impact, and the like.

[0030] The receiving device 22 receives the optical signals 4 and 5 output from the optical signal transmitting units 21-1 and 21-2, respectively, through a plurality of optical signal receiving units 22-1 and 22-2. At this time, the optical signal receiving units 22-1 and 22-2 correspond one-to-one to the optical signal transmitting units 21-1 and 21-2 and receive the optical signals transmitted from the corresponding optical signal transmitting units. That is, the optical signal transmitting and receiving units operate in pair.

[0031] If the transmitting and receiving devices 21 and 22 are normally aligned with each other, the optical signal receiving units 22-1 and 22-2 are in a state where they receive the optical signals 4 and 5 output from the optical signal transmitting units 21-1 and 21-2. At this time, if the user swings a golf club and the club head passes across the optical signals 4 and 5, the state where the optical signals 4 and 5 are received will be changed.

[0032] The receiving device 22 divides a predetermined distance D by a time interval taken between when the receiving state of the optical signals 4 and 5 is changed and calculates and indicates the golf club swing speed. Here, the predetermined distance D is a distance between the optical signal receiving units 22-1 and 22-2 or between the optical signals 4 and 5, and it is beforehand set and stored in the receiving device 22.

[0033] That is, if the time interval corresponding to the difference between a point of time when a receiving state of the first optical signal 4 is changed and a point of time when the receiving state of the second optical signal 5 is changed, the swing speed V can be determined as a value of D/T5. What change in the receiving state of the optical signals will be regarded as a change due to the golf club swing can be properly determined in various manners.

[0034] It is preferred that infrared rays be used as the aforementioned optical signals. In such a case, each of the optical signal transmitting units 21-1 and 21-2 includes an infrared transmitting device capable of outputting infrared rays, and each of the optical signal receiving units 22-1 and 22-2 includes an infrared sensor capable of sensing the infrared rays. However, a variety of optical signals such as lasers may be used, if necessary. Furthermore, any kind of the transmitting and receiving units can be used if they are capable of properly transmitting and receiving a desired optical signal selected among the variety of optical signals.

[0035] The configuration of the transmitting and receiving devices according to an embodiment of the present invention will be described in detail with reference to FIG. 3.

[0036] Preferably, the transmitting device 21 comprises a plurality of optical signal transmitting units 21-1 and 21-2, a transmission control unit 21-3 for outputting the optical signals through the optical signal transmitting units 21-1 and 21-2, and a power unit 21-4 for supplying power.
The power unit 21-4 of the transmitting device and a power unit 22-7 of the receiving device may be configured in various manners. For example, the power units may be configured to use a battery or external power (e.g., AC 220V, AC 110V, etc.) which in turn is rectified into direct current. Further, the power units may include a recharge circuit to use a rechargeable battery.

The optical signal receiving units 22-1 and 22-2 of the receiving device 22 receive the optical signals (e.g., infrared rays) output from the optical signal transmitting units 21-1 and 21-2 of the transmitting device 21 and operate in one-to-one correspondence with the optical signal receiving units 21-1 and 21-2.

A receive control unit 22-3 operates according to the receiving state of the optical signals from the optical signal receiving units 22-1 and 22-2. First, the receive control unit 22-3 decides whether both of the optical signal receiving units 22-1 and 22-2 receive optical signals. That is, the transmitting and receiving devices 21 and 22 are separately installed. Therefore, if the heights and horizontal positions of the optical signal transmitting units 21-1 and 21-2 are different from those of the optical signal receiving units 22-1 and 22-2, the optical signal receiving units 22-1 and 22-2 cannot receive the optical signals output from the optical signal transmitting units 21-1 and 21-2. The user cannot easily determine such an aligned state of the optical signal transmitting and receiving units.

Accordingly, as shown in FIG. 4, the receive control unit 22-3 indicates that the optical signal transmitting and receiving units are properly aligned with each other (S43) if the first optical signal receiving unit 22-1 receives the optical signals (S41) and the second optical signal receiving unit 22-2 also receives the optical signals (S42). Otherwise, the receive control unit 22-3 indicates that the optical signal transmitting and receiving units are not aligned with each other (S44). The aligned state may be indicated in various manners. Preferably, the aligned state can be informed using the flickering of light-emitting diodes (LEDs) 22-6 or a message informing whether they have been properly aligned can be output.

In addition, the receive control unit 22-3 decides whether the receiving state of the respective optical signals 4 and 5 changes into a state where a given condition is met. At this time, the receive control unit 22-3 can decide that the receiving state of the optical signals where the given condition is met has occurred in the relevant optical signal receiving unit when the optical signal receiving units 22-1 and 22-2 normally receive the optical signals after the change of their receiving state from a normally received state to a blocked state.

If the receiving state of the optical signals is changed, the calculation unit 22-4 calculates swing speed by dividing the predetermined distance D by the time interval Tg. The calculated swing speed is output to the user through a speed display unit 22-5.

Preferably, the receive control unit 22-3 and calculation unit 22-4 for performing the aforementioned functions can be configured using a microcomputer (or CPU) and computer program installed therein.

The speed display unit 22-5 may be configured in various manners for the sake of a user's convenience. For example, swing speed can be visually displayed using a display means such as a 7-segment or LCD module. Further, swing speed may be informed in the form of voice by using a voice output means. To this end, the voice informing the swing speed may be reproduced through speakers by first storing a sound source for each number and then synthesizing the sound source corresponding to the relevant numbers constituting the swing speed. That is, if the swing speed is '128', the sound sources corresponding to '1', '2' and '8', i.e. 'one hundred', 'twenty' and 'eight', and a sound corresponding to 'k' representing a unit of speed are synthesized and output into a voice. Since the aforementioned sound synthesis can be implemented using any well-known technology, a detailed description thereof will be omitted herein.

The overall operation of the swing speed measuring apparatus will be now described with reference to FIG. 5. If the user swings a golf club, the golf club passes across the optical signals 4 and 5 while blocking the optical signals. Thus, the receive control unit 22-3 detects change in the receiving state of the optical signals from the first optical signal receiving unit 22-1 and then stores time t1 when the change in the receiving state occurs (S51).

Further, the receive control unit 22-3 detects change in the receiving state of the optical signals from the second optical signal receiving unit 22-2 and then stores time t2 when the change in the receiving state occurs (S52).

At this time, the receiving state of the optical signals from the first and second optical signal receiving units 22-1 and 22-2 is changed as shown in FIG. 6. That is, when the club head passes across the first optical signal 4 while the first optical signal receiving unit 22-1 receives the first optical signal 4, the receiving state in the first optical signal receiving unit 22-1 is changed into a blocked state at a point of time k0 and then changed again into a receiving state at a point of time k1 after this blocked state has been kept for a specific period of time. The state change at the point of time k1 is recognized after a time Δ according to the performance of receive control unit 22-3. In addition, when the club head passes across the second optical signal 5 while the second optical signal receiving unit 22-2 receives the second optical signal 5, the receiving state in the second optical signal receiving unit 22-2 is changed into a blocked state at a point of time k2 and then changed again into a receiving state at a point of time k3 after this blocked state has been kept for a specific period of time. The state change at the point of time k3 is also recognized after a time Δ according to the performance of receive control unit 22-3.

Accordingly, the points of time t1 and t2 when a receiving state of the optical signals in the respective optical signal receiving units can be set in various manners. In an example shown in FIG. 6, t2 may be set to be k2, k3, k3+Δ or the like, while t1 may be set to be k0, k1, k1+Δ or the like.

The calculation unit 22-4 calculates the golf club swing speed using the mathematical expression, D/(t2-t1) (S53), and the calculated swing speed is displayed on the speed display unit 22-5 (S54). Here, the denominator (t2-t1) can be arbitrarily set to be 'k3-k1', 'k2-k1', 'k2-k0' or the like, but it is most preferable to be set as 'k3-k1'.

It is preferable to output the swing speed only when it can be regarded that the receiving state of the optical signals has occurred due to a golf club swing of the user.
That is, it is preferable to exclude a meaningless circumstance such as change in the receiving state of the optical signals occurring when the user slowly moves the golf club around the ball so as to take a proper stance or posture.

To this end, the present invention is configured in such a manner that the swing speed is output only when the calculated swing speed is greater than a predetermined minimum speed. Here, the minimum speed is an arbitrary value corresponding to the speed that can be determined as a minimum swing speed when the user normally swings a golf club. This minimum speed is set as a predetermined value and stored in the receiving device 22. It is apparent that another method having the same meaning as speed comparison can be utilized in addition to the comparison with the minimum speed. For example, it can be determined whether the time intervals (e.g., 12-11) between the points of time when the receiving state of the optical signals are equal to or less than a specific value.

Furthermore, the swing speed calculation and the calculated speed output are meaningful only when the swing speed measuring apparatus 10 is properly aligned and normally operated. Thus, it is preferable to configure the swing speed measuring apparatus in such a manner that the swing speed calculation and the calculated speed output are made only when the transmitting device 21 and receiving device 22 thereof are aligned with each other.

In the meantime, the user may be a right-handed or left-handed person. Therefore, the order of the state change of the optical signals is changed according to whether the user who swings the golf club is a left-handed or right-handed person. If the user is a right-handed person, the first optical signal receiving unit 22-1 first detects state change of the optical signals, and then, the second optical signal receiving unit 22-2 detects state change of the optical signals.

However, if the user is a left-handed person, the second optical signal receiving unit 22-2 first detects state change of the optical signals, and then, the first optical signal receiving unit 22-1 detects state change of the optical signals.

Therefore, the receiving device 22 processes the swing speed calculation based on that the change in receiving state of the optical signals is first produced in the first optical signal receiving unit 22-1, if the swing speed measuring apparatus is set for a right-handed person. On the other hand, the receiving device 22 processes the swing speed calculation based on that the change in receiving state of the optical signals is first produced in the second optical signal receiving unit 22-2, if the swing speed measuring apparatus is set for a left-handed person. That is, in a case where the swing speed measuring apparatus is set for a left-handed person, the golf club swing speed is calculated based on the mathematical expression, D1((11-12).

Furthermore, a back swing should be made when the user swings the golf club. The time period when it takes to finally hit the golf ball from the start of the back swing near the golf ball plays an important role in correcting swing tempo. This time period may be different according to each user. If a user has performed their best shot when the time period is 5 seconds, it is preferred that the user always maintain such a state. Accordingly, the swing speed measuring apparatus 10 is more preferably configured to allow this information to be displayed.

To this end, the receiving device 22 causes swing tempo to be displayed at regular time intervals when the change in receiving state of the optical signals has been made while the golf club is swung in a back swing direction. Here, the back swing direction is directed to a case where a point of time of the state change in the second optical signal receiving unit 22-2 is ahead of a point of time of the state change in the first optical signal receiving unit 22-1.

At this time, if the swing speed measuring apparatus 10 is set for a left-handed person, the back swing direction is of course directed to a case where the point of time of the state change in the first optical signal receiving unit 22-1 is ahead of the point of time of the state change in the second optical signal receiving unit 22-2.

An embodiment in which swing tempo is indicated will be described with reference to FIG. 7.

The receive control unit 22-3 decides whether the speed measured in the back swing direction, i.e. a backward speed obtained by dividing the predetermined distance D by a value 11-12 corresponding to a difference between the point of time of the state change in the first optical signal receiving unit 22-1 and the point of time of the state change in the second optical signal receiving unit 22-2, is greater than a minimum speed (S71). Here, the minimum speed is an arbitrary value corresponding to the speed that can be determined as a minimum back swing speed when the user starts to swing the golf club in the back swing direction. This minimum speed is set as a predetermined value and stored in the receiving device 22.

Further, the receive control unit 22-3 starts to indicate swing tempo at regular intervals when the backward speed is greater than the minimum speed (S72). Swing tempo can be indicated in various manners for the sake of a user's convenience. To this end, the relevant light-emitting diodes may be lighted at regular intervals, a given sound may be output through the speakers, or counted number or elapsed time may be displayed.

The swing tempo continues to be output until the swing speed has been displayed onto the speed display unit 22-5 after the normal swing following the back swing or the number of counts is equal to or greater than the predetermined number of times (S73 and S74), and then, the display of swing tempo is stopped (S75). Here, the fact that the number of counts is equal to or greater than the predetermined number of times means a case where a predetermined time period has elapsed because the user did not normally swing the golf club due to any number of reasons after starting to perform the back swing.

According to the preferred embodiment of the present invention, the user can have viewed the indication informing himself/herself of the swing tempo since he/she swings the golf club in the back swing direction. Accordingly, the user can determine the swing tempo that is most suitable for himself/herself.

The swing speed measuring apparatus of the present invention is configured to include a transmitting device for transmitting an optical signal and a receiving device for receiving the optical signal, which are manufac-
tered as individual devices separated from each other. Accordingly, it is very convenient to carry, install and use the swing speed measuring apparatus. Further, since the golf club itself does not have to be modified when the swing speed measuring apparatus is installed, the user can freely utilize any kind of golf clubs desired.

[0065] In particular, the present invention is configured in such a manner that a meaningless swing motion such as a case where the user slowly swings the golf club around the ball to take a proper stance or posture can be excluded, in consideration of actual practice circumstances of the user. Therefore, much more accurate swing actions can be learned.

[0066] Moreover, the user can learn the most preferred posture or stance over the total swing time because the swing tempo from the back swing to the normal swing can be simply and easily indicated.

[0067] Although the present invention has been described in connection with the embodiments of the present invention illustrated in the accompanying drawings, it is not limited thereto. It will be apparent to those skilled in the art that various modifications and changes may be made thereto without departing from the technical scope and spirit of the invention.

What is claimed is:

1. An apparatus for measuring golf club swing speed, comprising:
   a transmitting device for outputting optical signals through a plurality of optical signal transmitting units; and
   a receiving device for receiving the optical signals output from the plurality of optical signal transmitting units through a plurality of optical signal receiving units, calculating golf club swing speed by dividing a predetermined value (D) by the time interval (Tg) when the receiving state of the optical signals is changed from a state where the optical signals are normally received in the optical signal receiving units.

2. The apparatus as claimed in claim 1, wherein the optical signals are infrared rays.

3. The apparatus as claimed in claim 1, wherein the receiving device includes:
   a power unit for supplying power;
   the plurality of optical signal receiving units for receiving the optical signals;
   a receive control unit for indicating an alignment state of the transmitting and receiving units by determining whether all of the optical signal receiving units receive the optical signals, and determining whether the receiving state of the optical signals changes into a state where a given condition is met;
   a calculation unit for calculating the swing speed by dividing the predetermined value (D) by the time interval (Tg) when the receiving state of the optical signals is changed into a state where the given condition is met; and
   a speed display unit for outputting the speed calculated by the calculation unit.

4. The apparatus as claimed in claim 3, wherein it is determined that the given condition is met, if the optical signals are blocked and then again normally received in a state where the optical signals are normally received in the optical signal receiving units.

5. The apparatus as claimed in claim 3, wherein the swing speed is calculated only at the alignment state when all the optical signal receiving units receive the optical signals.

6. The apparatus as claimed in claim 3, wherein the calculated swing speed is output only when it is within a predetermined range.

7. The apparatus as claimed in claim 3, wherein the alignment state is indicated through the flickering of light-emitting diodes (LEDs).

8. The apparatus as claimed in claim 3, wherein the alignment state is indicated by outputting a message informing the speed display unit of the alignment state.

9. The apparatus as claimed in claim 3, wherein the speed display unit includes at least one of a display means for displaying the calculated swing speed in the form of characters and a voice output means for outputting the calculated swing speed in the form of a voice.

10. The apparatus as claimed in claim 1, wherein the receiving device is configured to allow swing tempo to be indicated at regular time intervals when the optical signals are blocked while the golf club is swung in a back swing direction.

11. The apparatus as claimed in claim 10, wherein the receiving device allows the swing tempo to be indicated by flickering the light-emitting diodes (LEDs) at regular time intervals.

12. The apparatus as claimed in claim 10, wherein the receiving device allows either numbers counted at regular time intervals or elapsed time to be displayed on the speed display unit to indicate the swing tempo.

13. The apparatus as claimed in claim 10, wherein the receiving device allows the swing tempo to be indicated by outputting a specific sound through speakers at the regular time intervals.

14. The apparatus as claimed in claim 10, wherein the receiving device is configured to stop indicating the swing tempo when the swing speed has been output or a predetermined period of time has elapsed after it is determined that the optical signals are blocked while the golf club is swung in the back swing direction.

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