US 20060211523A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2006/0211523 A1

Sabatino (43) Pub. Date: Sep. 21, 2006

(54) BAT SPEED SENSING DEVICE AND METHODS

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(21) Appl. No.: **11/161,608**

(22) Filed: **Aug. 9, 2005**

Related U.S. Application Data

(60) Provisional application No. 60/663,660, filed on Mar. 21, 2005.

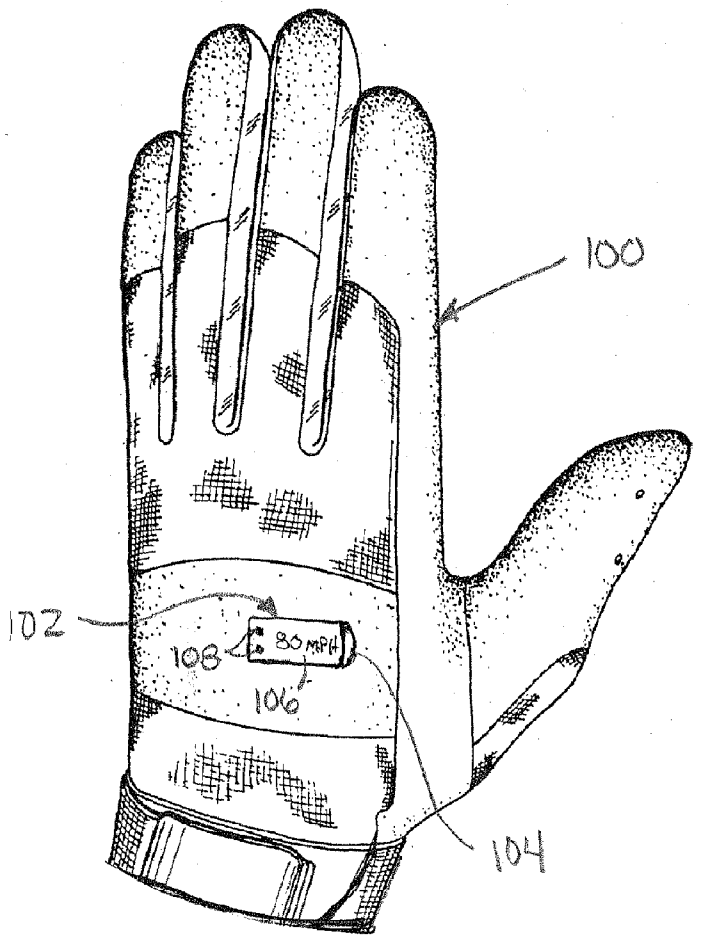
Publication Classification

(51) **Int. Cl.**
A63B 69/00 (2006.01)

(52) **U.S. Cl.** **473/453**

(57) **ABSTRACT**

The invention provides for baseball bat velocity sensing apparatus and method, which employs at least one sensor that may be selectively attached to a batting glove. To facilitate use of the system and avoid interference with the batters swing, swinging or hitting characteristics of the bat, the apparatus of the present invention is selectively positioned in association with the batter's hands during his/her swing. The apparatus provides an output that is responsive to swing movement, and measures the velocity of the swing and bat speed for display to a user. The method and apparatus of the present invention may be employed with any type of bat and regular bats may be used without any required modification or attachments. Thus, for example, bat velocity may be determined in the ordinary course of a baseball game. The invention is easily and conveniently used without materially altering or interfering with the batter's ordinary swings. Accordingly, the bat speed measuring apparatus of the present invention embodied as a separate, small, lightweight, self-contained device. Such a device is selectively secured in association with a batter's hands, such as by selective securance with a standard batting glove.



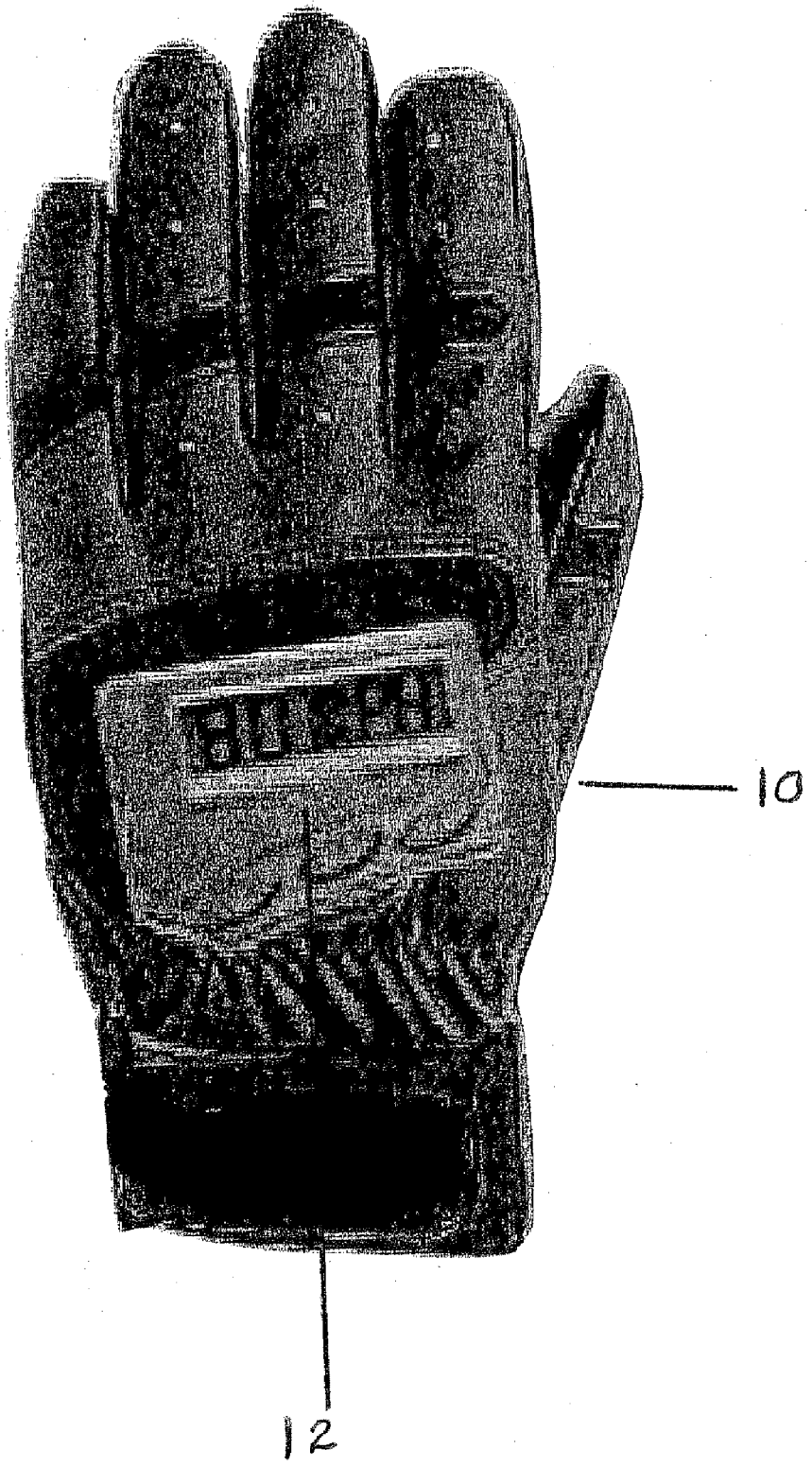


Fig. 1

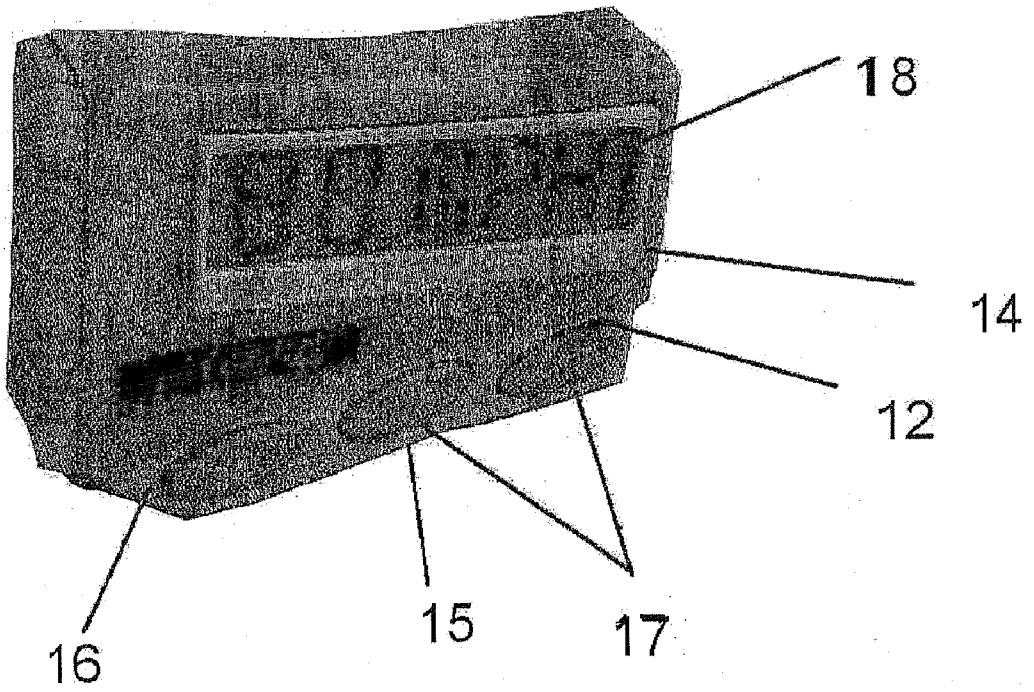
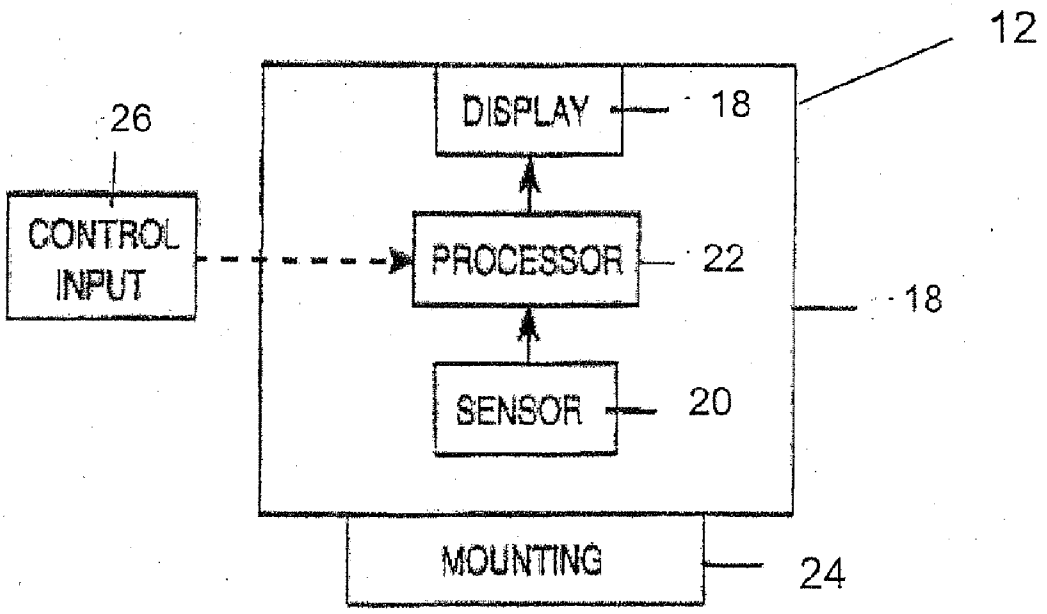


Fig. 2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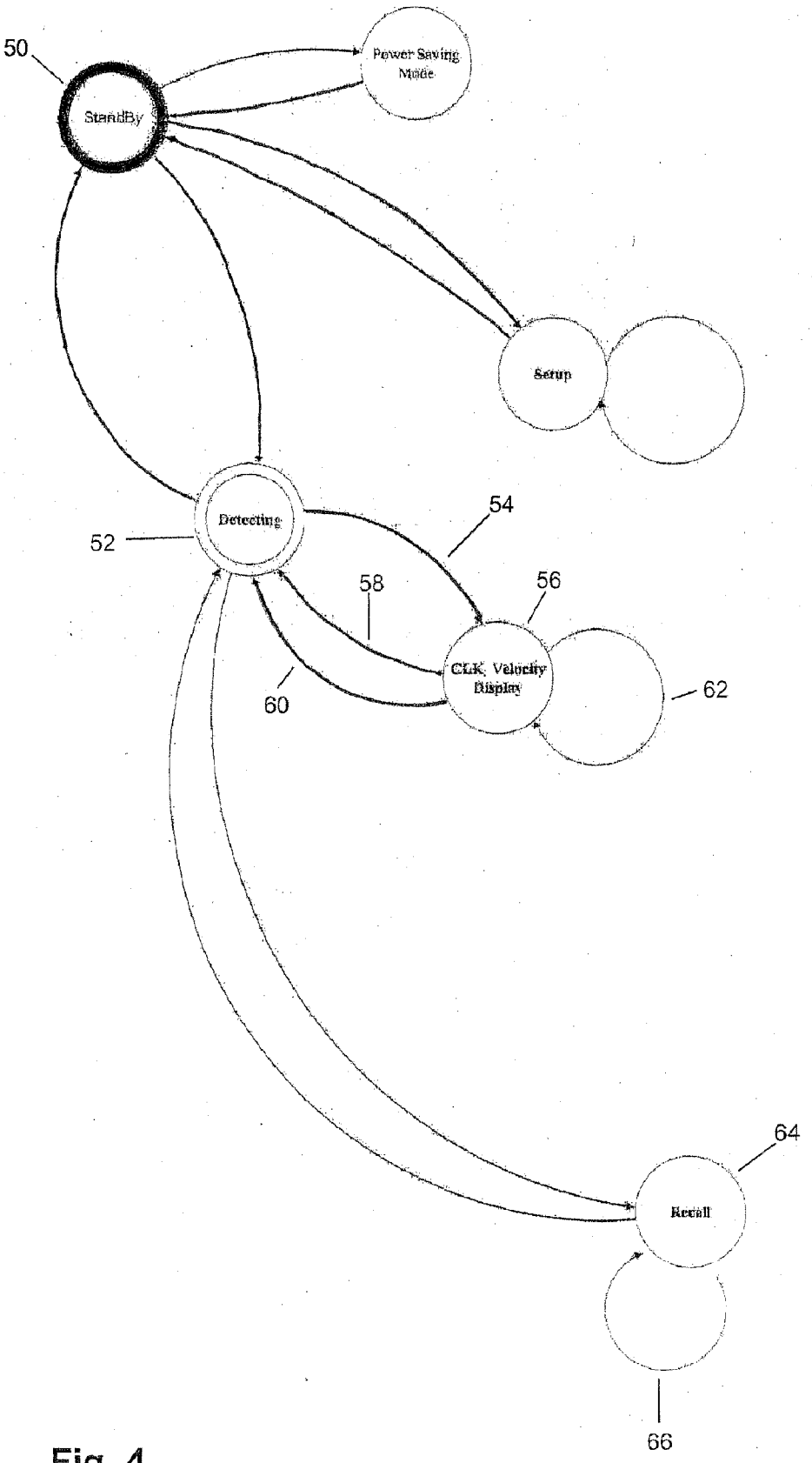
DISPLAY
18
26
CONTROL INPUT
PROCESSOR
22
18
SENSOR
20
MOUNTING
24

Fig. 3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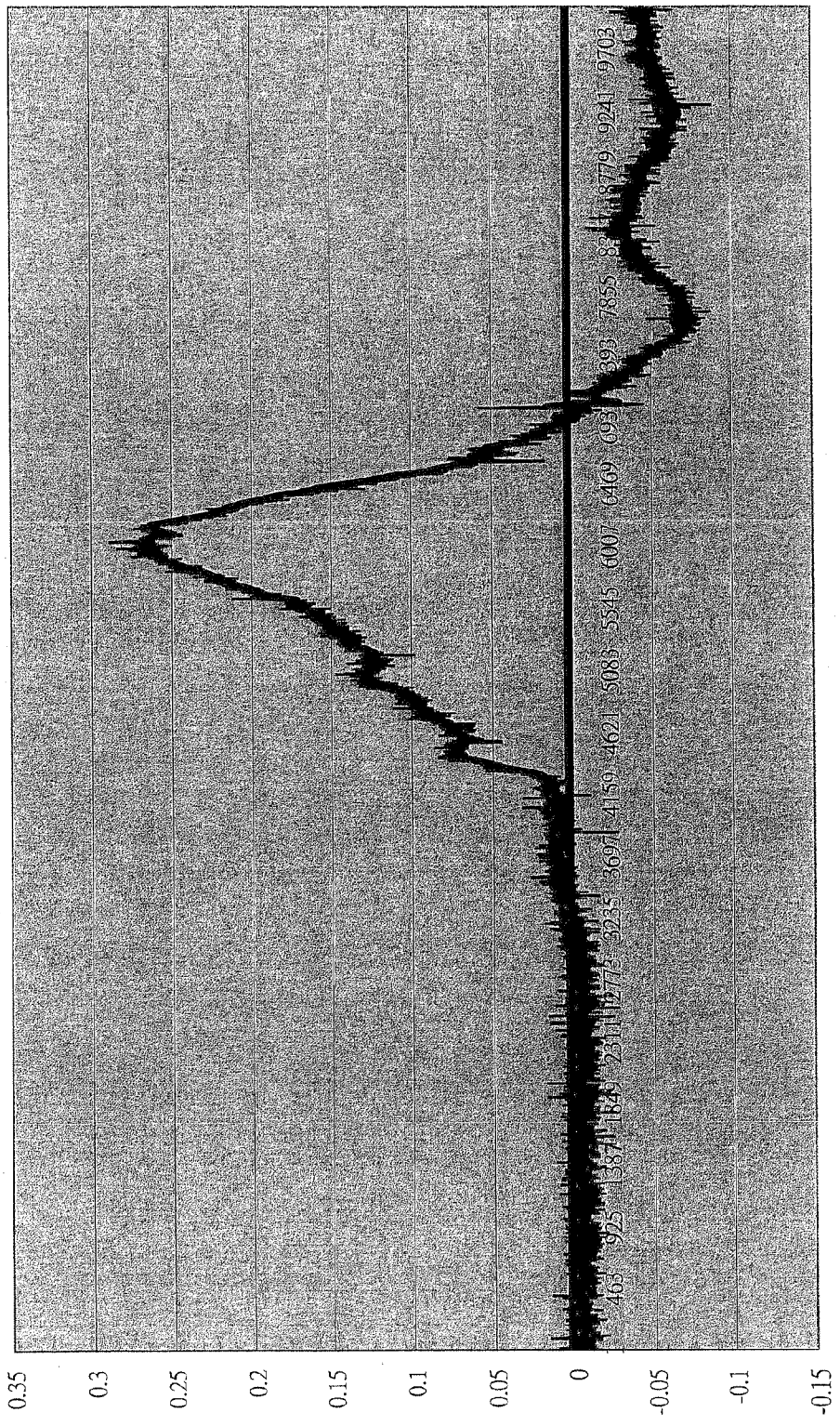
Power Saving Mode
StandBy
Setup
Detecting
52
54
58
56
CLK. Velocity Display
60
62
64
Recall
66

Fig. 4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0.2
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1849
2311
2773
3235
3697
4159
4621
5083
5545
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7855
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9241
9703

Fig. 5

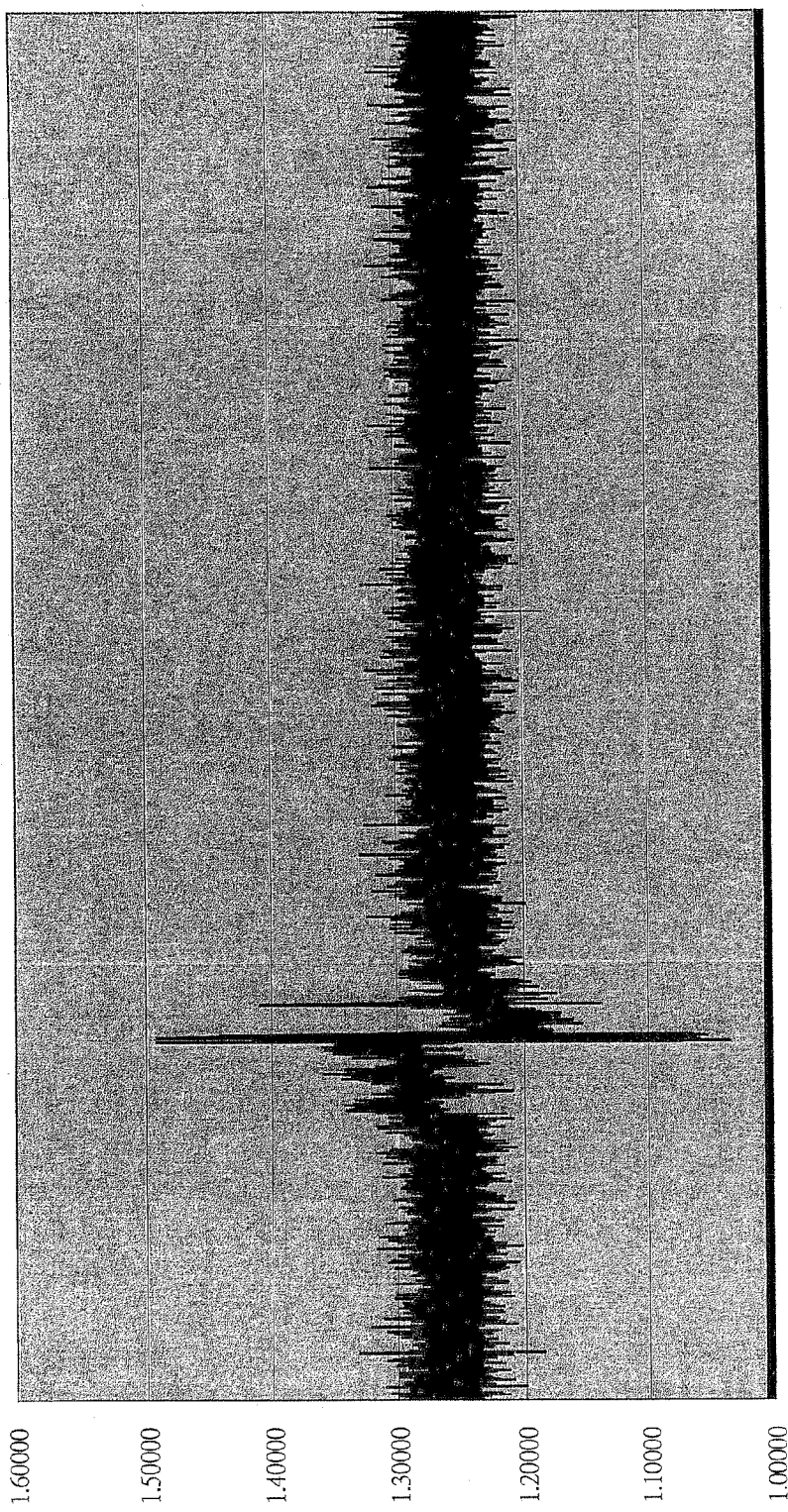
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Fig. 6

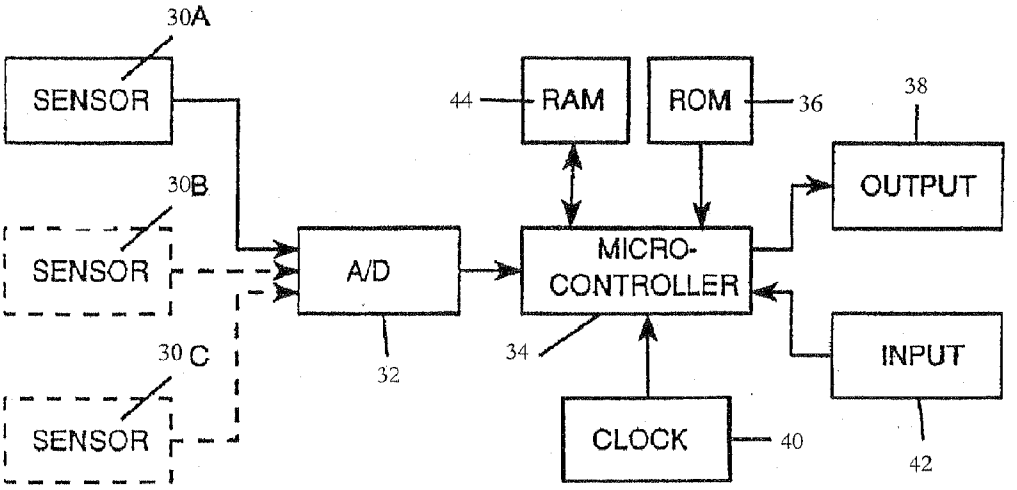
30A
SENSOR
30B
SENSOR
30 C
SENSOR
A/D
32
44
RAM
ROM
36
38
OUTPUT
MICRO-
CONTROLLER
34
INPUT
CLOCK
40
42

Fig. 7

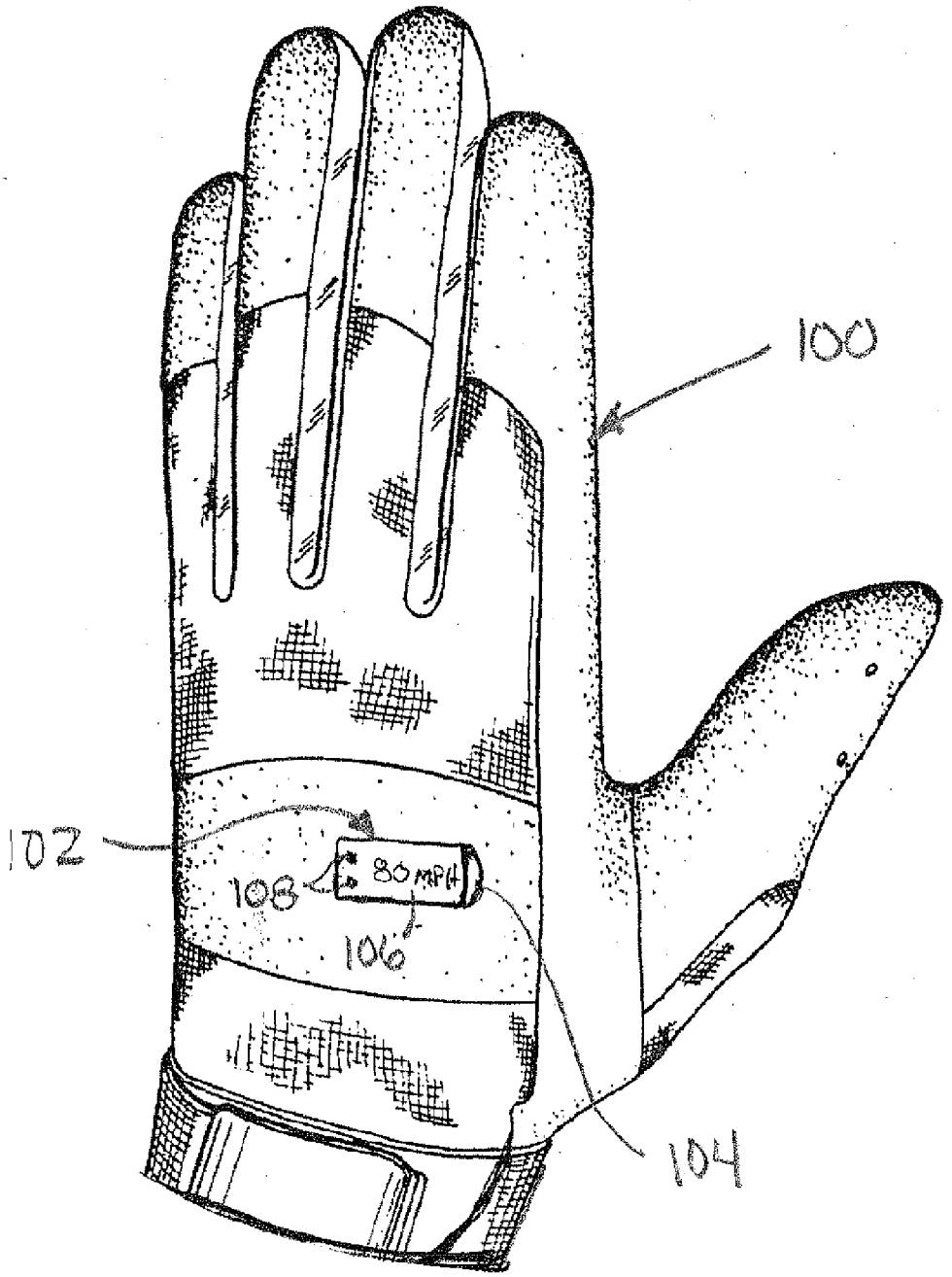

FIG. 8

BAT SPEED SENSING DEVICE AND METHODS

CROSS REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE

[0001] This patent application claims the benefit of U.S. provisional patent application Ser. No. 60/663,660, filed Mar. 21, 2005, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] This invention relates to a device and method for determining the velocity of a bat swing, either when hitting a ball or practicing. More particularly, this invention relates to a method and apparatus for sensing the velocity of a baseball bat when, wherein the apparatus and method provide for selective usage in association with a batting glove.

[0003] It is known that the flight of a struck baseball and its ultimate traveling distance is determined in part by the velocity of the baseball bat at the time of impact with the ball. Other factors that will influence the speed of the ball include the individual characteristics of the bat and the ball, the incoming or pitch speed in the case of a pitched ball, the orientation of the bat when it hits the ball, the point of contact at which the bat hits the ball, and environmental factors, such as wind resistance, that operate on the ball while it is in flight. Of these factors, there are four that are within the batter's control—the bat's characteristics, which is determined by the type of bat the batter selects, the bat's velocity, the bat's orientation, and the point of impact. Upon selection of an appropriate bat and stance for a particular swing, the batter's success in executing the hit is primarily reduced to controlling the bat's position and velocity at impact.

[0004] Others have employed a variety of means in seeking to either directly measure the speed of a baseball that was hit by a bat, or measuring a baseball bat's velocity, and thereby indirectly inferring the baseball's potential speed. These concepts generally relate to swing-practice instructional devices that may be used for comparative purposes, and for the batter to better recognize, present swing characteristics.

[0005] With respect to measuring the implement's velocity, some have developed fixed systems, such as those associated with a batting tee, which, of course, is unsuited to making measurements during ordinary play. Others have developed devices that measure bat speed and swing tempo using light beams and/or radar pointed at the device either from the ground directly below or near the batter, or from a significant distance away from the bat. Others have developed relatively small systems but which still require attachment to the bat, which is not conducive to use in ordinary play. Still others have developed systems in which the baseball bat itself is instrumented, which is expensive, and which will likely undesirably alter the characteristics of the bat or be subject to damage if used to hit a ball.

[0006] Further limitations and disadvantages of traditional or proposed devices that purport to measure the speed or velocity of sports swing impactors will become apparent to one skilled in the art through comparison of such systems with the present invention, as set forth in the remainder of this application.

SUMMARY OF THE INVENTION

[0007] There is a need for baseball bat velocity sensing apparatus and method, which avoids the drawbacks of prior art systems. This need is met in the present invention, which employs at least one sensor that may be selectively attached to a batting glove. To facilitate use of the system and avoid interference with the batters swing, swinging or hitting characteristics of the bat, the apparatus of the present invention is selectively positioned in association with the batter's hands during his/her swing. The apparatus provides an output that is responsive to swing movement, and measures the velocity of the swing and bat speed for display to a user. The method and apparatus of the present invention may be employed with any type of bat and regular bats may be used without any required modification or attachments. Thus, for example, bat velocity may be determined in the ordinary course of a baseball game. The invention is easily and conveniently used without materially altering or interfering with the batter's ordinary swings. Accordingly, the bat speed measuring apparatus of the present invention embodied as a separate, small, lightweight, self-contained device, or integrated into a batting glove for use. Such a device is selectively secured in association with a batter's hands above the wrist, to accurately monitor swing velocity, such as via selective attachment to a batting glove or integration into the glove.

[0008] The invention uses at least one or more sensor from which bat barrel velocity is determined, the at least one sensor disposed in a substantially fixed relationship to the bat during a swing to be monitored. A sensor may be disposed to measure the centripetal acceleration along the shaft of the bat, and/or to measure acceleration in one or more planes that are generally perpendicular to the bat's shaft. Using two or more sensors, the bat face orientation and/or direction of motion at impact with a ball may be determined.

[0009] The invention also provides the batter with a convenient, light weight chronometer or timepiece which does not restrict or adversely affect the user's sporting activities. In accordance with this aspect of the invention, the same circuitry which provides motion information may be used to provide a watch function. Thus it will be possible to omit one's regular watch during baseball play or a practice session. The invention may also provide for comparing a swing with one or more prior swings, or may provide an indication whether and by how much the bat speed is increasing or decreasing from swing to swing or over a number of swings. The device also may store a number of the fastest bat speeds from a predetermined number of the batter's previous swings. It is also capable of either automatically or manually switching between its clock, velocity, speed ratio modes or other modes. The device can also be reset to erase the previous swing memories. Although the device is lightweight, it is rugged, and is configured with a shape and design, which allows positioning in association with a glove adjacent to and above the wrist of the user without affecting the users normal swing. Other objects and features of the invention will be understood with reference to the specification, claims and drawings.

[0010] These and other advantages and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the

following description and drawings. The description should not be literally construed as a limitation of the invention. Rather, the invention should be interpreted within the broad scope of the further appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] One can better understand the present invention when one refers to the accompanying drawings, wherein identical parts are identified with identical alphanumeric reference characters, and wherein:

[0012] **FIG. 1** is a perspective of an embodiment of the apparatus, selectively attached to a batting glove.

[0013] **FIG. 2** is a perspective view of the embodiment as shown in **FIG. 1**, showing function buttons and display mode.

[0014] **FIG. 3** is a diagram illustrating an embodiment of functional operation of a device according to the present invention.

[0015] **FIG. 4** is a schematic flow diagram showing the various mode and select options and typical or potential event sequences within the underlying operational functions of the present invention.

[0016] **FIG. 5** is a graph illustrating a potential accelerometer sensor output during a potential or typical non-impact swing of a swing impactor such as a baseball bat.

[0017] **FIG. 6** is a graph illustrating a potential accelerometer sensor output after impact, associated with a swing in which the bat hits the ball.

[0018] **FIG. 7** is a block diagram illustrating the main functional components of a processor that may be used in the invention.

[0019] **FIG. 8** is a perspective of an embodiment of the apparatus, selectively integrated into a batting glove.

DETAILED DESCRIPTION OF THE INVENTION

[0020] When a bat is swung, it follows a curved path about two connected centers of rotation. A first center of rotation is located generally between the batter's shoulders. A second center of rotation is formed by the batter's wrists. At the time when the bat strikes the ball, as the batter moves his wrist, the bat is generally aligned with the centers of rotation, and the direction of motion of the batter's hands is generally parallel to the direction of motion of the bat.

[0021] A motion sensor disposed between the centers of rotation, e.g., between the shoulders and wrists, will not respond to motion about the second center of rotation. A sensor disposed between the second center of rotation and the bat will respond to motions about both centers of rotation. A bat-mounted sensor will experience the greatest motion if mounted on the bat's face, and this location will provide a given sensor with the largest signal output and measurement accuracy. However, there are problems, such as the effect on the bat's swinging and hitting characteristics, associated with disposing a sensor at the center of the bat's body or hitting surface.

[0022] It has been discovered that a sensor may be disposed not on the bat's body, but generally at or near the grip end of its handle, and provide an inferential determination of bat speed that is sufficiently accurate and repeatable to be useful for many purposes. Thus, if a batter wears a device on the hand, an accurate velocity measurement of the bat speed during a swing may be made. The positioning in association with a batting glove positions the device at a location to capture velocity data created by the swing at a point above the users wrists and this second center of rotation. **FIG. 1** shows a baseball batting glove **10**, worn on a player's hand, which is provided with a bat speed sensing device **12** at a location where the device **12** does not interfere with the batters swing. In **FIG. 1**, a bat sensing speed device **12** is shown as being selectively secured to the batting glove **10**. The batting glove **10** may include a closure or size adjustment mechanism including mating pieces of material such as that sold under the trademark Velcro. Adjacent and above the wrist, a further Velcro attachment surface can be exposed on the back of the glove **10**, and device **12** mounted at this location with a mating Velcro portion so that the device **12** may be detachably, selectively secured to the glove **10**.

[0023] The mounting location on the batting glove allows the device **12** to accurately capture velocity information upon swinging, while avoiding any interference with the bat or ability to hit a ball. Other device mounting locations and mounting means may also be provided, as long as the device is positioned above the wrist in association with the batter's hand. Each mounting location for a sensor has certain relative advantages and disadvantages. Glove or hand mountings are preferred because the device, once mounted, will always be in place for measuring a swing with any bat. As shown in **FIG. 2**, a device **12** according to an embodiment includes a housing **14**, which may be molded of plastic or the like. The housing **14** is designed to have a low profile, being miniaturized so as not to interfere with the normal use of the batting glove. For example, the housing **14** may be configured to have a size of approximately 2 inches long by one and one-eighth inch height and one-quarter inch thick, so as to fit easily on the back of the hand on the glove as shown. The housing **14** may have an attachment mechanism on its bottom surface for selective engagement to glove **10** as otherwise described. The housing **14** may also be configured to have shaped portions **15** and **16**, formed on the bottom and outside surfaces of the housing **14**, which allow a user to swing without interference with housing **14**. The portions **15** and **16** are shaped and positioned such that upon swinging, as the wrists move through the swinging motion, the housing **14** does not contact the wrists or arm of the user. The housing **14** may be configured in separable prices to allow easy access to an internal battery supply for replacement thereof. A plurality of function buttons **17** or other suitable interface for use in operating a processing system associated with device **12**. A display **18** is provided to indicate measured results in various modes of operation, and/or provide other functions such as the display or time/date or other information. Other suitable indication means, such as audio or any other suitable approach to communicate information.

[0024] **FIG. 3** is a block diagram showing an example of the functional operation of device **12** according to an embodiment. In device **12**, a processing system comprising motion-responsive sensor **20** is disposed within housing **14**. The raw sensor output will typically require processing and conversion to enable output of information representing determined bat velocity and/or other parameters, and so the

output of the sensor is coupled to a processor **22** for these purposes. Processor **22** controls an externally perceivable output, such as a visual display **18**, for providing bat velocity and other information. It is contemplated that other outputs, such as a synthesized speech output, may be used.

[**0025**] The mounting **24** provides a means for selectively associating the housing **14** with a batter or bat to be swung. The particular mounting **24** will depend on the location intended for mounting, and as discussed above may include a snap closure portion, a Velcro portion, or other suitable mounting systems. Mounting **24** is preferably physically disposed on the opposite side of housing **14** from the display **18**. A control input or several inputs **26** may be provided to control processor **20**. Such inputs may be provided for the purpose of operating the device **12** in one or more modes of operation. The control inputs **26** may be used to initiate measuring for sensing velocity of a swing is to be made, or the system may automatically determine a swing is made upon receipt of a signal of a predetermined type. The user inputs **26** may also be used to reset the device after a swing, to provide input parameters to calibrate the device or customize its output for a particular batter or bat, and the like. Such inputs **26** may physically take the form of a switch or button, or any suitable interface. In this regard, it is noted that the device of the present invention may provide other functions in addition to bat velocity determination. For instance, processor **22** may include a clock function, the time output of which may be visible on display **18** together with or alternately with the bat velocity. Thus the device may function as a sports watch, which is often advantageous when seeking to avoid damage to expensive dress watches that are more suitable for occasions other than playing baseball. A watch function is preferably provided, and control inputs **26** may function to set the time. Several displays may be provided so that the alternate functional modes can be visible simultaneously. If only a single display is provided, control inputs **26** may function to switch the device between its watch and bat speed monitoring functions. This may also be accomplished automatically, for instance by converting from a watch function to a bat monitoring function when a motion threshold has been exceeded, and returning the display to a time display after a predetermined interval. Other functions, such as scorekeeping or data input functions, may also be incorporated into processor **22** with necessary inputs provided by control inputs **26** and with outputs displayed on display **18**.

[**0026**] As seen in **FIG. 4**, an example of operation of the velocity recorder **12** will be described. In a standby mode at **50**, the device **12** may provide a display of time or other information via the display **18**. Using the user inputs **26**, a detecting mode may be selected at **52**, with an indication to the user, such as by flashing of display information. During the detecting mode, a user may swing a bat, and swing speed will be detected at **54** and the processor will determine the velocity of the swing and provide a display thereof at **56**. The user may detect further swings by selection of detecting mode at **58**, or automatically if no further swing is detected in a predetermined period at **60**. The velocity display **56** may also be set to provide a flashing circulating display of the current measured swing velocity, and/or whether the current swing speed is greater or less than a prior measured swing speed at **62**. For example, the processor may be configured to display the current swing speed and intermittently to display the percentage comparison of the current swing to a prior swing, such as the immediately prior swing speed. Thus, the display may intermittently flash the percentage greater or lesser than the prior swing speed, to allow a user to hone the swing to a consistent velocity or attempt to increase the velocity accordingly. The device **12** may also be configured to have a recall mode **64**, wherein upon selection, a display of a predetermined number of prior swing speeds may be displayed in a circulating manner at **66**. For example, the last 10 measured swing speeds may be displayed, to afford the user a significant history of measured swing speeds for comparison and evaluation.

[**0027**] The following, with reference to **FIG. 4**, this embodiment describes the possible operation of device **12**, and is not meant to be a limitation on the potential variations in its operation: buttons, i.e., mode, or on/off and select or start, are used to operate a velocity computer and other operations. Mode Button: Pressing the mode button allows the user to select or move from one mode or function to another, such as standby, detecting, display, recall or reset. In the setup process, pressing the mode button circulates the preferences, whereas pressing the select button changes or scrolls the value. As a further example, pressing the mode button for more than five seconds resets the velocity computer, or a clear button may be provided. Select Button: In the recall mode, pressing the select button circulates the recorded data. Pressing and holding for more than two seconds allows the user to enter the setup process. In the setup mode, pressing and holding the select button for more than two seconds will quit the setup process. Liquid Crystal Display (LCD): In the display mode, the current velocity and/or other data is circulated and displayed on the LCD every seven seconds. In detecting mode, the display may show the current velocity without flashing. In recall mode, the display circulates the from the highest to the lowest of the top ten bat speeds or the like. In the standby mode, the current time and/or other information may be displayed.

[**0028**] A variety of sensor technologies may be employed to measure the bat barrel velocity according to the present invention. Sensors which respond directly to their speed of movement, such as air pressure sensors, may be employed. However, it is believed that it is preferable to use acceleration sensors, particularly monolithic accelerometers. As the device **12** according to the invention may be used when hitting a ball, the impact of a hit ball and the vibrations caused by such impact, can adversely affect proper measurement. The sensor **20** and processor **22** may therefore be of a type which are ruggedized to avoid damage by such vibrations, and adapted for high speed processing for capturing information relating to bat speed prior to impact and induced vibrations.

[**0029**] To determine bat velocity at a desired impact point when acceleration sensors are used, their outputs can be processed by time integration. Alternatively, for a body moving in an arc, its speed at a point may be determined from its angular velocity at that point, and its angular velocity at that point may be determined from its centripetal acceleration. As a bat effectively moves in a circular arc, or an approximately circular arc for sufficiently short arc lengths, about a center of rotation C, near its grip, it is possible to measure velocity in this manner. The bat is disposed at a radius R_h from the center of rotation, and a sensor S is disposed intermediate between these points, at a

radius R_s. Both bat and sensor S effectively move at angular velocity ω about the center of rotation.

[0030] The sensor S may be disposed to measure its radial or centripetal acceleration, i.e., its acceleration in the direction of the Z axis (axis parallel to the bat's longitudinal axis). The angular velocity ω may then be determined as $\omega=\sqrt{(A_s/R_s)}$, where A_s is the acceleration at S. The magnitude of the bat velocity may then be determined as $V_h=\omega R_h=(R_h/\sqrt{R_s})\sqrt{A_s}$. The invention may therefore utilize centripetal accelerometer sensors mounted generally near the wrist of the batter and/or near the grip of the bat. While the values of R_h and R_s may be measured, it is simpler and more practical to compute the factor $R_h/\sqrt{R_s}$ by correlating acceleration and measured bat velocity. In the computation, the velocity of the bat at a point adjacent the barrel of the bat, being the "sweet spot" that a hitter desires the ball to hit. The measurement is thus taken at an average distance from the grip of the bat to measure velocity at a point centered about twelve inches from the top of the bat in an area that, dependent upon bat length, will be centered in a region approximately six to eight inches around this location.

[0031] Sensor motion data will be generated throughout a swing. Since the information desired is the bat's velocity at the time of impact or at a point where impact should occur with a ball, it is desirable to obtain as much information as possible before impact occurs. **FIGS. 5 and 6** are graphs illustrating sensor output versus time during a swing. The swing commences at time t_1, after which the output increases to a maximum typically at the time of impact t_2, after which the output decreases to zero at the time of completion of the swing t_3. Typically the impact will cause excessive noise and an acceleration profile which is not representative of the bat speed. The processing circuitry may therefore be programmed to capture data only until the detection of impact, such that any adverse effects from the impact are avoided. The signal from the sensor(s) is therefore analyzed to determine the time of impact, and process data prior to this point for producing the indication of bat speed. Alternatively, the effects of any such noise may be minimized by appropriate filtering, and the peak sensor output will be selected as the output representing bat velocity.

[0032] **FIG. 7** is a block diagram illustrating the functional signal acquisition and processing components which may be used in a device according to the invention. These components are powered by a battery (not shown). At least one sensor **30**A is provided; one or more additional sensors **30**B and/or **30**C may also be provided. Such sensors **30** provide an electrical output which is a function of their motion. The sensor blocks **30** shown may include signal conditioning circuitry such as amplifiers. The output of each sensor **30** is supplied to the analog input of an analog-to-digital converter **32**, the digital output of which is supplied to low power microcontroller **34**. Microcontroller **34** operates on the received sensor data in accordance with a program stored in read-only memory **36**. The bat velocity determined by microcontroller **34** is provided to the batter by output device **38**. A system clock **40** is provided to synchronize the operation of microcontroller **34**, and if a watch function is included in the device, system clock **40** may control this function. An input **42** to microcontroller **34** is provided for any calibrating, setting, resetting, and the like functions which may be necessary. It will be understood that many of these functional blocks may be provided by a single piece of hardware.

[0033] A variety of methods may be employed to determine bat speed using a system as shown in **FIG. 7**. As has been described, a single accelerometer may be disposed to measure centripetal acceleration along the Z axis. A sensor may also be disposed to measure movement along the Y axis (axis perpendicular to Z axis in the direction of the bat's movement); in this case, if it is an accelerometer, its output may be integrated over the swing period until impact, and if it is a velocity sensor, its output may be directly used to determine bat velocity. Alternatively, for greater accuracy, a pair of sensors may be used. For instance, an acceleration or velocity sensor may measure motion along the Y axis, and a centripetal accelerometer may measure acceleration along the Z axis, and their outputs averaged or otherwise combined to reduce measurement error. A pair of sensors may also be used to determine the bat's direction at impact. Given that the X-axis is perpendicular to both the Y and Z axes, a pair of acceleration or velocity sensors may be disposed to measure in the X-Y plane, for instance at Y+45° and Y−45°. Their outputs may be combined to determine the bat speed at impact, and the difference in their outputs may be used to determine motion in the X direction at impact, provide feedback on the swing plane of the bat Such a determination may also be made directly by a pair of sensors, one measuring in the X direction and one measuring in the Y direction. An array of three sensors may be disposed to measure in the Z direction and in the X-Y plane to enable virtually complete information regarding bat face movement to be inferentially determined. Any such information derived from the sensors may be displayed.

[0034] Turning now to **FIG. 8**, a further embodiment is shown, wherein the apparatus according to the invention is integrated into a batting glove for use in monitoring bat swing velocity. The glove **100** has integrated therein a velocity monitoring device **102**. In this embodiment, the device **102** may be miniaturized to fit within a small pocket or sleeve **104**, to allow battery exchange when necessary, but otherwise is integral to glove **100** for use. A Velcro flap may be provided at the location of the sleeve **104** device where batteries may be accessed to maintain the device **102** in position for example. The device **102** may have a display **106** and operating buttons or the like **108** for implementing various operating modes or functions, such as similar to that described in prior embodiments. Alternatively, the device **102** may be simplified to monitor swing speed and the relationship to prior swing speeds automatically, without requiring the user to actuate different modes of operation or control. The size and positioning of the device **102** is such that it is effectively part of the glove **100**. The LCD display **106** may be the only part of device **102** that is visible, with the rest of the product beneath the surface of the glove. The glove may also have padding beneath the device **102** so as to make the glove **100** comfortable for use.

[0035] While particular embodiments of the invention have been shown and described, variations will undoubtedly occur to those skilled in the art without departing from the spirit and scope of the invention. To illustrate the invention, it is shown and described with respect to a preferred embodiment. This is not intended as a limitation, and other modifications or variations in the specific form shown and

described will be apparent to those skilled in the art and will fall within the spirit of the invention and the scope of the following claims.

1. An apparatus for determining the velocity of a bat swung by a batter comprising:

a housing with at least one motion responsive sensor having an output responsive to its acceleration, said output being computed by a measurement taken before an impact time of the bat with the ball or at the location of impact in a bat swing,

a means for detachably securing the housing to the hand of a user at a position above the wrist of the user, wherein at least one motion responsive sensor is arranged to measure radial acceleration along the bat's longitudinal axis; and

a processor utilizing the sensor output for computing an output representing the bat face impact velocity based upon the sensor output, said means defining R_h as the radius of the bat from the center of its rotation C, defining R_s as the radius of the sensor from C, and A_s as the output from the sensor, whereby the angular velocity of the bat is ω and is determined by the formula $\omega=\sqrt{(A_s/R_s)}$, and the speed of the bat barrel or head (V_h) is determined by the formula $V_h=\omega R_h=(R_h/\sqrt{R_s})\sqrt{A_s}$ and V_h is provided as the sensor output, with the determined velocity of a swing selectively displayed on a display associated with the housing;

wherein the processor allows for computing and displaying an output representing the ratio of last bat swing speed compared to a prior bat swing speed.

2. An apparatus according to claim 1, including a plurality of motion responsive sensors, each of which is responsive to acceleration in a different direction.

3. An apparatus according to claim 1, wherein said computing and displaying means includes means for computing and displaying an output representing bat face velocity based upon the output of said sensor at a time near said impact.

4. An apparatus according to claim 1, further including means for computing and displaying time via the display associated with the housing.

5. An apparatus according to claim 1, wherein the processor allows the storage and selective display of a plurality of measured bat swing velocities.

6. An apparatus according to claim 5, wherein data associated with at least ten swings and associated swing speeds are retained in memory.

7. An apparatus according to claim 1, wherein the housing also includes user selection actuators for controlling operation of the processor and selectively displaying various information relating to measured bat swing speeds or other information.

8. An apparatus according to claim 1, wherein a plurality of prior measured bat velocities are stored in memory and the a plurality of the highest measured bat velocities are displayed.

9. (canceled)

10. An apparatus according to claim 1, wherein the processor allows for selectively alternating between a time mode and a sensor mode.

11. An apparatus according to claim 1, wherein the processor allows for simultaneously displaying output representing bat velocity, bat velocity ratios and time.

12. An apparatus according to claim 1, wherein the measured swing speed is calculated based upon the time of impact of the bat with a baseball, generating a noise signal which is used to determine a time of impact, and calculating the speed of the swing prior to the impact.

13. An apparatus according to claim 1, wherein the housing is removably attached in the desired position by selective attachment to a batting glove worn by the user.

14. An apparatus according to claim 13, wherein the housing is removably attached to the glove by means of a hook and loop fastening arrangement.

15. An apparatus according to claim 13, wherein the housing is removably attached at a position on the back side of the hand portion of the glove, such that it does not interfere with the normal swing of the bat by the user.

16. An apparatus according to claim 13, wherein the housing is shaped with a curved portion at a position adjacent to the users wrist, to allow full rotation of the wrist without interference.

17. An apparatus for determining the velocity of a bat swung by a batter comprising:

a housing with at least one motion responsive sensor having an output responsive to velocity of the swung bat, said output being computed by a measurement taken before an impact time of the bat with the ball or at the location of impact in a bat swing,

a means for detachably securing the housing to the hand of a user at a position above the wrist of the user above the wrist of the user,

a processor utilizing the sensor output for computing an output representing the bat face impact velocity based upon the sensor output with the determined velocity of a swing selectively displayed on a display associated with the housing; and

wherein the processor and sensor are ruggedized to withstand the impact vibrations of hitting a baseball with the bat when the housing is attached in the desired position by selective attachment to a batting glove worn by the user.

18. An apparatus for determining the velocity of a bat swung by a batter comprising:

a housing with at least one motion responsive sensor having an output responsive to its acceleration, said output being computed by a measurement taken before an impact time of the bat with the ball or at the location of impact in a bat swing,

a means for detachably securing the housing to the hand of a user at a position above the wrist of the user, wherein the velocity of the bat is calculated at a position in a range of eight inches about a point positioned approximately twelve inches from the top of a bat; and

a processor utilizing the sensor output for computing an output representing the bat face impact velocity based upon the sensor output with the determined velocity of a swing selectively displayed on a display associated with the housing.

19. An apparatus according to claim 1, wherein the velocity of a current swing bat is calculated and compared to a previous swing, wherein the percentage relationship between the current and previous swing is selectively displayed on the display associated with the housing.

20. An apparatus according to claim 18, further comprising control actuators selected from the group consisting of:

a select function used to recall and display a plurality of stored bat swing velocities,

a start function that initiates the detection and storage of bat swing velocities,

a mode function used to selectively display the time, bat velocities, ratio of bat swing velocities and/or percentage relationship between bat swing velocities,

an on/off function that turns the at least one motion sensor either on or off.

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