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(54) **UNITLESS ACTIVITY ASSESSMENT AND ASSOCIATED METHODS**

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CPC ***A43B 7/00*** (2013.01); ***A43B 1/0036*** (2013.01); ***A43B 3/0005*** (2013.01);
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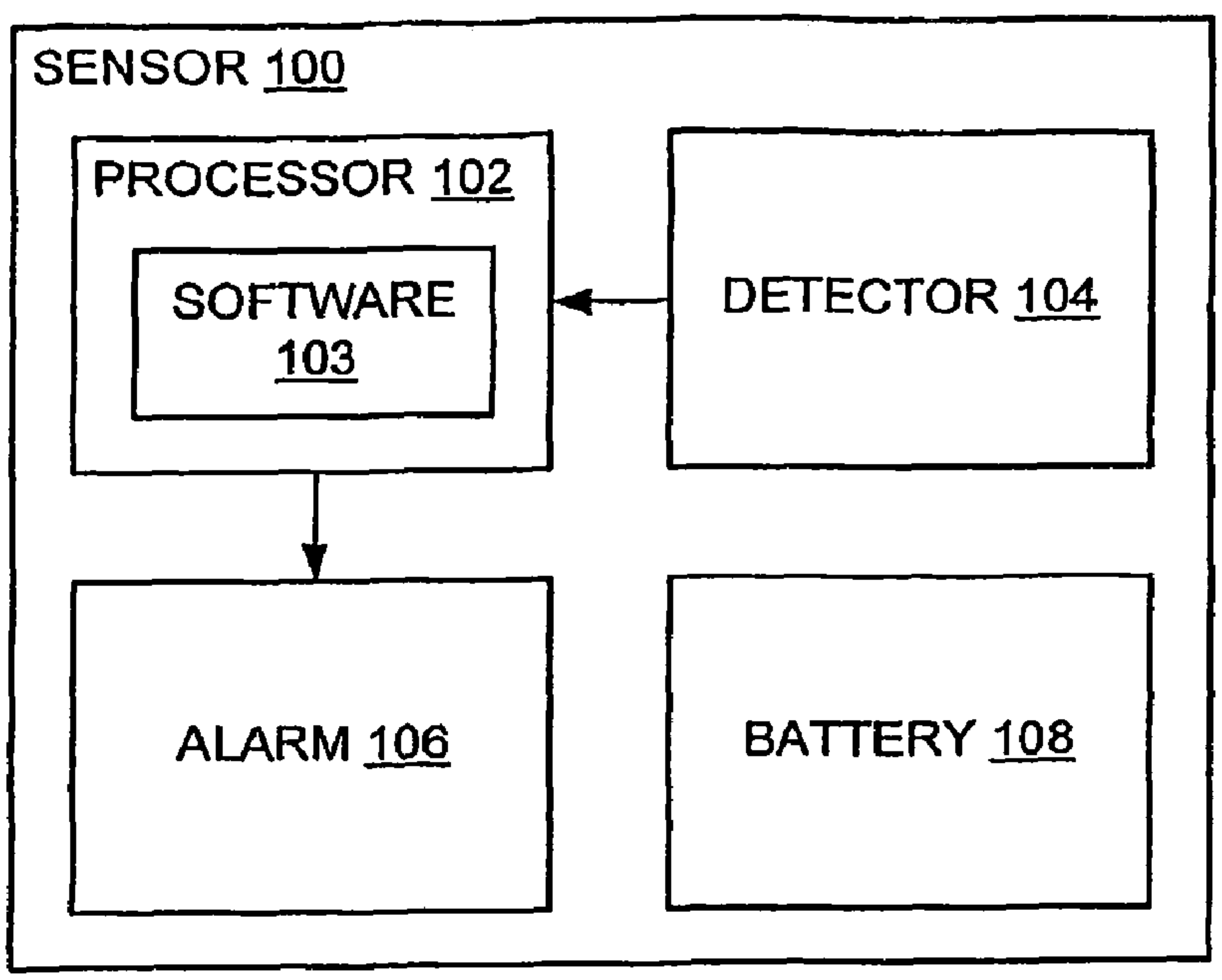
(57) **ABSTRACT**

A system assesses activity and displays a unitless activity value. A detector senses activity of a user. A processor reads sensed activity data from the detector. A display displays the unitless activity value. An enclosure houses the detector and the processor. The processor periodically reads the sensed activity data from the detector and processes the data to generate an activity number, the number being used to generate the unitless activity value based upon a maximum number and a display range.

20 Claims, 9 Drawing Sheets



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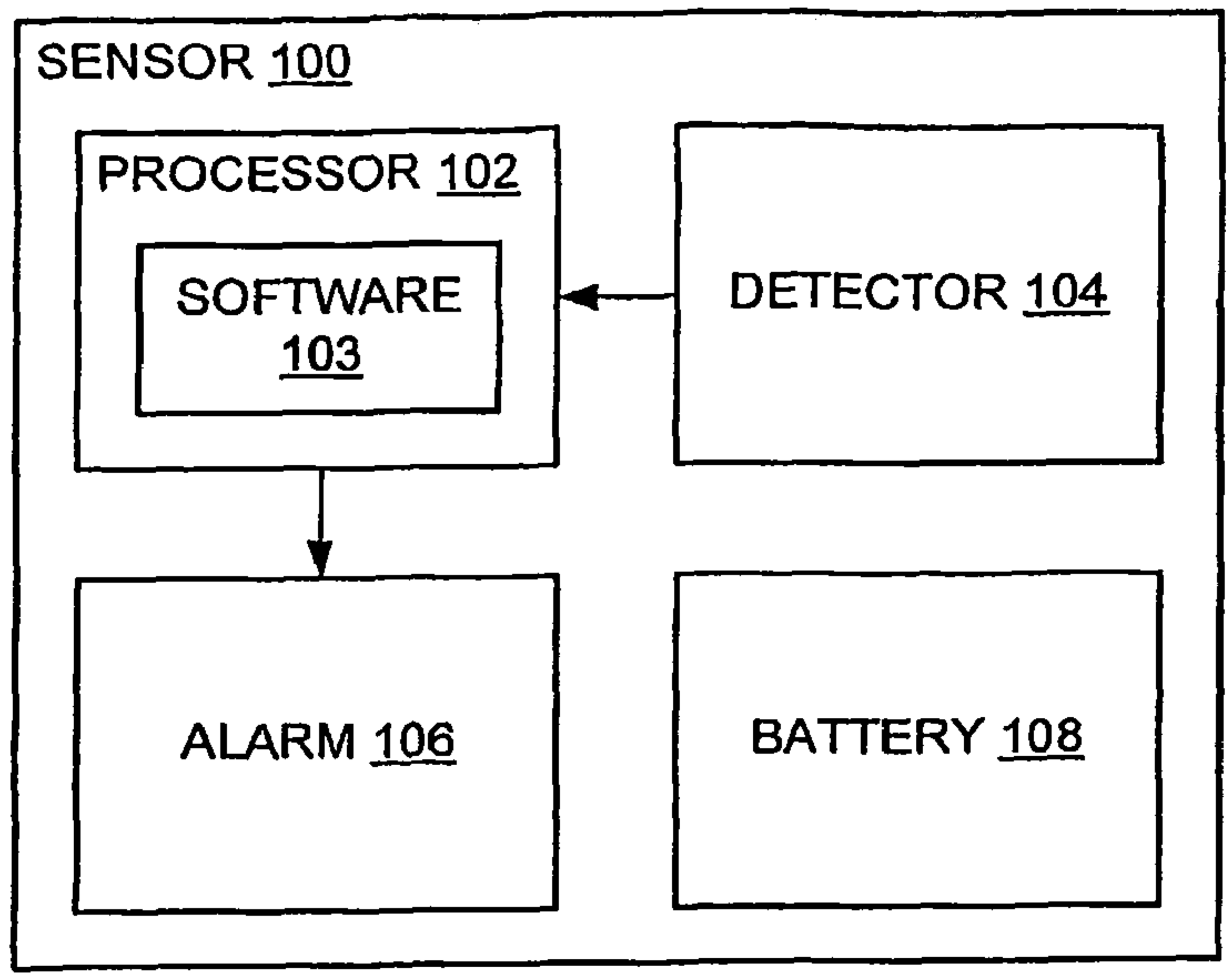

FIG. 1

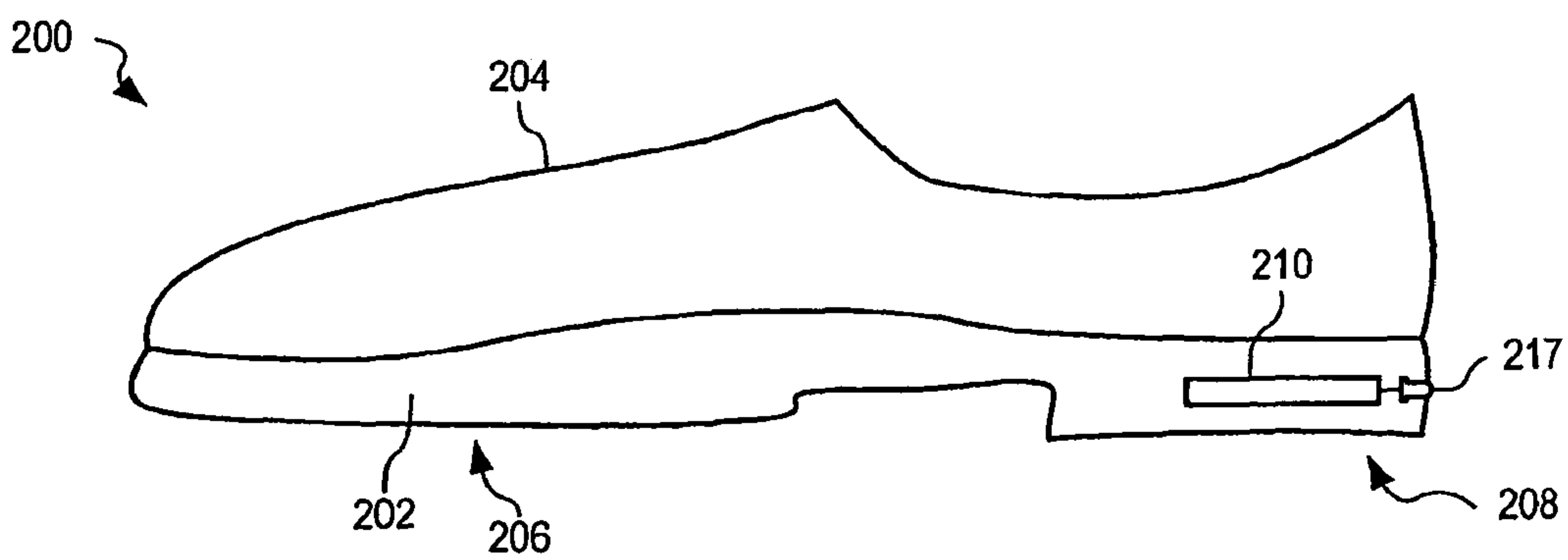

FIG. 2

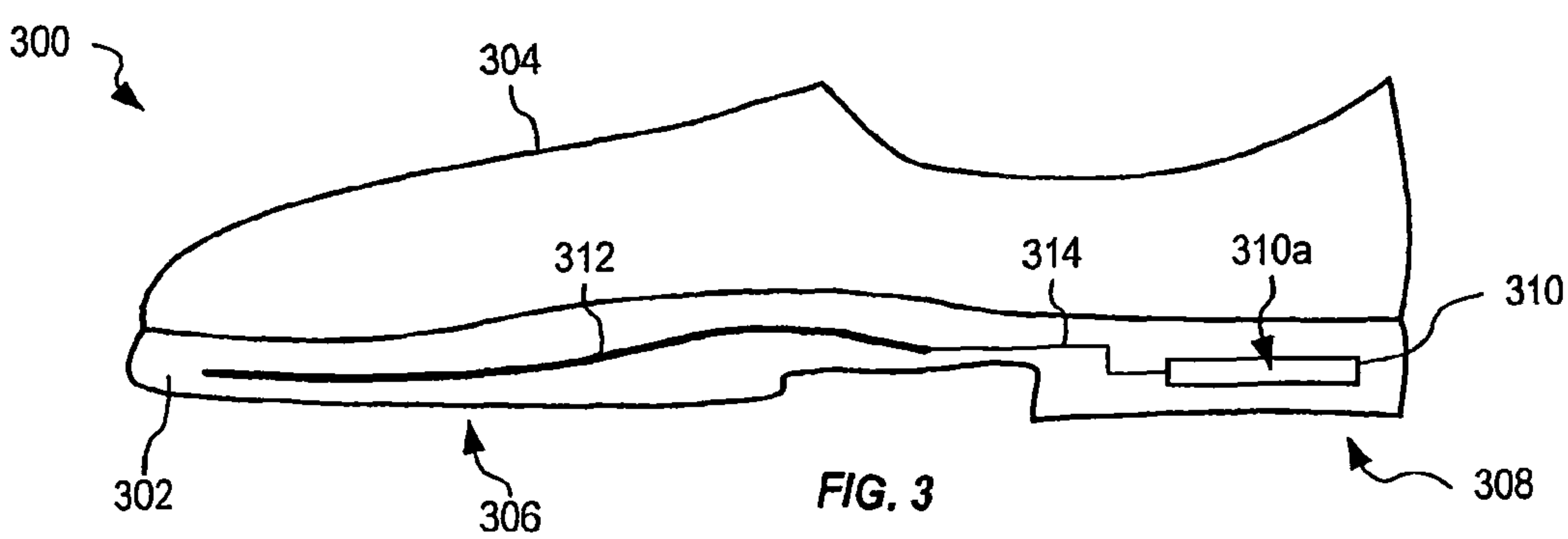

FIG. 3

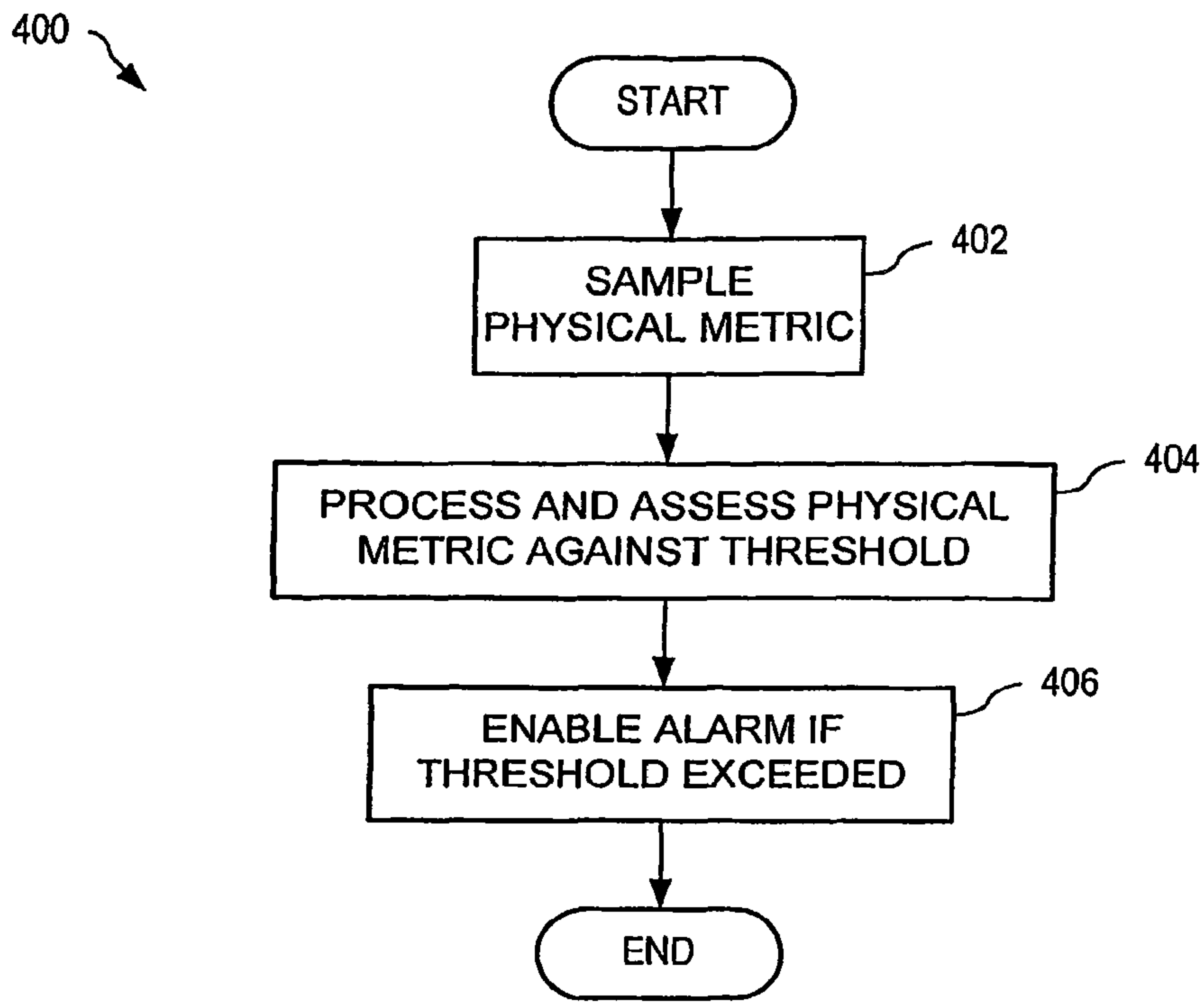
400
START
SAMPLE PHYSICAL METRIC
402
PROCESS AND ASSESS PHYSICAL METRIC AGAINST THRESHOLD
404
ENABLE ALARM IF THRESHOLD EXCEEDED
406
END

FIG. 4A

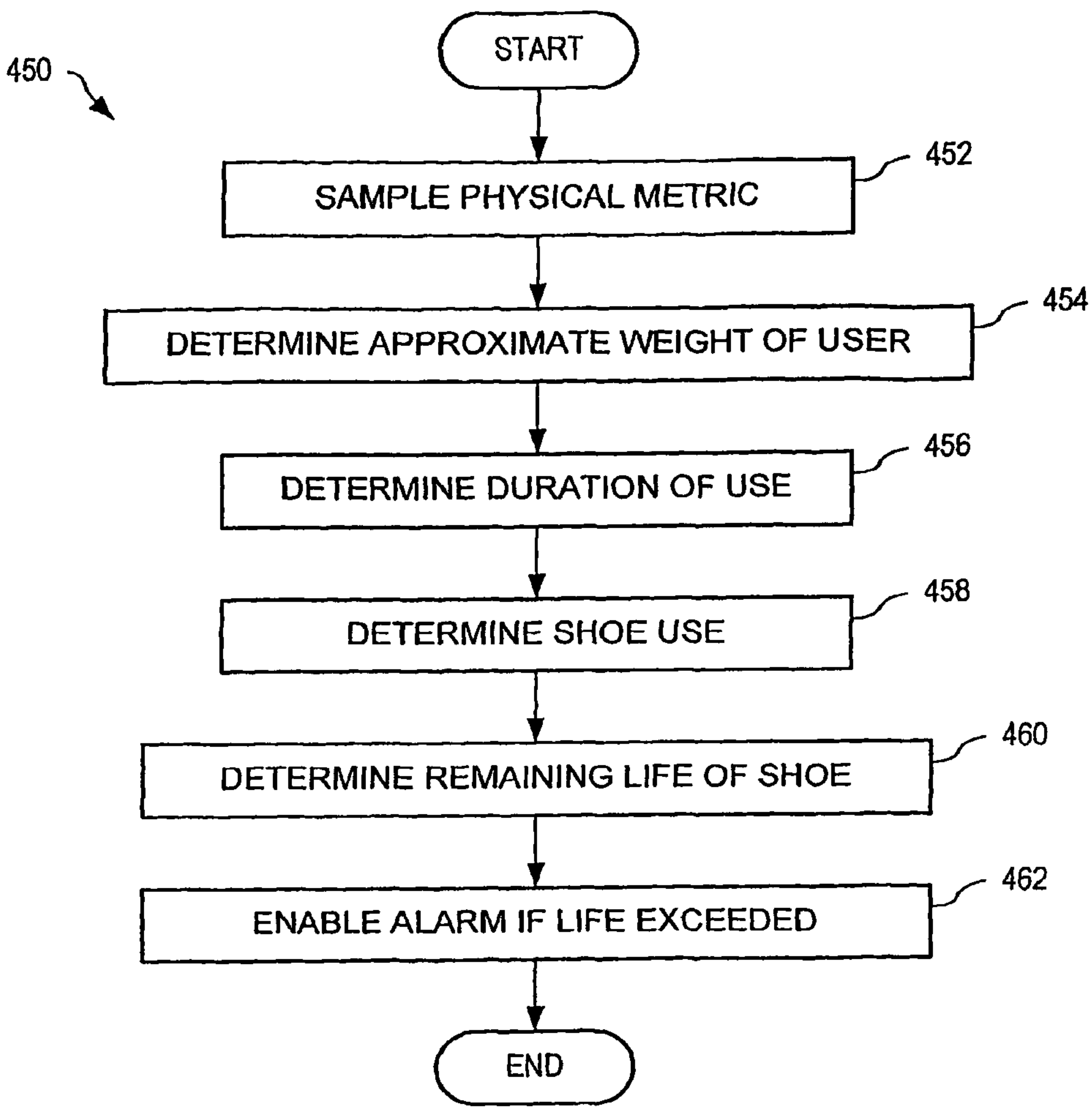
450
START
SAMPLE PHYSICAL METRIC
452
DETERMINE APPROXIMATE WEIGHT OF USER
454
DETERMINE DURATION OF USE
456
DETERMINE SHOE USE
458
DETERMINE REMAINING LIFE OF SHOE
460
ENABLE ALARM IF LIFE EXCEEDED
462
END

FIG. 4B

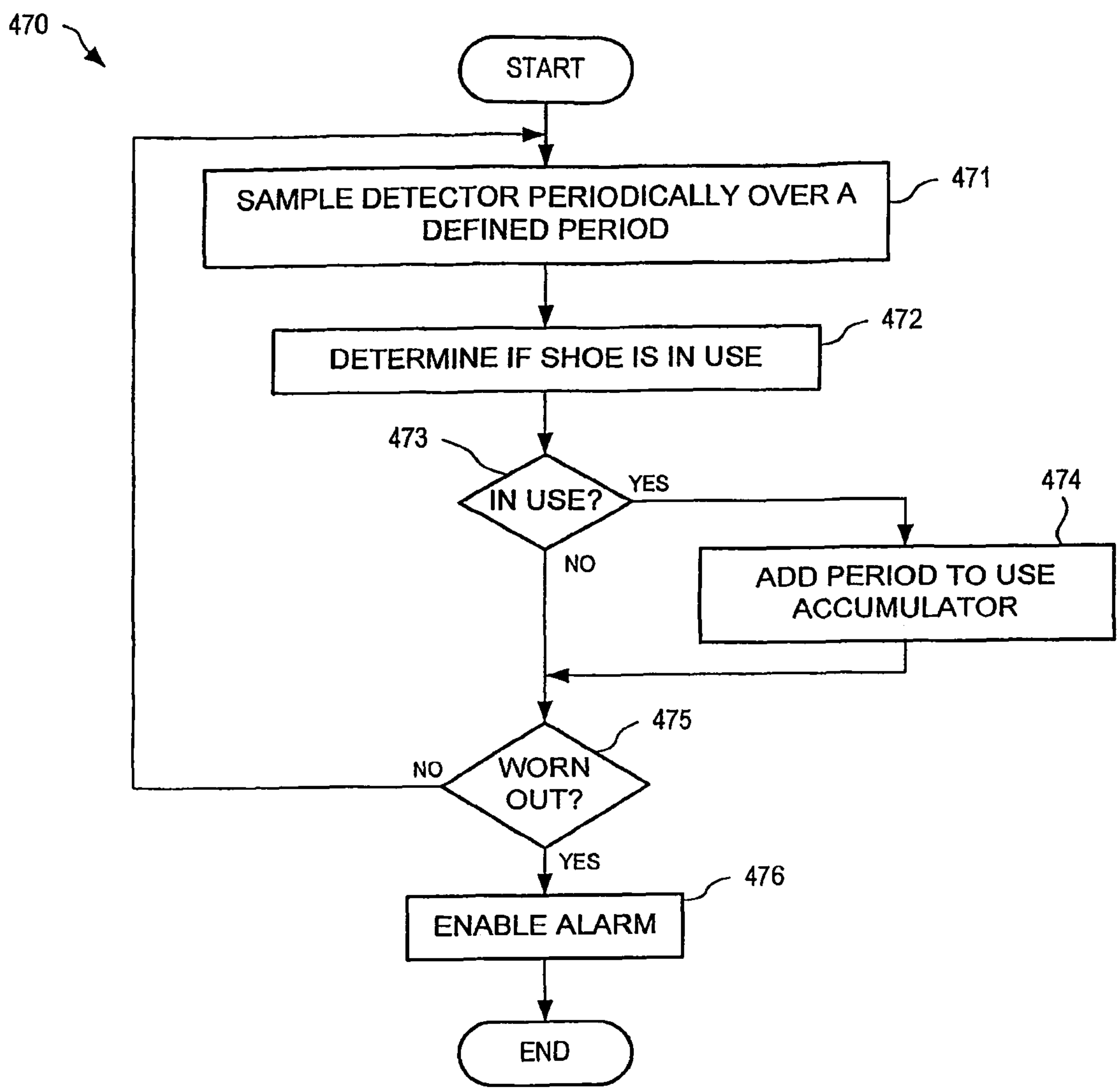
470
START
SAMPLE DETECTOR PERIODICALLY OVER A DEFINED PERIOD
471
DETERMINE IF SHOE IS IN USE
472
473
IN USE?
YES
474
NO
ADD PERIOD TO USE ACCUMULATOR
475
NO
WORN OUT?
YES
476
ENABLE ALARM
END

FIG. 4C

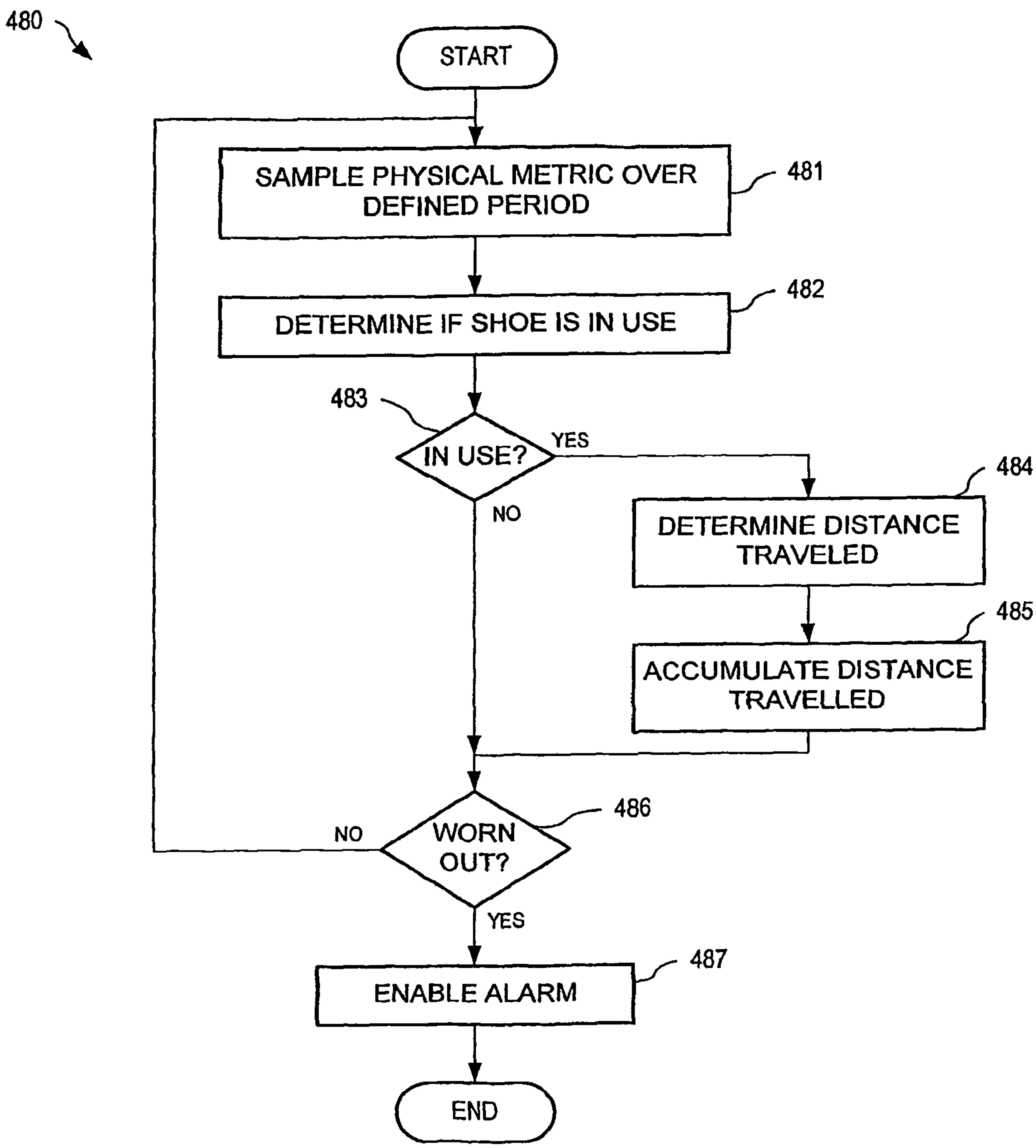
480
START
SAMPLE PHYSICAL METRIC OVER DEFINED PERIOD
481
DETERMINE IF SHOE IS IN USE
482
483
IN USE?
YES
NO
484
DETERMINE DISTANCE TRAVELED
485
ACCUMULATE DISTANCE TRAVELLED
486
WORN OUT?
NO
YES
487
ENABLE ALARM
END

FIG. 4D

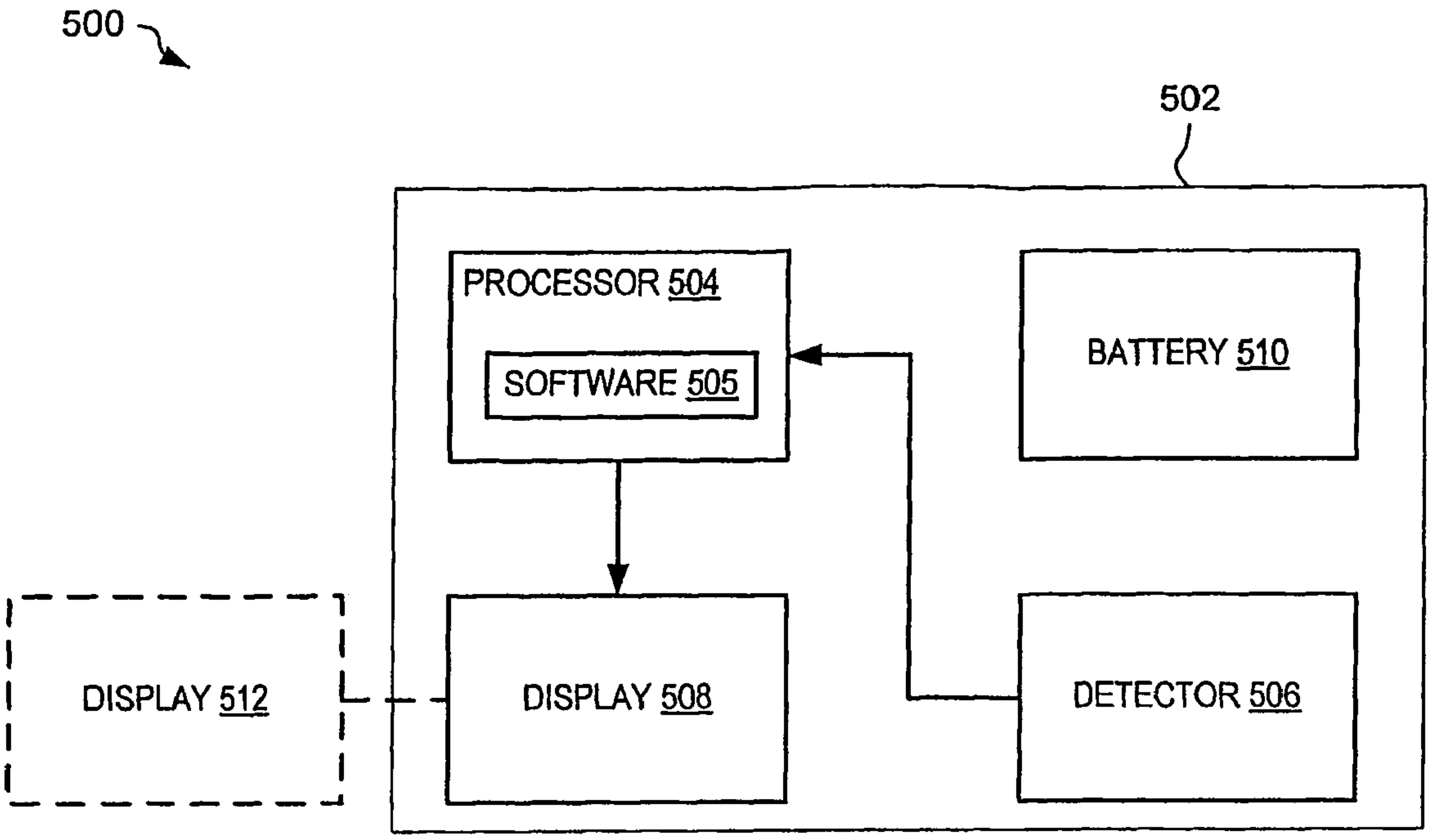
500
502
PROCESSOR 504
SOFTWARE 505
BATTERY 510
DISPLAY 512
DISPLAY 508
DETECTOR 506

FIG. 5

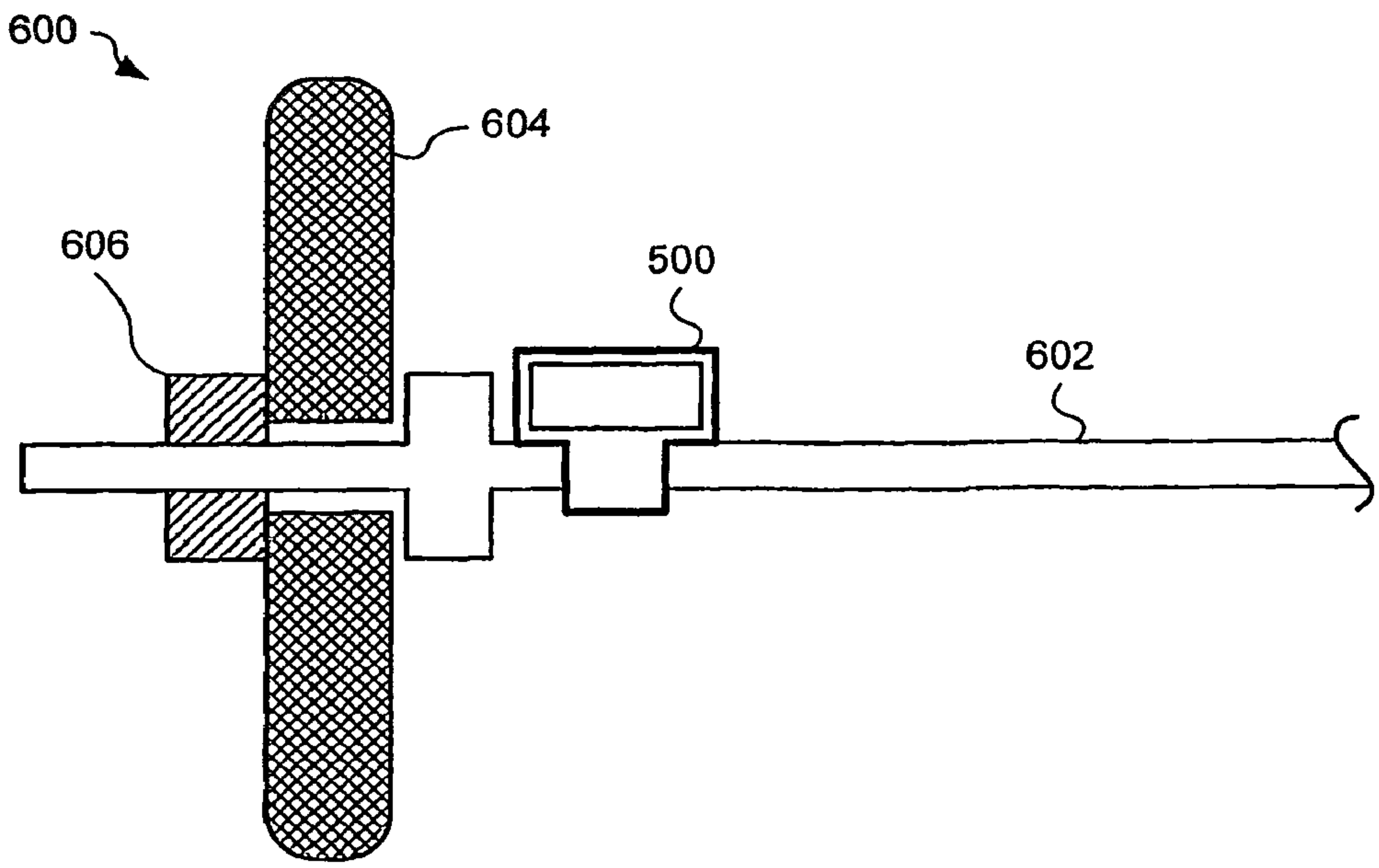
600
604
606
500
602

FIG. 6

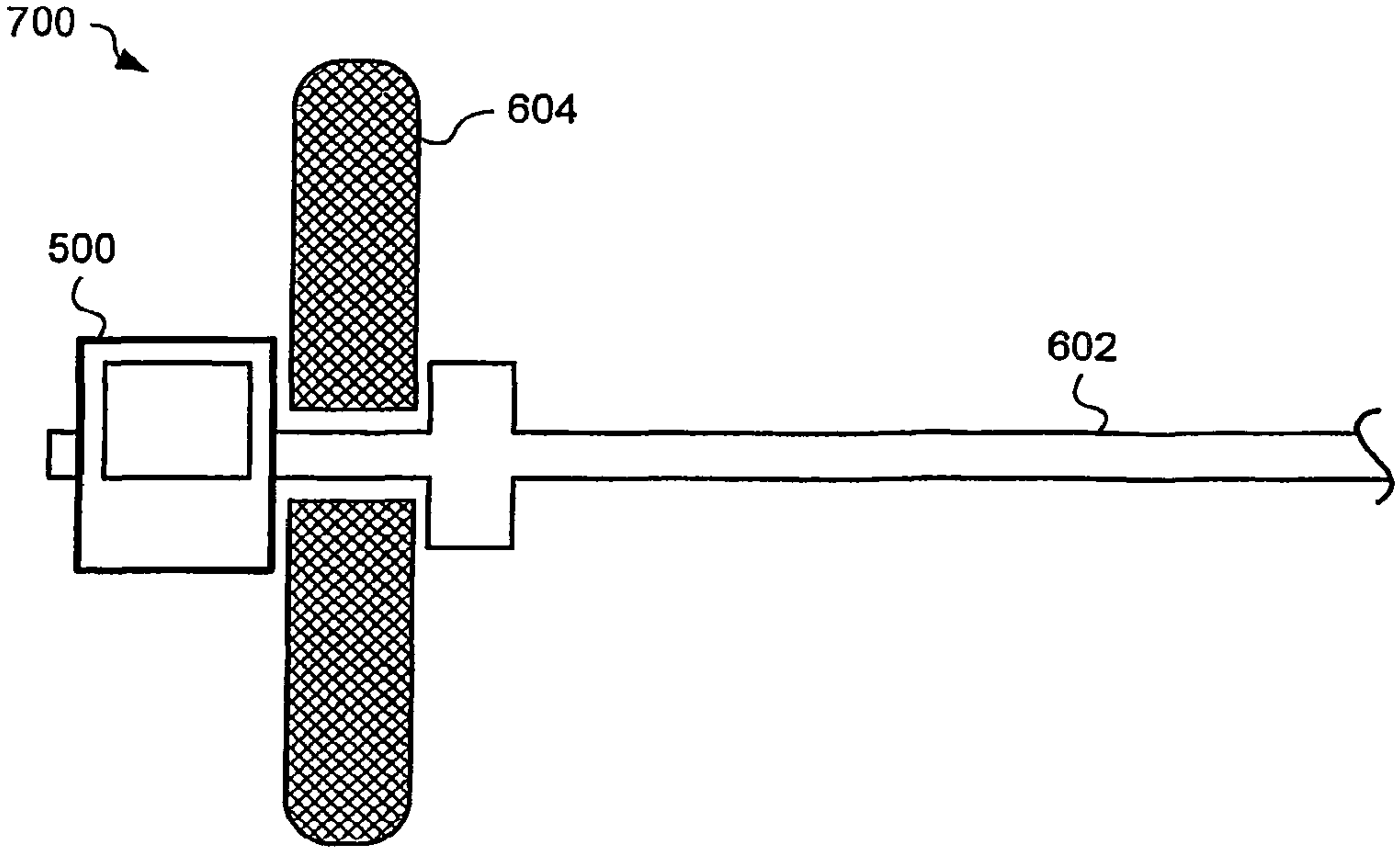
700
604
500
602

FIG. 7

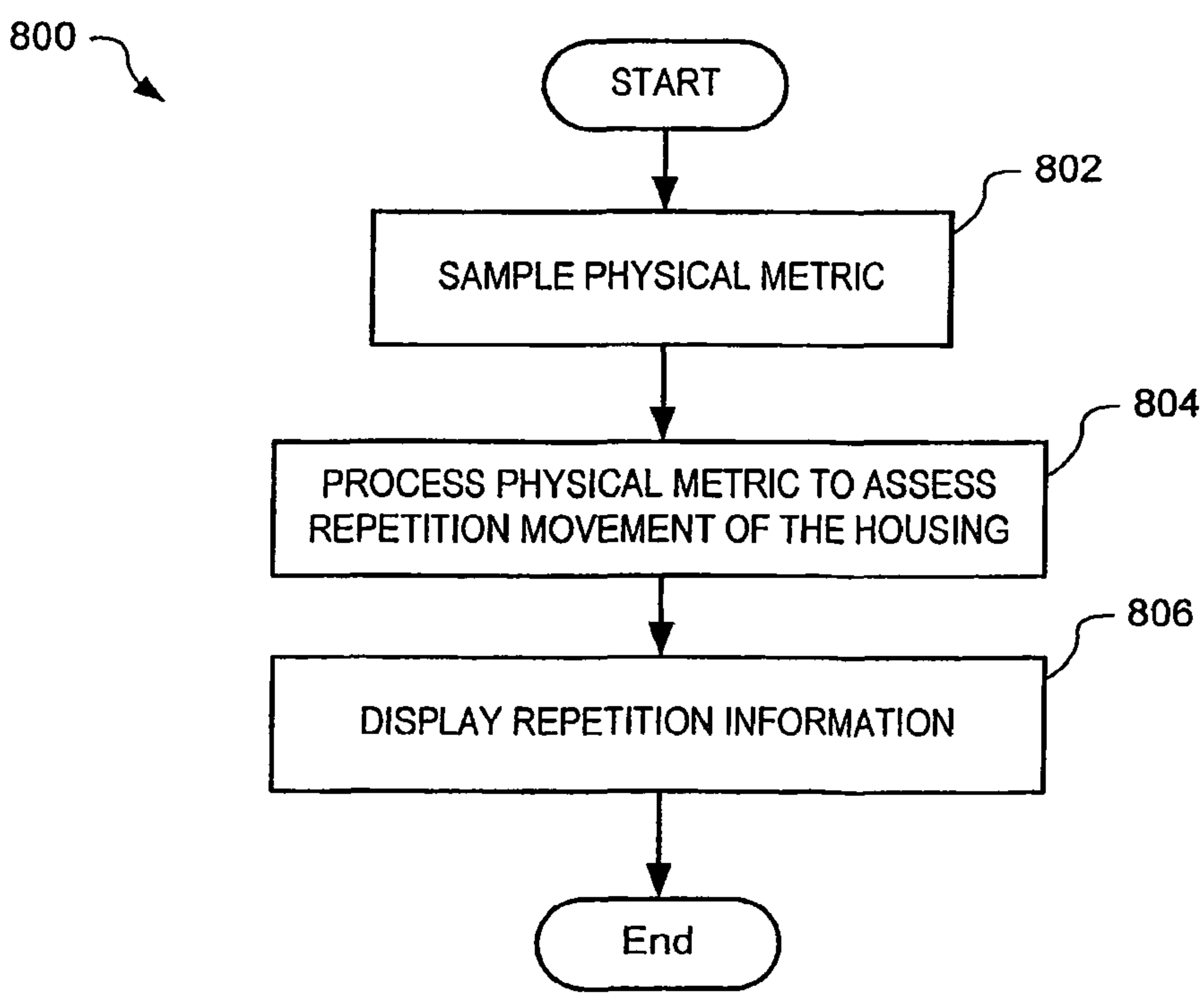
800
START
802
SAMPLE PHYSICAL METRIC
804
PROCESS PHYSICAL METRIC TO ASSESS REPETITION MOVEMENT OF THE HOUSING
806
DISPLAY REPETITION INFORMATION
End

FIG. 8

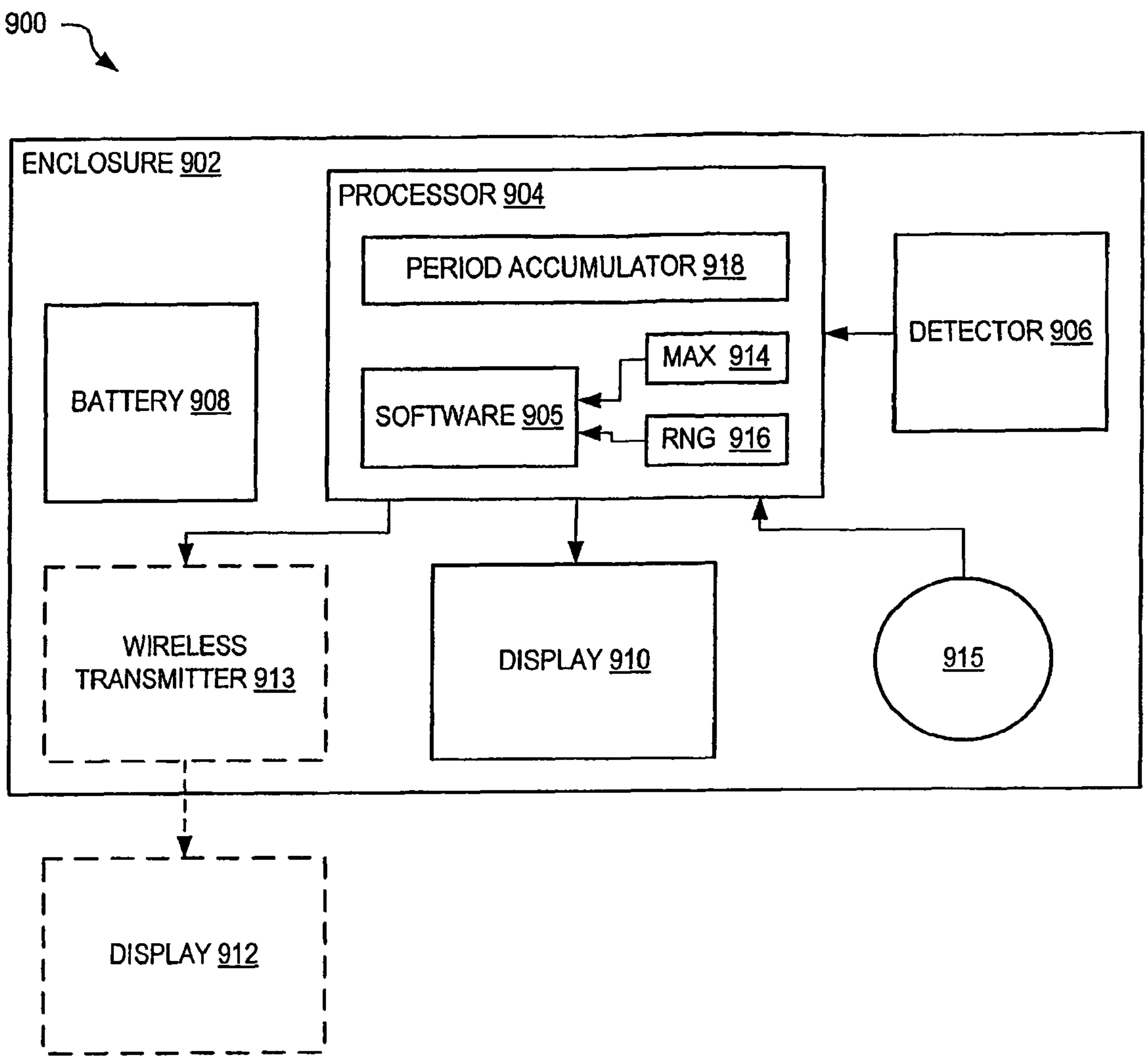
900
ENCLOSURE 902
PROCESSOR 904
PERIOD ACCUMULATOR 918
DETECTOR 906
MAX 914
BATTERY 908
SOFTWARE 905
RNG 916
WIRELESS TRANSMITTER 913
DISPLAY 910
915
DISPLAY 912

FIG. 9

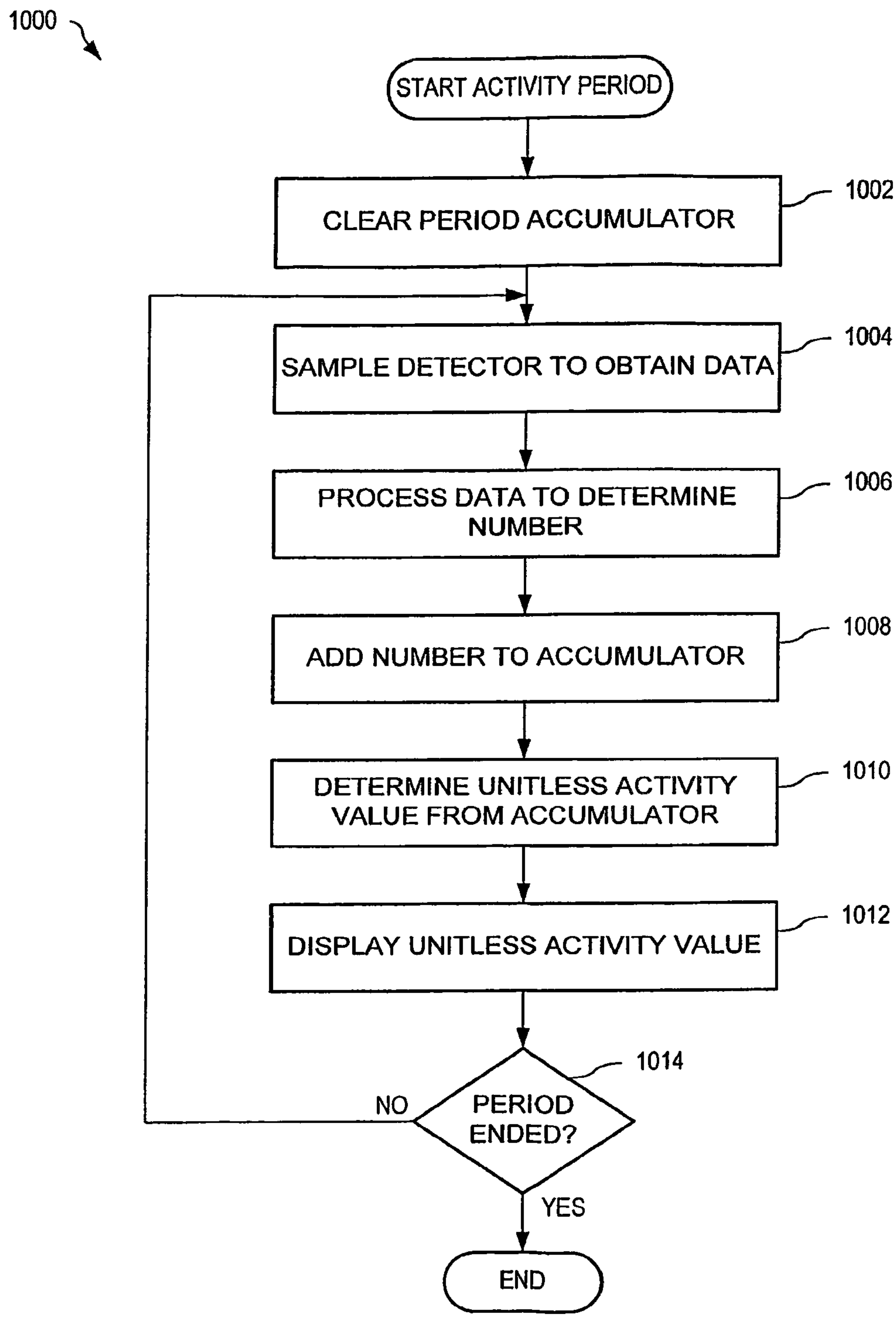
1000
START ACTIVITY PERIOD
CLEAR PERIOD ACCUMULATOR
1002
SAMPLE DETECTOR TO OBTAIN DATA
1004
PROCESS DATA TO DETERMINE NUMBER
1006
ADD NUMBER TO ACCUMULATOR
1008
DETERMINE UNITLESS ACTIVITY VALUE FROM ACCUMULATOR
1010
DISPLAY UNITLESS ACTIVITY VALUE
1012
PERIOD ENDED?
1014
NO
YES
END

FIG. 10

UNITLESS ACTIVITY ASSESSMENT AND ASSOCIATED METHODS

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 15/972,959 filed May 7, 2018 (now U.S. Pat. No. 10,376,015), which is a continuation of U.S. patent application Ser. No. 15/443,392 filed Feb. 27, 2017 (now U.S. Pat. No. 9,968,158), which is a continuation of U.S. patent application Ser. No. 14/298,454 filed Jun. 6, 2014 (now U.S. Pat. No. 9,578,927), which is a continuation of U.S. patent application Ser. No. 13/544,733 filed Jul. 9, 2012 (now U.S. Pat. No. 8,749,380), which is a continuation of U.S. patent application Ser. No. 13/034,311 filed Feb. 24, 2011 (now U.S. Pat. No. 8,217,788), which is a continuation of U.S. patent application Ser. No. 12/083,726 filed Apr. 16, 2008 (now U.S. Pat. No. 7,911,339), which is a 35 U.S.C. 371 National Phase entry of International Patent Application No. PCT/US2006/040970 filed Oct. 18, 2006, which claims priority to US Provisional Patent Application No. 60/728,031 filed Oct. 18, 2005. All of these earlier applications are incorporated herein by reference.

BACKGROUND

Shoes (including sneakers or boots, for example) provide comfort and protection for feet. More importantly, shoes provide physical support for feet to reduce risk of foot injuries. A shoe is often necessary to provide support during intense physical activity, such as running, soccer and American football. As a shoe wears, physical support provided by the shoe decreases, thereby reducing associated protection from injury. When a critical wear level is reached, even if the shoe looks like it is not particularly worn, the shoe may not provide adequate support and may, in fact, cause damage to feet.

SUMMARY

In one embodiment, a shoe wear out sensor includes at least one detector for sensing a physical metric that changes as a shoe wears out, a processor configured to process the physical metric, over time, to determine if the shoe is worn out, and an alarm for informing a user of the shoe when the sole is worn out.

In another embodiment, a system determines the end of a shoe's life. Use of the shoe is sensed by at least one detector. A processor is configured to measure the use of the shoe and to determine if the shoe is worn out. An alarm informs a user of the shoe when the shoe is worn out.

In another embodiment, a body bar sensing system includes a housing with at least one detector for sensing a physical metric that indicates repeated movement of the housing when attached to the body bar, a processor configured to process the physical metric, over time, to determine repetitions thereof, and a display for informing a user of the repetitions.

In another embodiment, a system assesses activity and displaying a unitless activity value and includes a detector for sensing activity of a user of the system, a processor for processing sensed activity data from the detector, a display for displaying the unitless activity value, and an enclosure for housing the detector and the processor. The processor periodically reads the sensed activity data from the detector and processes the data to generate an activity number, the number being used to generate the unitless activity value based upon a maximum number and a display range.

In another embodiment, a method determines a unitless activity value for a desired period of activity. A period accumulator is cleared prior to the start of the activity period. A detector is periodically sampled to obtain data that is processed to determine a number representative of the sampling period. The number is added to the period accumulator. The unitless activity value is then determined based upon the period accumulator, a maximum activity number and a display range. The unitless activity value is then displayed. The sampling, processing and adding are repeated until data is sampled for the desired period of activity.

In another embodiment, a method assesses activity unitlessly by detecting motion of a user, processing the detected motion, over time, to determine an activity value, ratioing the activity value to a maximum activity value, and reporting a scaled unitless activity value to the user based upon the ratio and a scale.

A software product has instructions, stored on computer-readable media, that, when executed by a computer, perform steps for determining a unitless activity value for a desired period of activity, including instructions for: detecting motion of a user, processing detected motion, over time, to determine an activity value, ratioing the activity value to a maximum activity value, and reporting a scaled unitless activity value to the user based upon the ratio and a scale.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** shows one exemplary embodiment of a shoe wear-out sensor.

FIG. **2** shows one exemplary embodiment of a shoe with a shoe wear out sensor.

FIG. **3** shows another exemplary embodiment of a shoe with a shoe wear out sensor.

FIG. **4**A shows one exemplary process for determining shoe wear out.

FIG. **4**B shown one exemplary process for determining shoe wear out.

FIG. **4**C shows one exemplary process for determining shoe wear out.

FIG. **4**D shown one exemplary process for determining shoe wear out.

FIG. **5** shows one body bar sensing system embodiment.

FIG. **6** shows one part of an exemplary body bar with a body bar sensing system embodiment attached.

FIG. **7** shows one part of a body bar in an embodiment showing a weight and a body bar sensing system that secures the weight onto the body bar.

FIG. **8** shows one exemplary process for reporting body bar usage.

FIG. **9** shows an embodiment of a sensor that unitlessly assesses activity.

FIG. **10** shows a process for unitlessly determining activity.

DETAILED DESCRIPTION OF THE FIGURES

FIG. **1** shows one shoe-wear out sensor **100**. Sensor **100** includes a processor **102**, a detector **104** and an alarm **106**. A battery **108** may be used to power processor **102**, detector **104** and alarm **106**; alternatively, a magnetic coil generator (not shown) or other mechanical motion-to-electricity conversion device may be employed with sensor **100** to power these elements. Detector **104** is for example an accelerometer and/or a force sensing resistor (FSR). Alarm **106** is for example a light emitting diode (LED) and/or a small speaker and/or a small sound actuator (e.g., a buzzer, piezoelectric beeper etc).

FIG. **2** shows a shoe **200** with a shoe-wear out sensor **210**. Shoe **200** is for example a running or sport shoe, boot (e.g., a snowboard or hiking boot), slipper, dress shoe or flip-flop; shoe **200** may alternatively be an orthopedic shoe for providing special foot support. Sensor **210** may represent sensor **100**, FIG. **1**. In the illustrated embodiment, shoe **200** has a sole **202** and an upper part **204**. Sole **202** has an outsole **206** and a heel **208**. Sensor **210** is shown contained within heel **208**; however sensor **210** may be placed elsewhere within or on the shoe to function similarly.

FIG. **3** shows one exemplary embodiment of a shoe with a shoe-wear out sensor **310**. Sensor **310** may again represent sensor **100**, FIG. **1**. Shoe **300** is shown with a sole **302** and an upper part **304**. Sole **302** has an outsole **306** and a heel **308**. Shoe **300** may again represent, for example, a running shoe, sports shoe or orthopedic shoe (or other type of shoe or boot). Electronics **310***a* of sensor **310** are shown contained within heel **308**; but detector **312** is shown located within outer sole **306**, illustrating that the elements of sensor **100** (FIG. **1**) may be dispersed to various locations of the shoe while providing similar functionality. Detector **312** is for example detector **104**, FIG. **1**; it may thereby be a force sensing resistor and/or a piezoelectric foil that is electrically connected, via connection **314**, to electronics **310***a* of sensor **310**. If detector **312** is a piezoelectric foil (or other piezoelectric device), use of shoe **300** results in flexing of detector **312** which may generate sufficient electricity to power electronics **310***a* of sensor **310**, avoiding the need for battery **108**.

FIGS. **1**, **2** and **3** are best viewed together with the following description. Sensor **100** may be embedded in a shoe (e.g., sensors **210**, **310** within shoes **200**, **300**) and configured to determine when that shoe has "worn out". It then informs the user, via alarm **106**, that it is time to buy a new shoe (usually a new pair of shoes). In an embodiment, alarm **106** is an LED **217** that is positioned at the outside of the shoe such that it may be seen, when activated, by the user of the shoe, as illustratively shown in FIG. **2**.

Processor **102** may operate under control of algorithmic software **103** (which is illustratively shown within processor **102**, though it may reside elsewhere within sensor **100**, for example as stand alone memory of sensor **100**). Algorithmic software **103** for example includes algorithms for processing data from detector **104** to determine when a shoe is worn out.

FIG. **4**A for example illustrates one process **400** performed by processor **102** of FIG. **1**. In step **402**, processor **102** samples detector **104** to determine a physical metric associated with the shoe. In an example of step **402**, detector **104** is an accelerometer and thereby provides acceleration data resulting from movement of the shoe upon a surface as the physical metric. For example, as the shoe strikes the ground when in use, processor **102** takes a plurality of samples using detector **104** to form an impact profile. In step **404**, processor **102** processes the physical metric and compares it against a predetermined threshold, response curve or other data reference. In an example of step **404**, processor **102** compares the impact profile determined from the accelerometer against an impact profile of a "new" shoe. In another example of steps **402**, **404**, the physical metric is power spectral density corresponding to certain frequencies of interest; and the power spectral density is compared, during use of the shoe, to a data reference containing power spectral density of a new or acceptably performing shoe. If the current data (i.e., physical metric) is too large or exceeds the data reference, for example, then processor **102** sets off alarm **106** (e.g., lights LED **217**) in step **406**. In one embodiment, upon first use of the shoe, processor **102** determines an impact profile of the new shoe that is then used (e.g., as the threshold or data reference) in comparison against subsequently determined impact profiles. Or, upon first use of the shoe, for example, processor **102** may store the appropriate data reference (e.g., power spectral density or threshold) for comparison against data captured in latter uses of the shoe. In this way, therefore, process **400** may be efficiently used to inform a user of shoe wear out.

As noted, data from detector **104** may be processed in the frequency domain (e.g., using Fourier transforms of data from detector **104**) so as to evaluate, for example, power spectral density of the physical metric (e.g., acceleration or force), in step **404**. In this manner, therefore, a range of frequencies may be evaluated (e.g., an area under the curve for certain frequencies may be integrated) from detector **104** and then compared to similar data (as the threshold) of a new shoe. As a shoe wears, the elasticity of the material from which it is made changes; thus the ability of the material to absorb the shock of the shoe contacting the ground deteriorates, resulting in more shock force being transferred to the foot within the shoe. By determining the increase of the shock force above the threshold, in this embodiment, the wear on the shoe may be determined.

We now specifically incorporate by reference the teachings and disclosure of: U.S. Pat. Nos. 6,539,336; 6,266,623; 6,885,971; 6,856,934; 6,8963,818; 6,499,000; and 8,280,682. These patents provide useful background, power sensing and weight/movement monitoring techniques suitable for use with the teachings of this present application.

In an embodiment, similar to the embodiment of FIG. **3**, processor **102** determines wear of shoe **300** based upon weight of the user of shoe **300**. By using signals from detector **312** to determine an approximate weight of the user of shoe **300** (for example by using a pressure sensor and fluid-filled cavity as detector **104**), processor **102** may determine a life expectancy of shoe **300**. Since the wear on the shoe is roughly proportional to the weight applied by the wearer, during activity, by determining the weight of the wearer and the amount the shoe is used (e.g., how often and how long the shoe is used), processor **102** may thus determine shoe wear with increased accuracy. That is, a shoe used by someone who spends most of their time sitting at a desk receives less wear that a shoe used by someone who spends most of the day standing on their feet.

In another embodiment, by sensing when the shoe is used—or for how long—the teachings herein may instead be applied so as to set off the alarm after a term or time of use has expired. For example, if a shoe is specified for use to at least 100 hours or 500 miles (or other similar metric specified by the shoe manufacturer), then by sensing weight or acceleration (or other physical metric, via detector **104**) that use may be determined; processor **102** then activates alarm **106** when the use is exceeded. For example, using one or more accelerometers as detector **104**, speed of the shoe may be determined through operation of processor **102** using an appropriate algorithm within software **103**; this processor **102** then uses the speed information to determine distance traveled and sets off alarm **106** when, for example, the manufacturer's specified distance use is met. Illustratively, in another example, if the manufacturer specifies that the shoe may be used under normal conditions for 500 hours (or some other time), then detector **104** in the form of an accelerometer may determine when the shoe is in use; processor **102** then determines the period of use, over time (e.g., weeks and months) and sets off alarm **106** when the accumulated use exceeds the specified limit.

FIG. **4**B for example illustrates one process **450** performed by processor **102** of FIG. **1** for determining shoe wear out. In step **452**, processor **102** samples detector **104** to determine one or more physical metrics associated with the shoe. In an example of step **402**, detector **104** includes a fluid filled cavity and a pressure sensor and thereby provides a signal representative of force upon the shoe (e.g., a value representative of the weight of the user of the shoe). For example, as the shoe is used, processor **102** takes a plurality of pressure reading from detector **104**. In step **454**, processor **102** determines an approximate weight upon the shoe based upon samples of step **452**. In one example of step **454**, processor **102** utilizes algorithms of software **103** to determine an approximate weight of the user of the shoe based upon pressure values sensed by detector **104**. In step **456**, processor **102** determines the duration of the shoe's use. In one example of step **456**, processor **102** utilizes algorithms of software **103** to measure the duration that the shoe is used based upon readings from detector **104** and an internal timer of processor **102**. In step **458**, processor **102** determines the shoe use for the sample period of step **452**. In one example of step **458**, processor utilizes algorithms of software **103** to determine a use factor based upon the determined weight of step **454** and the duration of use of step **458**. In step **460**, processor **102** determines remaining life of the shoe based upon the determined shoe use of step **458**. In one example of step **460**, processor **102** maintains a cumulative value of usage determined in step **458** for comparison against a manufacturer's expected usage of the shoe. In step **462**, processor **102** enables alarm **106** if the shoe's life is exceeded. Steps **452** through **462** repeat periodically throughout the life of the shoe to monitor shoe usage based upon wear determined from the weight of the user and the duration of use.

In the above description of process **450**, it is not necessary that weight be determined. Rather, in an embodiment, it may instead be determined that the shoe is in "use" based on an algorithm using the pressure or force based detector **104**; and then this use is accumulated time-wise to determine when the shoe's life expectancy is exceeded. For example, once a user puts weight onto this detector (in this embodiment), then processor **102** detects (through use of an algorithm as software **103**) that the shoe is in use due to the presence of weight onto detector **104**.

FIG. **4**C for example illustrates one process **470** performed by processor **102** of FIG. **1** for determining shoe wear out. In step **471**, processor **102** samples detector **104** periodically over a defined period. In one example of step **471**, detector **104** is an accelerometer that is sampled periodically by processor **102** over a period often seconds. In step **472**, processor **102** determines if the shoe is in use. In one example of step **472**, processor **102** utilizes algorithms of software **103** to process the samples of step **471** to determine if the shoe is in use. Step **473** is a decision. If, in step **473**, processor **102** determines that the shoe is in use, process **470** continues with step **474**; otherwise process **470** continues with step **475**. In step **474**, processor **102** adds a value representative of the defined period of step **471** to an accumulator. In one example of step **474**, a non-volatile accumulator is incremented by one, where the one represents a period often seconds. Step **475** is a decision. If, in step **475**, processor **102** determines that the shoe is worn out, process **470** continues with step **476**; otherwise process **470** continues with step **471**. In one example of the decision of step **475**, processor **102** compares the use accumulator of step **474** against a value representative of the expected life of the shoe. Steps **471** through **475** repeat throughout the lifetime of the shoe. As appreciated, power saving measures may be used within sensor **100** when it is determined that the shoe in which sensor **100** is installed is not in use. In step **476**, processor **102** enables alarm **106**. In one example of step **476**, processor **102** may periodically activate LED **217**, FIG. **2**, until battery **108** is exhausted.

Process **470** thus determines the wear on a shoe by measuring the amount of use and comparing it against the expected use defined by a manufacturer, for example. In an embodiment, the use accumulator of step **474** is a timer within processor **102**. This timer is started when step **473** determines that the shoe is in use and is stopped when step **473** determines that the shoe is not in use. This timer thus accumulates, in real time, the use of the shoe for comparison against a manufacturer's expected use. In another embodiment, step **472** may determine the number of steps a shoe has taken such that the use accumulator of step **474** accumulates the total number of steps taken by the shoe. This total number of steps is then compared to the manufacturer's recommended number of steps expected in the shoes life time.

FIG. **4**D illustrates one process **480** performed by processor **102** of FIG. **1** for determining shoe wear out. In step **481**, processor **102** samples detector **104** periodically over a defined period. In one example of step **481**, detector **104** is an accelerometer and processor **102** samples acceleration values over a period of 1 second. In step **482**, processor **102** determines if the shoe is in use. In one example of step **482**, processor **102** utilizes algorithms of software **103** to determine if characteristics of samples values of step **481** indicate that the shoe is in use. Step **483** is a decision. If, in step **483**, processor **102** determines that the shoe is in use, process **480** continues with step **484**; otherwise process **480** continues with step **486**. In step **484**, processor **102** determines a distance traveled over the defined period of step **481**. In one example of step **484**, processor **102** utilizes algorithms of software **103** to first determine speed of the shoe, and then determines distance covered in one second. In step **485**, processor **102** accumulates the distance traveled. In one example of step **485**, processor **102** adds the distance determined in step **484** to a total distance traveled accumulator. In one example, this accumulator is stored in non-volatile memory. Step **486** is a decision. If, in step **486**, processor **102** determines that the shoe is worn out, process **480** continues with step **487**; otherwise process **480** continues with step **481**. In one example of step **486**, processor **102** compares the total accumulated distance of step **485** against the manufacturer's recommended maximum distance for the shoe. Steps **481** through **486** repeat throughout the lifetime of the shoe. As appreciated, power saving measures may be used within sensor **100** when it is determined that the shoe is not in use. In step **487**, processor **102** enables alarm **106**. In one example of step **487**, processor **102** may periodically activate LED **217**, FIG. **2**, until battery **108** is exhausted. Process **480** thus determines shoe wear by measuring the distance traveled by the shoe, using one or more accelerometers, and compares that distance to a manufacturer's recommended maximum distance for the shoe.

FIG. **5** shows a body bar sensing system **500**. System **500** includes a housing **502**, a processor **504**, a detector **506** and either an internal display **508** or an external display **512**. A battery **510** may be used to power processor **504**, detector **506** and display **508/512**. Detector **506** is for example an accelerometer or a Hall Effect sensor. Display **508/512** is for example a liquid crystal display and/or a small speaker (e.g., that emits voice annunciations or other sounds generated by processor **504**).

FIG. **6** shows one part of an exemplary body bar **602** with body bar sensing system **500** attached; a weight **604** and a retaining clip **606** are also shown to secure weight **604** onto body bar **602** (note, some body bars use no weights but weight is shown in FIG. **6** for illustrative purposes). Body bar **602** may represent a work out bar used by people in the gym, or a barbell, or other similar apparatus that requires a number of repetitions in exercise. FIG. **7** shows body bar **602** in an embodiment with another body bar sensing system **500** that secures weight **604** onto body bar **602**. That is, sensing system **500** in addition operates as retaining clip **606**, FIG. **6**.

FIGS. **5**, **6** and **7** are best viewed together with the following description. Housing **502** attaches to body bar **602** as shown in FIG. **6** or as shown in FIG. **7**. Processor **504** utilizes detector **506** to determine when system **500** (as attached to body bar **602**) has performed one repetition; it then informs the user, via display **508**/**512** for example, of a number of repetitions (or whether the user has performed the right number or any other number of planned repetitions as programmed into processor **504**).

Where display **512** is used (i.e., remote from housing **502**), a wireless transmitter (not shown) may be included within housing **502** to remotely provide data from processor **504** to remote display **512** (as shown in dotted outline). Where display **508** is integral with housing **502**, then display **508** provides a visual display for a user when housing **502** attaches to the body bar. In one embodiment, display **512** (shown in dotted outline) is part of a watch (or a MP3 player or a cell phone) that may be seen when worn or used by the user when performing exercises; and measurements determined by processor **504** are transmitted to the watch (or to the MP3 player or cell phone) for display upon display **512**.

Processor **504** may operate under control of algorithmic software **505** (which is illustratively shown within processor **504** although it may reside elsewhere within housing **502**, such as stand alone memory within housing **502**). Algorithmic software **505** for example includes algorithms for processing data from detector **506** to determine the repetitions performed by a user of body bar **602**.

FIG. **8** shows one exemplary process **800** performed by processor **504**. In step **802**, detector **506** samples a physical metric associated with body bar **602**. In an example of step **802**, detector **506** is an accelerometer and thereby provides acceleration as the physical metric. In another example of step **802**, detector **506** is a Hall effect sensor which detects inversion (and thus repetition) of bar **602**. In step **804**, processor **504** processes the physical metric to assess whether the metric indicates a repetition of body bar **602**. In an example of step **804**, processor **504** evaluates the acceleration to determine if body bar **602** has been raised or lowered within a certain time interval. In step **806**, repetition information is displayed to the user. In an example of step **806**, the number of repetitions is relayed remotely (wirelessly) to a watch that includes display **512**. That watch may also include a processor to store data and inform the user of repetitions for workouts, over time.

FIG. **9** shows one exemplary system **900** for unitlessly assessing activity of a user. System **900** has a processor **904**, a detector **906** and a battery **908** within an enclosure **902** (e.g., a plastic housing). System **900** may include a display **910** for displaying unitless units to the user. Alternatively (or in addition), a remote display **912** is used to display the unitless units; in this case, enclosure **902** includes a wireless transmitter **913** in communication with, and controlled by, processor **904**, so that transmitted unitless assessment numbers are sent to remote display **912**.

In an embodiment, detector **906** is an accelerometer and processor **904** determines a value representing an activity level of the user of system **900** for display on display **910** or display **912**. The accelerometer is for example positioned within housing **902** so that, when housing **902** is attached to a user, accelerometer **906** senses motion perpendicular to a surface (e.g., ground or a road or a floor) upon which the user moves (e.g., runs, dances, bounces). Data from the accelerometer is for example processed in the frequency domain as power spectral density (e.g., by frequency binning of the data). Multiple accelerometers (e.g., a triaxial accelerometer) may also be used as detector **906**—for example to sense motion in other axes in addition to one perpendicular to the surface—and then processed together (e.g., in power spectral density domain) to arrive at a unitless value (as described below).

Processor **904** may utilize one or more algorithms, shown as software **905** within processor **904**, for processing information obtained from detector **906** to assess the activity of the user. For example, processor **904** may periodically sample detector **906** to measure acceleration forces experienced by the user (when enclosure **902** is attached to the user, e.g., at the user's belt or shoe). Processor **904** may then process these forces to assess the activity level of the user. This activity level may represent effort exerted by the user when skiing.

The following represents a typical use of system **900**, in an embodiment. In this example, detector **906** is one or more accelerometers. First, processor **904** determines when system **900** is in use, for example by sensing movement of housing **902** that corresponds to known activity (e.g., skiing or running). Alternatively, system **900** includes a button **915** that starts processing (in which case, separate determination of a known activity is not necessary). In an embodiment, button **915** is located proximate to display **912**, and communicated wirelessly with processor **904**. In this case, wireless transmitter **913** is a transceiver and button **915** includes a transmitter or a transceiver.

Once processor **904** knows (by sensing motion) or is notified (by button **915**) that system **900** is operating in the desired activity, then it collects data over a period of that activity—for example over 1 hour (a typical aerobic hour), 4 hours (a typical long run), 8 hours (a typical "ski" day) or over one full day, each of these being typical sport activity periods; however any time may be used and/or programmed in system **900**. In an example, processor **904** integrates power spectral density of acceleration over this period of time to generate a number. This number in fact is a function of g's, frequency units and time, which does not make intuitive sense to the user. For example, consider a professional athlete who snowboards down difficult, double diamond terrain for eight hours. When system **900** measures his activity over this period, his number will be high (e.g., 500 "units" of power spectral density) because of his extreme physical capabilities. Then, when a less capable user uses system **900**, a number of, e.g., 250 units may be generated because the user is not as capable (physically and skilled) as the professional. Therefore, in this example, an expected maximum number, shown as MAX **914** within processor **904**, may be set at 500. A display range, shown as RNG **916** within processor **904**, may also be defined such that system **900** may display a unitless value that is relative to the maximum number. Continuing with the above example, if RNG **916** is set to 100, system **900** displays a unitless value of 100 for the professional athlete and a unitless value of 50 for the less capable user (i.e., the less capable user has a 50% value of the professional athlete). By setting RNG **916** to other values, the displayed output range of system **900** may be modified.

In one example of use, system **900** is formed as a wrist watch to facilitate attachment to a child's wrist. System **900**, when worn by the child, may then determine the child's activity level for the day. In another example of use, system **900** may be attached to a person's limb that is recuperating from injury (e.g., sporting injury, accident and/or operation etc.) such that system **900** may determine if the limb is receiving the right amount of activity to expedite recovery.

In another example of use, two skiers each use a system **900** when skiing for a day. The first skier, who is experienced and athletic, skis difficult ski runs (e.g., black double diamonds) all day, whereas the second skier is less experienced and skis easy runs (e.g., green runs) all day. At the end of the day, the first skier has a unitless activity value of 87 and the second skier has a unitless activity value of 12. Thus, these unitless activity values indicate the relative activity levels of each skier.

FIG. **10** shows a flowchart illustrating one process **1000** for determining and displaying a unitless value representative of a user's activity. Process **1000** may represent algorithms within software **905** of FIG. **9**, for example, to be executed by processor **904**. In step **1002**, process **1000** clears a period accumulator. In one example of step **1002**, processor **904**, under control of software **905**, clears period accumulator **918**. In step **1004**, process **1000** samples the detector to obtain data. In one example of step **1004**, processor **904** periodically samples detector **906** over a sample period to determine data representative of the user's activity for that period. In step **1006**, process **1000** processes the data of step **1004** to determine a number. In one example of step **1006**, processor **904** integrates power spectral density of acceleration sampled in step **1004** over the sample period of step **1004** to generate a number. In step **1008**, the number determined in step **1006** is added to the period accumulator. In one example of step **1008**, processor **904** adds the number determined in step **1006** to period accumulator **918**. In step **1010**, process **1000** determines a unitless activity value from the accumulator. In one example of step **1010**, processor **904** converts the accumulated value to a display value based upon MAX **914** and RNG **916**. In step **1012**, process **1000** displays the determined unitless activity value. In one example of step **1012**, processor **904** sends the determined unitless activity value to display **912** via wireless transmitter **913**. Step **1014** is a decision. If, in step **1014**, the activity period for display has ended, process **1000** terminates; otherwise process **1000** continues with step **1004**. Steps **1004** through **1014** thus repeat until the desired activity period is over.

Changes may be made to this application without departing from the scope hereof. It should thus be noted that the matter contained in the above description or shown in the accompanying drawings should be interpreted as illustrative and not in a limiting sense. The following claims are intended to cover all generic and specific features described herein, as well as all statements of the scope of the present method and system, which, as a matter of language, might be said to fall there between.

What is claimed is:

1. A method of assessing usage by a user of an electronic system comprising a detector and a processor, the method comprising:

detecting, with the detector, use data indicative of use of the electronic system by the user during a use period;

processing, with the processor, the detected use data to determine a number representative of the detected use data during the use period; and

generating, with the processor, a value based on a comparison of the determined number and an expected maximum number for the use period.

2. The method of claim **1**, further comprising:

prior to the generating, identifying a type of activity of the user performed during the use period; and

prior to the generating, identifying the expected maximum number for the use period based on the identified type of activity.

3. The method of claim **2**, wherein the identifying the type of activity comprises detecting at least one press of a button.

4. The method of claim **2**, wherein the identifying the type of activity comprises processing at least a portion of the detected use data.

5. The method of claim **1**, further comprising presenting the generated value to the user.

6. The method of claim **5**, further comprising repeating the detecting, the processing, the generating, and the presenting for a plurality of consecutive use periods.

7. The method of claim **1**, further comprising repeating the detecting, the processing, and the generating for a plurality of consecutive activity periods.

8. The method of claim **1**, wherein the processing the detected use data to determine the number comprises integrating power spectral density of acceleration data of the detected use data over the period of time of the use period.

9. The method of claim **1**, wherein the use period is at least eight hours.

10. The method of claim **1**, wherein the detected use data is indicative of a number of physical repetitions.

11. The method of claim **1**, wherein the value is based on an intensity of the use of the user during the use period.

12. The method of claim **1**, wherein the value is based on a length of the use period.

13. The method of claim **1**, wherein the detected use data is indicative of at least two different activities.

14. The method of claim **1**, wherein the generating the value comprises:

determining a ratio based on the comparison of the determined number and the expected maximum number for the use period; and

multiplying the determined ratio by a range number.

15. A system comprising:

a detector configured to detect movement data indicative of movement over a movement duration of time; and

a processor configured to:

determine a number representative of the detected movement data over the movement duration of time; and

generate a value based on the determined number and a maximum number for the movement duration of time.

16. The system of claim **15**, further comprising an enclosure that at least partially houses each one of the detector and the processor.

17. The system of claim **16**, wherein the enclosure is configured to be worn on a wrist of a user during the movement duration of time.

18. A method of assessing data, comprising:

detecting data;

sampling the detected data during a time period;

processing the sampled data to determine a number representative of the sampled data for the time period;

adding the number to an accumulator number to provide an updated accumulator number; and

determining a value based upon the updated accumulator number and an expected maximum number, wherein the determining the value comprises:

determining a ratio based on a comparison of the updated accumulator number and the expected maximum number; and

multiplying the determined ratio by a range number.

19. The method of claim **18**, further comprising presenting the determined value to a user.

20. The method of claim **18**, wherein the detected data is indicative of a number of physical repetitions.

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