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Goetzl

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[54] **SPEEDOMETER FOR IN-LINE SKATES**

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[51] **Int. Cl.**[6] **G08C 19/00**

[52] **U.S. Cl.** ..... **340/870.3**; 340/870.05; 340/870.28; 324/166; 235/95 R; 377/24.2

[58] **Field of Search** ..... 340/870.01, 870.05, 340/870.18, 870.19, 870.28, 870.3, 870.31, 670, 671; 73/493, 494, 530; 324/160, 166, 168, 171, 174, 175; 235/95 R, 96, 103, 133 A; 377/24.2; 280/809, 816, 841, 11.19

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,454,411	6/1984	Hale et al.	235/95 R
4,546,650	10/1985	Cameron	73/490
4,780,864	10/1988	Houlihan	368/10
5,170,161	12/1992	Sakurai	340/870.3
5,177,432	1/1993	Waterhouse et al.	324/166

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Attorney, Agent, or Firm—Thomas Schneck; George B. F. Yee

[57] **ABSTRACT**

An in-line roller skate includes a transducer portion capable of sensing the rotary movement of at least one wheel on the roller skate and transmitting information concerning the same to a receiver worn on a user's wrist. In the preferred embodiment, the transducer portion includes a magnet attached to one of the plurality of wheels and a sensor positioned in a shoe portion to detect the magnet and produce electrical pulses containing information corresponding to the angular velocity of the wheel. The transducer portion also includes a micro-controller, a transmitter and an antenna. The micro-controller creates a digital data stream containing information corresponding to the angular velocity of the wheel, which is then modulated onto a carrier wave produced by the transmitter. The transmitter transmits the coded signals to the receiver. The receiver demodulates the carrier wave, reproducing the digital data stream. A microprocessor processes the modulated signals and drives the display to produce a real time visual representation of selected portions of information contained in the digital data stream, including speed and distance travelled by the skate.

24 Claims, 5 Drawing Sheets

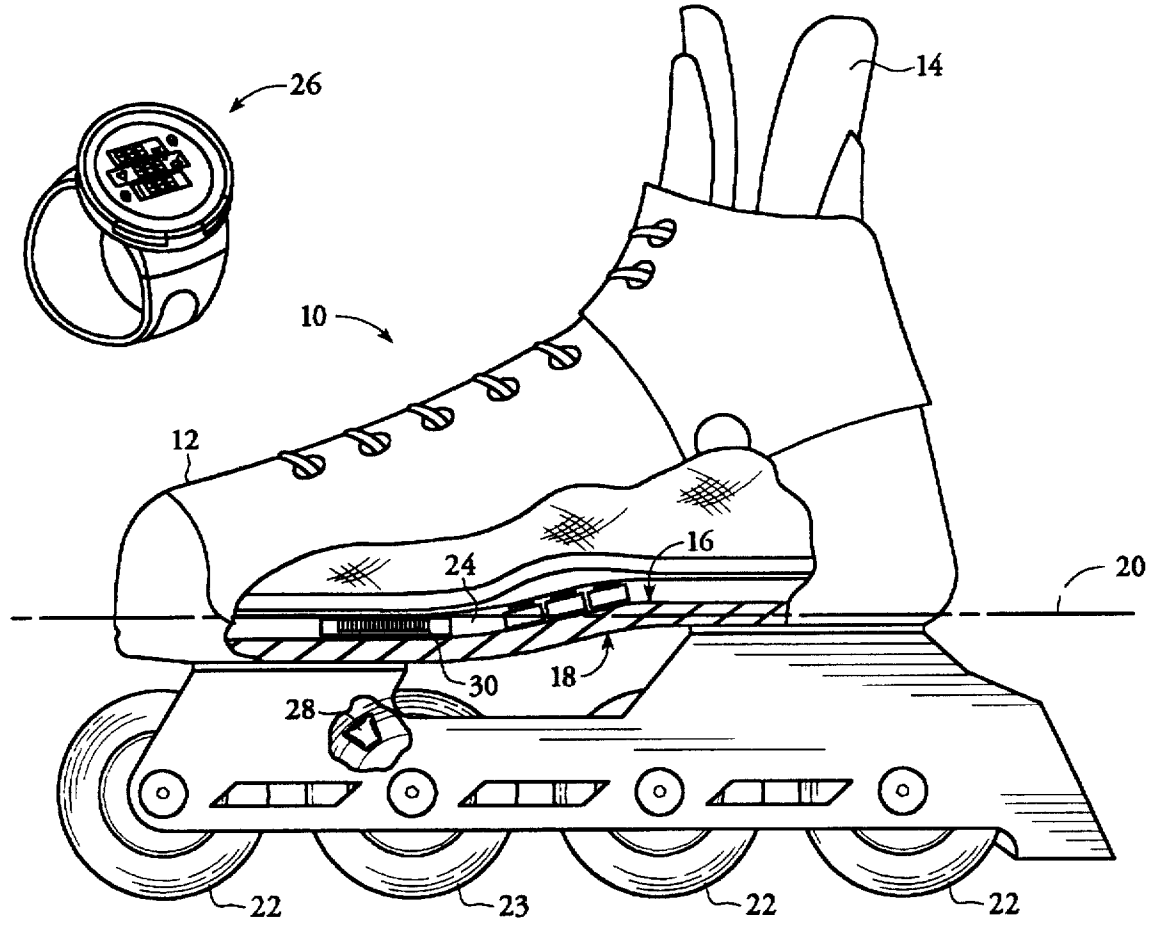
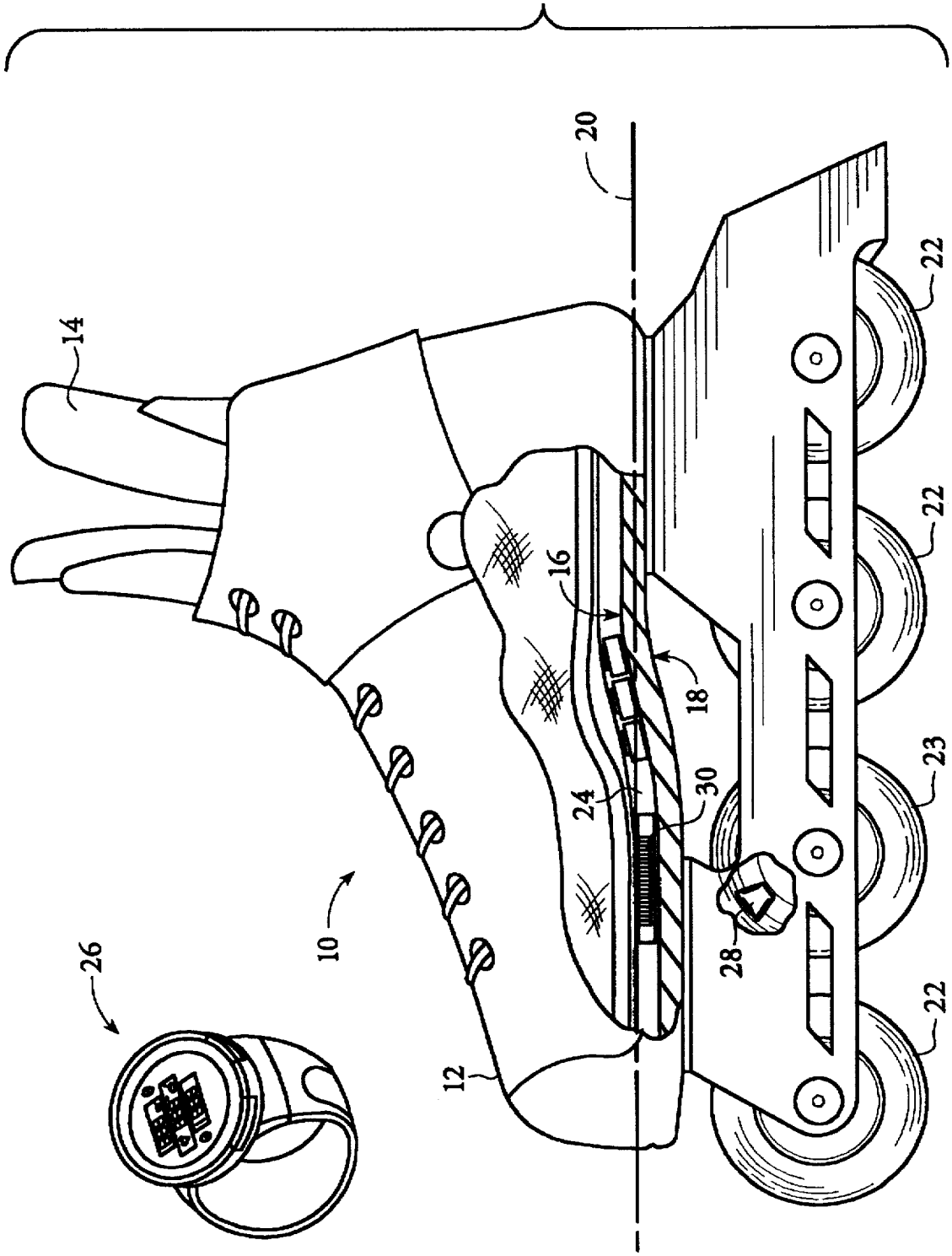


FIG. 1



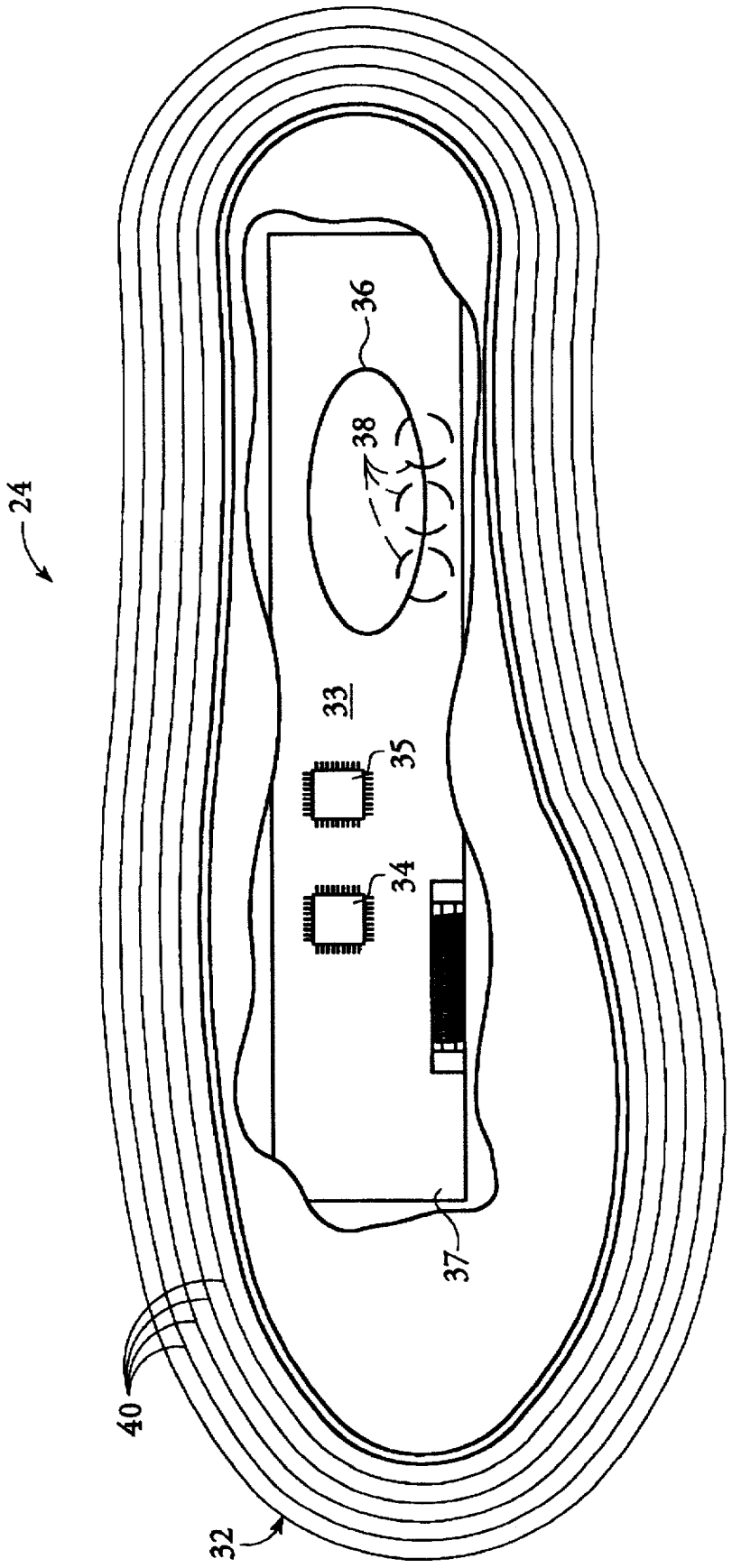


FIG. 2

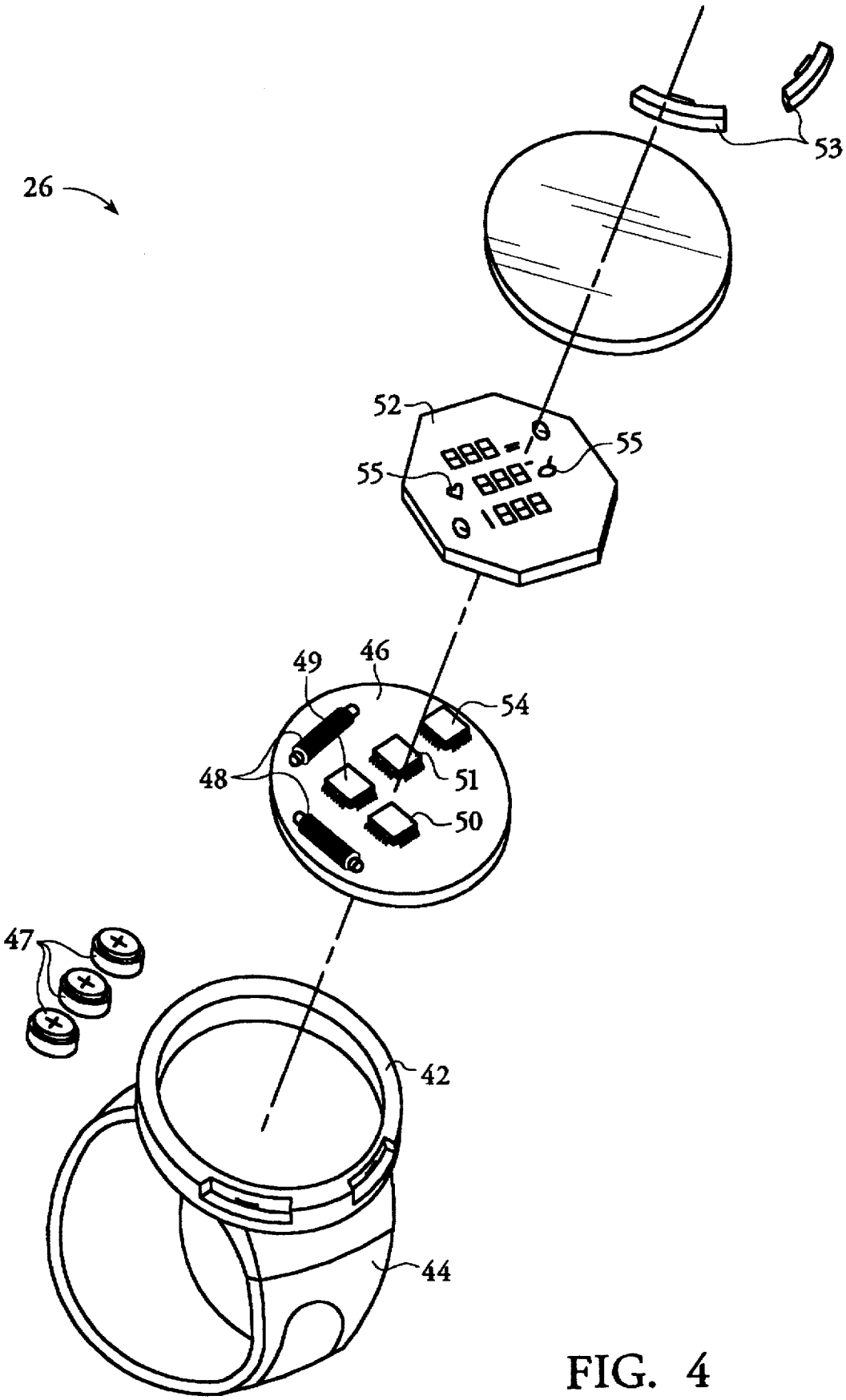


FIG. 4

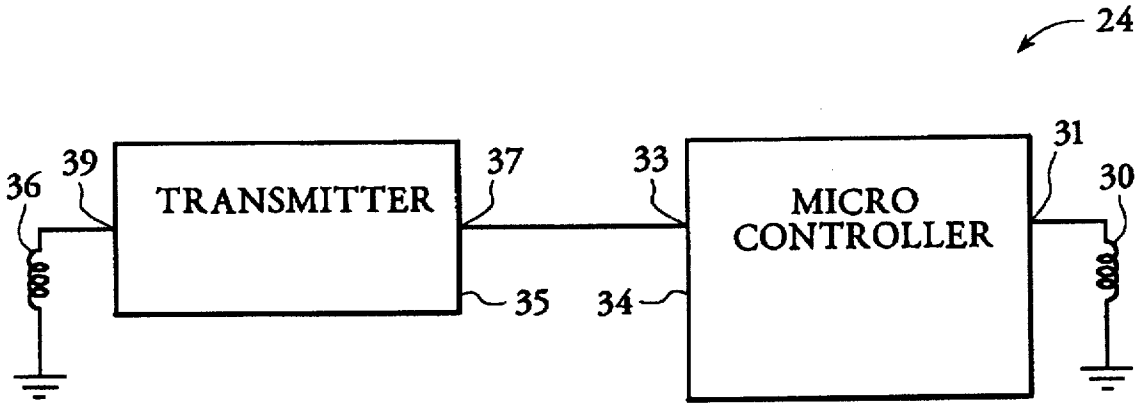


FIG. 3

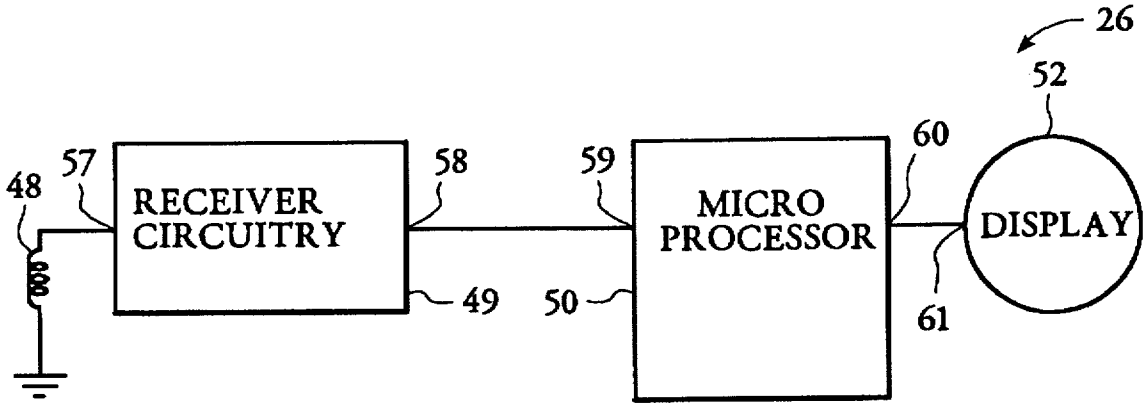


FIG. 5

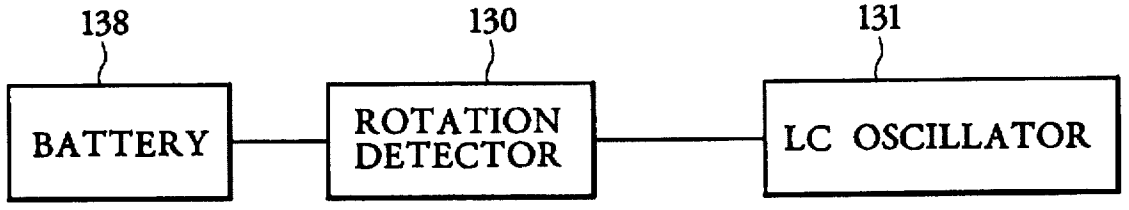


FIG. 6

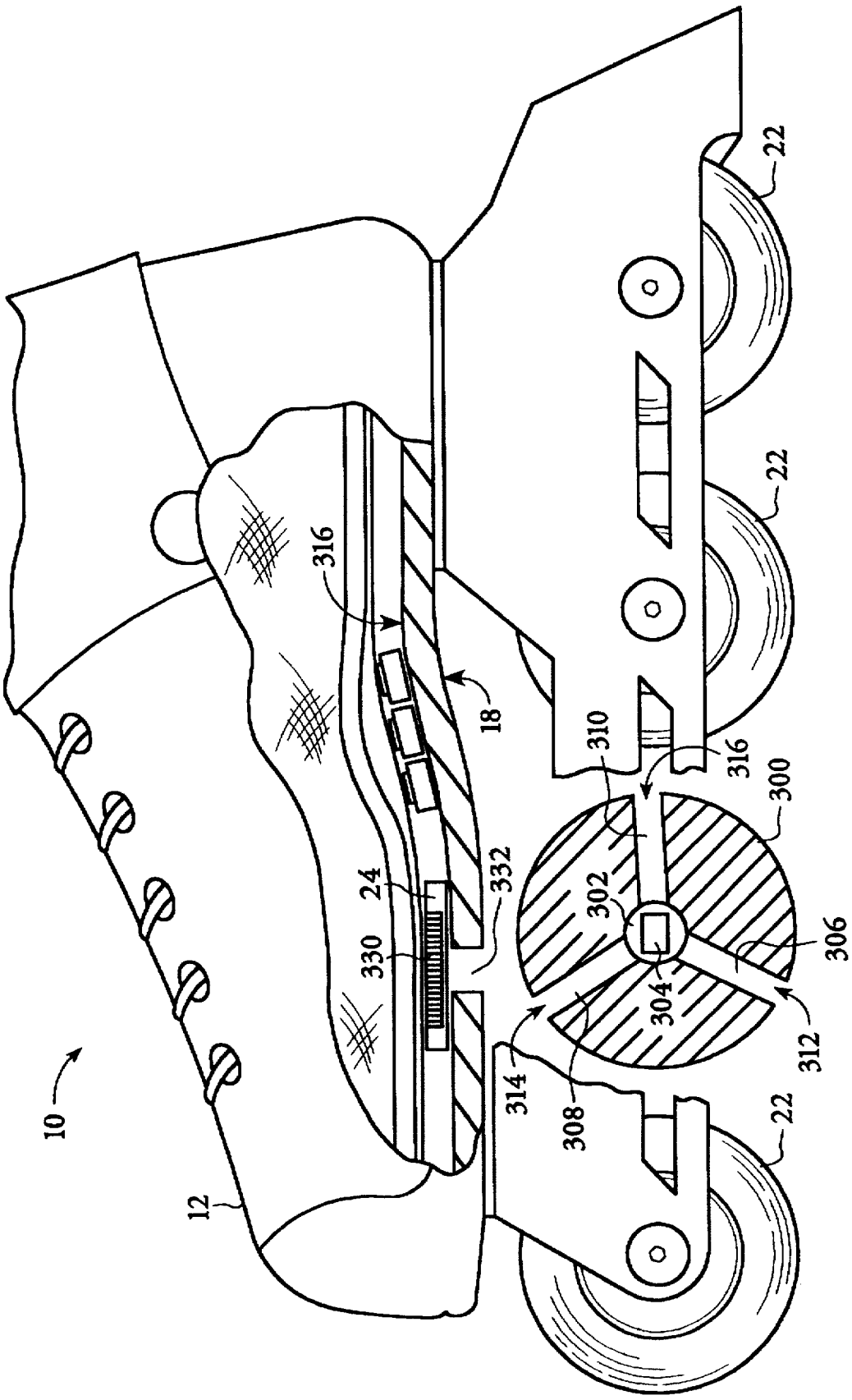

10
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316
316
330
332

FIG. 7

SPEEDOMETER FOR IN-LINE SKATES

TECHNICAL FIELD

The present invention pertains to the field of roller skates. Specifically, the present invention pertains to a data transmission system, and more particularly a speedometer, suited for use with a roller skate.

BACKGROUND ART

Skating on in-line roller skates is fast becoming one of the most popular outdoor activities. Recently, there has been an increase in competitive sport activities developed around the in-line roller skate, such as in-line speed skating and roller street hockey. These competitive sports have lead many in-line roller skate athletes to undertake more regimented workouts. Important to determining the quality of a workout is knowing the speed one is skating and the distance traveled, as well as information concerning one's cardiovascular system, e.g., heart-rate. In addition, many local municipalities have passed speed laws in various areas frequented by in-line roller skaters, thereby increasing the necessity of knowing the speed traveled during a workout.

There are many devices that can provide the aforementioned information to an athlete. U.S. Pat. No. 5,177,432 to Waterhouse et al. discloses a wireless velocity detector for a bicycle including a transmitter mounted onto the hub of a wheel and a receiver mounted onto the handlebars. The transmitter includes an LC oscillator producing a signal having a predefined frequency and a pair of mercury switches to ensure that the transmitter is energized only upon sensing rotary movement. A coil is connected to receive the signal from the LC oscillator and functions as the radiating element of the transmitter. The coil radiates a magnetic field in the plane of the wheel, once for each revolution of the transmitter. The speed of the rotating magnetic field is proportional to the rate of the wheel's rotation. The receiver includes a CPU, an LCD, driven by the CPU, and a set of coils. The set of coils detect the magnetic field generated by the transmitter to generate continuously changing analog signals. The analog signals are digitized by an analog to digital converter and then passed on to the CPU. The CPU processes the signals and displays the information represented by them on the LCD. For example, the signals may represent velocity, RPM of the wheel or distance traveled.

U.S. Pat. No. 4,780,864 to Houlihan discloses a wristwatch that also serves as a computer to display speed, distance and pedaling cadence. The wristwatch functions as a receiver and is and placed in a special mount attached to the handlebars of the bicycle. A first permanent magnet is attached to one of the wheels and a second permanent magnet is attached to the pedal sprocket. Sensors are disposed upon the frame of the bicycle and positioned to detect the magnets. The wristwatch is hard-wired to each sensor via the special mount. In this fashion, the sensors detect and transmit, to the wristwatch, the rate of revolution for both the wheel and the pedal sprocket. The wristwatch includes a CPU to process the data received from the sensors and produce the requisite information, such as speed and distance traveled.

U.S. Pat. No. 4,546,650 to Cameron discloses a speed and distance calculator for skis which includes a toothed wheel extending from the back of a ski to come into frictional contact with snow. Two magnets are attached to the toothed wheel inductively coupling the toothed wheel to a Hall effect device, which is mounted on the back of the ski. In this fashion, the toothed wheel functions as a transmitter and the Hall effect device functions as a receiver. The Hall effect device is hard-wired to a microprocessor. The microprocessor receives signals from the Hall effect device indicative of the rate of rotation of the tooth wheel and processes these signals to determine the distance traveled by the ski.

U.S. Pat. No. 4,454,411 to Hale et al. discloses a conventional odometer attached to the rear truck of a roller skate. The odometer includes a plurality of digit carrying discs, all interconnected by suitable shafts and gears, to produce a sequential display in a magnifying window indicating a distance travelled by the skate. A rubber wheel extending from the rear of the roller skate frictionally engages the ground. The rubber wheel is connected to a shaft of the odometer to transmit the number of revolutions the rubber wheel has undergone. The odometer is calibrated appropriately to properly indicate the distance travelled by the skate as a function of the revolutions of the rubber wheel.

A problem with the aforementioned prior art devices is that the transmitter and the receiver are designed to be communicated over a fixed radial distance, making them unsuitable for providing a real-time visual representation to a user of a roller skate.

Therefore, it is an object of the present invention to have a wireless speedometer providing a real-time visual representation of information, such as the speed and distance traveled, to a user of a roller skate.

SUMMARY OF THE INVENTION

The above object has been achieved by providing an in-line roller skate with a transducer portion capable of sensing the rotary movement of at least one wheel on the roller skate and transmitting information concerning the same in a wireless manner to a receiver worn on a user's wrist. In the preferred embodiment, the transducer portion includes a magnet attached to at least one of the plurality of wheels and a sensor positioned in a shoe portion of the roller skate to detect the magnet, thereby producing pulses corresponding to the angular velocity of the wheel. The transducer portion also includes a micro-controller, a transmitter and an antenna. The micro-controller is electronically coupled to both the detector and the transmitter. The micro-controller and the transmitter may both be formed on a monolithic chip. The transmitter is electronically coupled to the antenna. The micro-controller conditions and averages the time between pulses produced by the sensor, creating a digital data stream containing information corresponding to the angular velocity of the wheel. The micro-controller then modulates a carrier wave produced by the transmitter with the digital data stream and a plurality of control signals, including an identification code, producing coded signals. The identification code uniquely associates the transducer portion with the coded signals. The transmitter transmits the coded signals to the receiver. The receiver includes an antenna, a microprocessor and a display driven by the microprocessor. The antenna receives the coded signals and sends them to the microprocessor. The detector demodulates the coded signals, reproducing the digital data stream. The microprocessor processes the data stream deriving information therefrom concerning velocity and distance travelled by the skate. The display is driven by the microprocessor to produce a real-time visual representation of selected portions of the information.

In an alternate embodiment, the control wheel includes a chamber, proximate to the wheel's center, with a source of light contained therein. The source of light may be an LED or laser diode. At least one bore hole extends from the

chamber and terminates in at least one aperture at the periphery of the control wheel. The transceiver includes an optical detector which may be disposed proximate to a hole in the shoe portion. The optical detector senses light emitted through the apertures and produces an electrical signal corresponding to the angular velocity of the control wheel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side view of an in-line roller skate including a transducer portion and a receiver, in accord with the present invention.

FIG. 2 shows a top cut-away view of the transducer portion encapsulated in a support housing, shown in FIG. 1.

FIG. 3 is a simplified schematic view of the circuitry of the transducer portion shown in FIG. 2.

FIG. 4 is an exploded perspective view of a receiver shown in FIG. 1, in accord with the present invention.

FIG. 5 is a simplified schematic view of the circuitry of the receiver shown in FIG. 4.

FIG. 6 is a block diagram of the transducer portion shown in FIG. 1, in accord with an alternate embodiment.

FIG. 7 is a side view of a revolution detector of the transducer portion, shown in FIG. 1, in accord with an alternate embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

In FIG. 1, an in-line skate **10** is shown including a shoe portion **12** designed to receive a removable liner **14** having a shape to fit over a human foot and the lower portion of a leg extending from the foot. The shoe portion **12** includes a sole having first **16** and second **18** opposed major surfaces extending along the entire longitudinal axis **20** of the skate **10**. The liner **14** includes a bottom surface **15** which rests adjacent to the first major surface **16**, upon the liner **14** reaching a final seating position. The skate **10** is considered in-line because a plurality of wheels **22**, rollably attached to the second major surface **18**, are coaxially aligned along the longitudinal axis **20**. Mounted proximate to the first major surface **16** is a transducer portion **24** to produce modulated signals containing data corresponding to rotational movement of the wheels **22**. A receiver **26** is in communication with the transducer portion **24** to receive the modulated signals. The receiver **26** includes a display device, such as an LCD, to produce a real-time display of selected portions of information derived from the data, including speed and distance travelled by the skate **10**. The signals produced by the transducer portion **24** may be acoustic. In this manner, the transducer portion **24** and the receiver **26** are acoustically coupled, placing them in acoustical communication. It is preferred, however, that the transducer portion **24** produce electromagnetic signals, placing the receiver **26** in radio communication therewith. At lower frequencies, i.e. 10 to 250 kHz, the communication between the transducer portion **24** and the receiver **26** would be achieved primarily by a magnetic field. At higher frequencies, i.e. 100 MHz to 2.5 GHz, communication would be achieved primarily by an electric field.

A magnetic base **28**, containing one or more permanent magnets, is attached to at least one of the wheels, defining a control wheel **23**. The magnetic base **28** may be attached to the control wheel **23** with a suitable adhesive, or the magnetic base **28** may be integrally molded with the control wheel **23**. Integrally molding the magnetic base **28** with the control wheel **23** allows the magnets to be disposed proximate to the wheel's centerline, thereby having little effect on wheel balance. The transducer portion **24** includes a revolution detector **30** positioned to sense the magnetic base **28**. The revolution detector **30** may be a pick-up coil or other inductively coupling mechanism, such as a reed switch or Hall effect device. Typically, the revolution detector **30** is positioned above the control wheel **23** and operates as a transducer to detect the changing magnetic field generated by the magnetic base **28** and produce pulses corresponding to the rotational movement of the wheels **22**. Specifically, the revolution detector **30** produces pulses containing raw data corresponding to the rate of rotation of the control wheel **23**.

Referring also to FIG. 2, the transducer portion **24** is shown attached to a support body **32** having a profile matching the profile of the first major **16** surface of the shoe portion **12**. In addition to the detector **30**, the transducer portion **24** includes a microcontroller **34**, a transmitter **35** and an antenna **36**. Also included is a suitable power source **38**, such as batteries, to power the transducer portion **24**. The microcontroller **34** and the transmitter **35** may both be formed on a single monolithic chip, but are shown separate for demonstrative purposes. The micro-controller **34** is electronically coupled to receive the pulses from the revolution detector **30**. The transmitter **35** is electronically coupled to both the micro-controller **34** and the antenna **36**. The micro-controller **34** conditions and averages the time between pulses produced by the detector **30**, creating a digital data stream from the raw data. The micro-controller **34** preferably measures the period from edge to edge of each of the pulses produced by the detector **30**. This provides great accuracy, especially for low revolutions per second of the control wheel **23**. The micro-controller **34** then modulates a carrier wave produced by the transmitter **35** with the digital data stream and a plurality of control signals, including an identification code to produce coded signals. The control signals will be discussed more fully below. The transmitter **35** transmits the coded signals to the receiver **26** via antenna **36**.

Referring also to FIG. 3, shown therein is a simplified schematic of the transducer portion, showing the revolution detector **30** in electrical communication with the input **31** of the micro-controller **34**. The input **37** of the transmitter **35** is in electrical communication with the output **33** of the micro-controller **34**. The output **39** of the transmitter **35** is in electrical communication with the antenna **36**. The transmitter **35** may be of any design desired, but preferably has a small footprint and is compatible with the power source **38**. The micro-controller **34** is preferably an MC68HC785P9 and is available from Motorola, Inc. The micro-controller **34** is typically programmed with an algorithm to appropriately condition the pulses so that they are suitable for transmission by the transmitter **35**.

The support body **32** is designed to rest between a foot of a user wearing the skate and the first major surface **16**. To that end, the transducer portion **24** is usually manufactured on a single printed circuit board **33** and is of reduced thickness so that the support body **32** may completely encapsulate the transducer portion **24**. The support body **32** is rigid to protect the transducer portion **24** from stresses associated with roller skating. In addition, the support body **32** may be hermetically sealed to protect the transducer portion **24** from moisture, as well. Due to the size of the power source **38**, it is typically located so that it lies beneath the arch of the foot of the skate **10**'s user. The power source **38** provides, therefore, added support for the skate **10**'s user in an unobtrusive manner. To allow access to the power source **38**, a removable cover may be present.

The support body **32** may be integrally formed with the shoe portion **12** of the skate **10**. It is preferred, however, that the support body **32** is removably attached to the first major surface **16**. One manner in which to achieve the removable attachment of the support body **32** is to affix the support body **32** to the bottom surface **15** of the liner **14**, or alternatively the support body **32** may be inserted between the liner **14** and the first major surface **16**. This allows the present invention to be available as an after-market accessory for in-line roller skates. To facilitate the manufacture of the support body **32**, it may be constructed to fit the largest shoe-size available. Manufacturing a support body **32** of only one size reduces the tooling costs. The end-user may trim the support body **32** to the appropriate size of the shoe portion **12** using, for example, a pair of scissors. To that end, the support body **32** may include markings **40**, such as grooves or lines, to indicate differing sizes. The end-user would cut along the appropriate markings **40** to provide a satisfactory fit with the first major surface **16** of the appropriate shoe portion **12**.

Referring also to FIG. **4**, the receiver **26** is shown including a housing **42** and a strap **44** attached to the housing **42**. The receiver **26** is configured so that it may be donned by a user in a manner similar to a wrist-watch. The circuitry is typically attached to a printed circuit board **46**, which is powered by batteries **47**, or any other suitable power source, and may include a plurality of antennas **48** electronically coupled to a microprocessor **50** via receiver circuitry **49**. Antenna **48** places the receiver **26** in radio communication with the transducer portion **24** to receive the coded signals containing information corresponding to the rotational movement of the control wheel **23**. Typically, there is only one antenna **48**. However, there may be two antennas **48**, oriented orthogonally with respect to each other, as shown. Having two antennas orientated as shown in FIG. **4** provides a more sensitive coupling to the magnetic field associated with the coded signals.

The modulated carrier wave received by antenna **48** is sent to the receiver circuitry **49** which demodulates the coded signal and reproduces the digital data stream for processing by the microprocessor **50**. A display **52**, such as an LCD, is attached to the housing **42** so as to be visible to a user wearing the receiver **26**. The microprocessor **50** receives the digital data stream from the receiver circuitry **49**. Having the diameter of the control wheel **23** preprogrammed in memory, the microprocessor calculates various information corresponding to the rotational movement of the control wheel **23**, using a suitable algorithm. For example, the microprocessor **50** can determine information regarding speed and distance travelled by the skate. The display **52** is driven by the microprocessor **50** to produce a real-time visual representation of the speed and distance travelled in any units desired, e.g. metric or English. In this manner, selected portions of the information corresponding to the rotational movement of the wheels **22** is produced on the display **52**. A plurality of switches **53** are operationally coupled to the microprocessor **50** to change the information visually represented on the LCD display **52** and to input data.

In addition, the microprocessor **50** may be electronically coupled to non-volatile memory **51** that may include preprogrammed data corresponding to a user's weight and height. The microprocessor **50** may also determine, based upon both the information corresponding to the rotational movement of the control wheel **23** and the preprogrammed information, parameters concerning the calories burned by the user. In addition, an orthogonal orientation of the antennas **48** would facilitate detection of signals transmitted by state of the art heart rate monitors which may be worn on the exterior of the chest. Alternatively, the receiver **26** may include circuitry capable of detecting, directly, the heart rate of a user. In this fashion, the microprocessor **50** may process signals associated with a user's heart rate and may transmits these signals to the LCD display **52**. The microprocessor **50** may also incorporate information concerning the heart rate into the calculations to determine the amount of calories burned by the user, providing a more accurate measurement of the same. The memory **51** may also include stored information corresponding to a history of past distances and speeds associated with previous workouts.

To facilitate a user's rapid comprehension of the visual representations the on the display **52**, internationally known graphical icons **55** may shown along with corresponding information. Instead of being worn as a wristwatch, the receiver **26** may be included in a safety helmet and mounted so as to be visible to a wearer. Additionally, the receiver **26** may be formed as a pair of glasses to be worn on a user's head.

Referring also to FIG. **5**, a simplified schematic view of the receiver **26** is shown with the antenna **48** in electrical communication with the input **57** of the receiver circuitry **49**. The output **58** of the receiver circuitry **49** is in electrical communication with the input **59** of the microprocessor **50**. The output **60** of the microprocessor **50** is in electrical communication with the input **61** of the display **52**. Preferably, the receiver circuitry **49** is an operational amplifier. The microprocessor **50** is an LC58E68 and is manufactured by, and available from, Sanyo, Inc.

In operation, the transducer portion **24** is always in a state to sense a rotating magnetic field when the control wheel **23** rotates. The magnetic field rotates directly proportional to the rate of rotation of the control wheel **23**. The revolution detector **30** produces pulses containing raw data corresponding to the rotating magnetic field, which is sent to the micro-controller **34**. After conditioning, the pulses are converted into a digital data stream and modulated onto a carrier wave by the micro-controller **34**. The micro-controller **34** also modulates the carrier wave with an identification code, along with other control signals, producing a coded signal. Any number of modulation schemes may be employed, e.g. amplitude, phase, or frequency-shift modulation. The identification code uniquely associates the coded signal with the transducer portion **24**. The transmitter **35** transmits the coded signal at variable intervals of time via antenna **36**. In this manner, the digital data stream may be transmitted periodically, e.g. every one to two seconds, forming a train of data.

Switches **53** may be depressed to place the receiver **26** in one of three modes: power-down, power-on or time-delayed deactivation mode. In the power-on mode, antenna **48** of the receiver **26** receives and demodulates the coded signal, reproducing the digital data stream corresponding to the rotational/angular velocity of the control wheel **23**. Receiver circuitry **49** determines whether the appropriate code is present therein. If the appropriate code is not present therein, the receiver **26** will ignore the digital data stream. If the appropriate code is present, the receiver circuitry **49** sends the digital data stream to the microprocessor **50**. The microprocessor **50** performs various calculations described above to determine velocity and distance travelled, as well as calories burned by the user. After performing the aforementioned calculations, the microprocessor **50** will drive the display **52** to provide a real-time visual representation of selected portions of the information.

In the time-delayed deactivation mode, an activation/deactivation circuit **54**, incorporated into the receiver **26**, is activated. The circuit **54** may include a microprocessor to poll the antenna **48** and determine whether a coded signal is present. If such a signal is present, activation/deactivation circuit **54** automatically places the receiver **26** into the power-on mode. The receiver **26** will maintain the power-on mode for a predetermined amount of time in the absence of a coded signal. After a predetermined amount of time has lapsed, the activation/deactivation circuit **54** automatically places the receiver **26** into a wait state, thereby deactivating it. Upon the antenna **48** receiving a coded signal, the receiver **26** would once again be placed into the power-on mode by the activation/deactivation circuit **54**. In the power-down mode, the receiver **26** is non-operational.

Transmitting a modulated carrier wave having an identification code uniquely associated with the transducer portion **24** enables many of these systems to operate in close proximity without cross-talk, because each receiver may be programmed to recognize only one identification code. This ensures that each receiver is in radio communication with only one transducer portion. The remaining control signals are a battery condition signal and a checksum signal. The battery condition signal contains information concerning the charge state of the power source **38**. The checksum signal contains information concerning the amount of data present in the data stream. Typically, the transducer portion **24** and the receiver **26** operate at a frequency which enables filtering of unwanted signals that may be present in a surrounding environment. This allows the transducer portion **24** and receiver **26** to communicate over greater radial distances, depending upon the power of the transducer portion **24**, thereby providing more flexibility with regard to the distances over which the transducer portion **24** and receiver **26** may communicate, i.e., the distance need not be fixed.

Although the transducer portion **24** has been discussed as modulating a carrier wave with a digital data stream, the carrier wave could be modulated with an analog signal, as well, thereby abrogating the need for the micro-controller **34**. The receiver chip **49** would comprise of circuitry to demodulate the signal received from antenna **48** and also convert it into a digital data stream so that it may be processed by the microprocessor **50**. Moreover, instead of transmitting a modulated radio frequency, the transducer portion **24** may transmit a periodic magnetic wave representative of the rotational movement of the wheels. One method in which to transmit and detect a rotating magnetic wave in discussed in U.S. Pat. No. 5,177,432 to Waterhouse et al. In this manner, the control wheel would contain a battery **138**, rotation detector **130** and a PCB with an LC oscillator **131**, as shown in FIG. **6** and discussed in Waterhouse et al.

An additional embodiment, as shown in FIG. **7**, includes a control wheel **300** having a chamber **302** proximate mate to the wheel's center, with a source of light **304** contained therein. The source of light may be an LED or laser diode. One or more bore holes **306**, **308** and **310** may extend from chamber **302** and terminate in one or more apertures **312**, **314** and **316**, equally spaced about the periphery **318** of the wheel **300**. The revolution detector **330** comprises of an optical detector which could be disposed proximate to a hole **332** in the first major surface **316** to sense light emitted through said apertures **312**, **314** and **316**. The revolution detector **330** would produce a pulse each time light is sensed. In this manner, the revolution detector **332** would produce pulses corresponding to the rotational movement of the control wheel **300**. These pulses would be transmitted to the receiver as discussed above.

I claim:

1. A speedometer system for skates comprising:

a roller skate including a sole with first and second opposed major surfaces and a plurality of wheels rollably attached to said second major surface;

transducer means, disposed in said roller skate, for producing electrical pulses in response to a rotational movement of said plurality of wheels;

means, in communication with said transducer means, for converting said electrical pulse into digitized data related to said rotational movements of said plurality of wheels;

a transmitter, disposed in said roller skate, for receiving said digitized data and emitting corresponding signals containing said digitized data;

wireless receiver means, in communication with said transmitter, for receiving said signals;

means, in communication with said receiver means, for processing said signals to produce information related to said rotational movement, said information including an angular velocity of said wheels;

display means, in electrical communication with said receiver means, for producing a real-time visual representation of said information; and

a housing containing said processing means and said display means.

2. The system as recited in claim **1** wherein said wireless receiver means is in radio communication with said transmitter.

3. The system as recited in claim **1** wherein said wireless receiver means is in acoustic communication with said transmitter.

4. The system as recited in claim **1** wherein said housing includes means for attaching said housing to a wrist of the user.

5. The system as recited in claim **1** wherein said transducer means includes a means, attached to at least one of said plurality of wheels, for generating a rotating magnetic field; and means, mounted proximate to said first major surface, for converting said magnetic field into said pulses.

6. The system as recited in claim **5** further including a means for modulating said pulses onto a carrier wave.

7. The system as recited in claim **1** wherein said transducer means detects rotary movement of one of said plurality of wheels, defining a control wheel.

8. The system as recited in claim **7** wherein said transducer means is an optical sensor, whereby said rotary movement of said control wheel results in said optical sensor detecting light at a periodicity proportional to a rotational velocity of said control wheel and producing said electrical pulses.

9. The system as recited in claim **7** wherein said transducing means includes a magnet coupled to said control wheel, producing a rotating magnetic field having a rotational velocity proportional to said rotary movement, and a sensor inductively coupled to detect said magnetic field and produce said electrical pulses corresponding thereto.

10. The system as recited in claim **9** wherein said magnet is integrally formed with said control wheel.

11. The speedometer system of claim **1** wherein said digitized data relates to the number of rotations of said wheels produced during a period of time.

12. The speedometer system of claim **1** wherein said digitized data relates to the angular velocity of said wheels.

13. The speedometer system of claim **1** further including means, operating in conjunction with said producing means,

for incorporating an identification code with said digital data signal, and wherein said processing means is further characterized in recognizing only those digital data signals containing said identification code.

14. The system as recited in claim **1** wherein said housing includes means for wearing said housing on the user's head and said display means is a visual display.

15. A speedometer system for skates comprising:

a roller skate including a sole with first and second opposed major surfaces and a plurality of wheels rollably attached to said second major surface;

transducer means for converting rotations of one of said plurality of wheels to electrical pulses

means, coupled to receive said pulses, for computing an angular velocity based on said pulses and for producing a digital data signal containing computed angular velocities, said producing means positioned proximate to said first major surface;

receiver means, in wireless communication with said producing means, for receiving said digital data signal;

means, in communication with said receiver means, for processing said digital data signal to produce information related to said rotational movement, said information including a distance traversed by said roller skate;

display means, coupled to receive said information from said processing means, for producing a real-time visual representation of selected portions of said information; and

a wrist-mounted housing containing said receiver means, said processing means, and said display means.

16. The system as recited in claim **15** wherein said transducer means and said producing means are both incorporated into a support housing which is removably disposed upon said first major surface.

17. The system as recited in claim **15** wherein said plurality of wheels are coaxially aligned along a longitudinal axis of said roller skate, and said roller skate includes a removable liner having a shape to receive and conform to a human foot and a lower portion of a leg extending upward therefrom, with both said transducer means and said producing means disposed between said roller skate and said liner, thereby being removably mounted within said roller skate.

18. The system as recited in claim **15** wherein said transducer means includes a source of light, mounted to said control wheel, and an optical sensor attached proximate to an aperture in said first major surface to detect light generated by said source of light, whereby said rotational movement of said wheel results in said optical sensor detecting light at a periodicity proportional to a rotational velocity of said control wheel and producing electrical pulses corresponding to said light detected.

19. The system as recited in claim **15** wherein said transducer means includes a magnet coupled to said control wheel, producing a rotating magnetic field having a rotational velocity proportional to said rotational movement, and a sensor inductively coupled to detect said magnetic field and produce electrical pulses containing information corresponding to said rotational movement.

20. A speedometer system for a roller skate comprising:

a roller skate having first and second opposed major surfaces with a plurality of wheels rollably attached to said second major surface and coaxially aligned along a longitudinal axis of said roller skate;

transducer means for detecting rotation of one of said plurality of wheels and producing electrical pulses in response thereto;

computer means for computing an angular velocity based on said pulses;

transmitter means, attached to said roller skate, for modulating a carrier wave with a digital representation of said computed angular velocity;

receiver means, in radio communication with said transmitter means, for receiving and demodulating said carrier wave, thereby reproducing said digital representation of said angular velocity;

means, electronically coupled to said receiver means, for processing said digital representation to produce information corresponding to said angular velocity, said information including velocity of said roller skate; and

display means, in electrical communication with said processing means, for producing a real-time visual representation of selected portions of said information.

21. The system as recited in claim **20** wherein said transmitter means modulates said carrier wave with an identification code along with said pulses, with said receiver means being tuned to receive only those carrier waves modulated with said identification code.

22. The system as recited in claim **21** wherein said transducer means includes a magnet coupled to said control wheel, producing a rotating magnetic field having a rotational velocity proportional to said rotation of said wheel, and a sensor inductively coupled to detect said magnetic field and produce pulses corresponding thereto.

23. The system as recited in claim **22** wherein said magnet is integrally formed with said wheel.

24. The system as recited in claim **23** wherein said roller skate includes a shoe portion extending upward from said first major surface and shaped to receive a removable liner, said liner shaped to receive a human foot and a lower portion of a leg extending upward therefrom, with both said transducer means said transmitter means disposed between said first major surface and said liner.

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