UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PELOTON INTERACTIVE, INC.,

Petitioner

v.

JOHNSON HEALTH TECH CO., LTD.,

Patent Owner.

PTAB Case No. IPR 2023-01163

Patent No. 10,032,227

DECLARATION OF R. LEE RAWLS IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,032,227 CHALLENGING CLAIMS 1-20

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LIST OF EXHIBITS AND APPENDICES

Exhibit	Description
1001	U.S. Patent No. 10,032,227 ("'227 patent")
1002	Declaration of R. Lee Rawls
1003	File History of U.S. Patent No. 10,032,227
1004	U.S. Patent No. 9,785,827 ("Ray")
1005	U.S. Patent No. 7,736,273 ("Cox")
1006	U.S. Patent App. Pub. No. 2010/0160115 ("Morris")
1007	Reserved
1008	U.S. Patent No. 6,638,198 ("'198 patent")
1009	File History of U.S. Patent No. 10,796,375
1010	U.S. Patent No. 11,227,340 ("'340 patent")
1011	U.S. Patent No. 8,574,131 ("Daly")
Appendix	**Description**
A	Mr. R. Lee Rawls' Curriculum Vitae
B	U.S. Patent No. 1,064,968 ("Hagen")
C	U.S. Patent No. 4,544,152 ("Taitel")
D	U.S. Patent No. 6,783,482 B2 ("Oglesby")
E	U.S. Patent No. 5,034,576 ("Dalebout")
F	U.S. Patent No. 9,072,930 ("Ashby")
G	U.S. Patent No. 8,277,377 ("Quy")
H	U.S. Patent No. 9,460,632 ("Watterson '632")
I	U.S. Patent No. 9,403,053 ("Kaiser")
J	U.S. Patent App. Pub. No. US 2009/0239709 A1 ("Wu")
K	U.S. Patent App. Pub. No. 2011/0082007 A1 ("Birrell")
L	U.S. Patent App. Pub. No. US 2004/0010420 A1 ("Rooks")

I, R. Lee Rawls declare as follows:

1. I have been retained as an expert consultant by Perkins Coie LLP on behalf of Peloton Interactive, Inc. ("Petitioner") in this proceeding before the United States Patent and Trademark Office ("PTO") against Johnson Health Technology ("Patent Owner") regarding U.S. Patent No. 10,032,227 ("the '227 patent") (Ex 1001). I have been asked to consider whether certain references disclose or suggest the features recited in claims 1-20 ("the challenged claims") of the '227 patent. My opinions are set forth below.

2. I am being compensated for my time at a rate of $340 per hour. I am not receiving any other form of compensation. I have no interest in the outcome of this proceeding, and my compensation is not dependent on the content of my opinions or the outcome of this proceeding.

I. INTRODUCTION AND QUALIFICATIONS

3. I am an independent consultant. All opinions stated in this Declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience relating to the technology referenced in this Declaration.

4. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. A copy of my current curriculum vitae, which includes a more detailed summary of my education and

professional and academic experience is provided as Appendix A to this Declaration. The following provides an overview of some of my experience that is relevant to the matters set forth in this Declaration.

A. Qualifications

5. I received my Master's Degree from the University of California at Davis in 1986. My area of specialty was Biomechanics, a field which focuses on understanding forces and stresses involving the human body. For example, biomechanics involves complex modeling and analysis of movements at joints, forces/tension on muscles, and the geometry of the musculoskeletal system (either for a static or a dynamic system). The field also includes the study of mechanics in relation to devices that interact with the human body. Biomechanics is closely related to engineering, because it often uses traditional engineering sciences to analyze biological systems. Some applications of Newtonian mechanics and/or materials sciences can supply correct approximations to the mechanics of many biological systems. Applied mechanics—most notably mechanical engineering disciplines such as continuum mechanics, mechanism analysis, structural analysis, kinematics and dynamics—play prominent roles in the study of biomechanics.

6. As part of my graduate education in Biomechanics, I studied the mechanics of motion, free body diagram analysis and kinematics along with significant study of the human body (Anatomy & Physiology). As part of my

Master's thesis, I designed and physically built a configurable arm ergometer, which is an exercise machine for measuring how much work a person outputs during a bout of exercise. This device included electronic sensors to detect the instantaneous load, instantaneous speed, and overall duration of the exercise. I also personally wrote the software to sample, compile, analyze, and generate meaningful results from the data so that the results could be used to analyze the results of the study. I received permission to conduct a study with human subjects using the device and was able to collect enough data to achieve statically significant results. The testing and final analysis and results were then submitted as my Master's thesis.

7. Since receiving my Master's Degree, I have worked for 37 years designing products including exercise devices with mechanical, electrical and software components. I started my industry career in 1986 at Loredan Biomedical, a start-up medical device/rehab equipment company. As director of manufacturing at Loredan Biomedical, I wore many hats, including product manager for isokinetic testing devices. My projects included work on the Lido multi-joint, Lido Back and Lido Lift devices. These products were very sophisticated computerized physical rehab/testing devices with servo motors, precision mechanisms, and sensitive electronics. My work at Loredan involved developing product specifications and test protocols for mechanical, electrical and software requirements, as well as building and testing prototypes. As the director of manufacturing, I was very familiar with all

aspects of these products, including their design, the interaction of mechanical/electrical/software components and was involved in all stages of development, testing, and in ushering products into production.

8. From 1991 to 1999, I was the Vice President of Product Development and Engineering at StairMaster, where I managed and directed a team of over twenty engineers, including mechanical engineers, software engineers and electrical engineers. At StairMaster, I was directly responsible for the conception, development and ongoing engineering of fitness equipment, including numerous computerized exercise devices. Those devices generally included many components and capabilities, including motors, flywheels, conveyors, wheels, belts, chains, microprocessors, displays, interconnectivity, user input devices, and magnetic brakes. The StairMaster products included the capability to measure performance parameters from operating components, send and receive performance parameters and other information, and to communicate through various interfaces and displays. Most of the StairMaster products also included resistance means and microprocessors.

9. One of the product lines that I was responsible for was the StairMaster treadmill line.

10. I am the named inventor on at least nineteen patents, twelve of which are directed to exercise products (mostly computerized) that were filed and issued

while I was at StairMaster. My patents are listed in my curriculum vitae (provided as Appendix A).

11. I am presently a partner in a mechanical engineering/design firm doing business as Jump Design Innovations, LLC. I am primarily engaged by my clients on projects relating to product development and product design, including the design and engineering of mechanical, electrical and computerized devices and components. I work for clients in many diverse industries including fitness equipment, high-volume consumer products, bicycle components, medical devices, optical equipment, outdoor equipment, the aerospace industry, the marine industry, musical instruments and electronics packaging. I routinely take on projects that require that I expand my knowledge base, and, as a consequence, I have undertaken studies in materials science, finite element analysis, corrosion, buoyancy, plastics, acoustics, and other fields.

12. From 1986 to this day, I have worked continuously in the engineering field. I worked on the development of computerized physical rehabilitation and exercise equipment from 1986 to 1999. I am and was a person of at least ordinary skill in the art during the relevant timeframe.

B. Materials Reviewed

13. The opinions contained in this Declaration are based on the documents I have reviewed, my professional judgment, and my education, experience, and

knowledge relating to exercise equipment and related fields. In forming my opinions, I have reviewed all materials listed in the List of Exhibits and Appendices provided above (as well as any other materials and information I reference in this Declaration).

14. My opinions contained in this Declaration are based on the documents I have reviewed and considered, as well as my knowledge and professional judgment. My opinions have been guided by my appreciation of how a person of ordinary skill in the art ("POSITA") would have understood the state of the art, the prior art, and the claims and the specification of the '227 patent at the time of the alleged invention.

15. The time of the alleged invention of the '227 patent encompasses the time frames near and including December 30, 2014. I understand the application for the '227 patent claims priority to a provisional application filed on December 30, 2014. (Ex. 1001, 1:8-10.) My opinions reflect how a POSITA (which I describe below) would have understood the '227 patent, the prior art to the patent, and the state of the art at the time of the alleged invention.

C. Summary of My Opinions

16. Claims 1-20 of the '227 patent are obvious under 35 U.S.C. § 103 based on the grounds shown in the table below:

Ground	Claims Challenged	35 U.S.C. §	References
1	1-9, 12, 14-20	103	Morris, Ray
2	10-11, 13, 20	103	Morris, Ray, Cox
3	1-6, 14-20	103	Ray in view of AAPA
4	10-11, 20	103	Ray, Cox
5	7-9, 12	103	Ray, Daly
6	13	103	Ray, Daly and Cox

17. Based on my experience and expertise, it is my opinion that the prior art discloses and/or suggests all the limitations recited in challenged claims 1-20 of the ’227 patent, as I discuss in detail below.

II. UNDERSTANDING OF LEGAL PRINCIPLES AND PERSPECTIVES

18. I am not a lawyer and I will not provide legal opinions. Although I am not a lawyer, I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims.

19. I understand that a patent claim is invalid if it is anticipated or obvious in view of the prior art and that a claim can be unpatentable even if all requirements of the claim cannot be found in a single prior art reference. I further understand that invalidating a claim requires that the claim be anticipated or obvious from the perspective of a POSITA at the time the invention was made.

20. In forming my analysis, opinions, and conclusions expressed in this Declaration, I have applied the legal principles set forth below, which were provided to me by counsel for Petitioners.

A. Types of Claims

21. I understand that there are two types of U.S. patent claims: 1) independent claims and 2) dependent claims. I understand that independent claims only include the aspects stated in the independent claim. I further understand that dependent claims include the aspects stated in that dependent claim, and any other aspects stated in any claim from which that dependent claim depends.

B. Anticipation and Obviousness

22. I understand that a claim is not patentable if it is anticipated or obvious. Although my opinion in this Declaration only relates to obviousness of the challenged claims, I understand that anticipation of a claim requires that every element of a claim is disclosed expressly or inherently in a single prior art reference.

23. I further understand that obviousness of a claim requires that the claim be obvious from the perspective of a person of ordinary skill in the relevant art at the time the invention was made. I understand that the earliest patent application leading to the ’227 patent was a U.S. provisional patent application filed on December 30, 2014. I have therefore analyzed the unpatentability of the claims as of that day. I may refer to the relevant time as the “2014 timeframe” in this Declaration.

24. I understand that to prove that prior art or a combination of prior art renders a patent obvious, it is necessary to:

a) identify the particular references that, singly or in combination, make the patent obvious;

b) specifically identify which elements of the patent claim appear in each of the asserted references; and

c) explain why a POSITA would have combined the references, and how they would have done so, to create the inventions claimed in the patent.

25. I further understand that exemplary rationales that may support a conclusion of obviousness include:

a) combining prior art elements according to known methods to yield predictable results;

b) simple substitution of one known element for another to obtain predictable results;

c) use of known technique(s) to improve similar devices (methods or products) in the same way;

d) applying a known technique to a known device (method or product) ready for improvement to yield predictable results;

e) "obvious to try" - choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;

f) known work in one field of endeavor may prompt variations of the work for use in either the same field or a different field based on design incentives or other market forces if the variations are predictable to a POSITA; and

g) some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

26. In analyzing obviousness, I understand that it is important to understand the scope of the claims, the level of skill in the relevant art, the scope and content of the prior art, the differences between the prior art and the claims, and any "secondary considerations" (described below). I also understand that if a technique has been used to improve one device, and a POSITA would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. Although I understand that it is not required, there may also be a specific "teaching, suggestion or motivation" to combine any first prior art reference with a second prior art reference. Such a "teaching, suggestion, or motivation" to combine the first prior art reference with the second prior art reference can be explicit or implicit and may provide further evidence of obviousness.

27. I understand that secondary (or objective) considerations are relevant to the determination of whether a claim is obvious. Such secondary (or objective) considerations can include evidence of commercial success caused by an invention, evidence of a long-felt need that was solved by an invention, evidence that others copied an invention, or evidence that an invention achieved a surprising or unexpected result. I understand that such evidence must have a nexus, or causal relationship to the elements of a claim, to be relevant to the obviousness or non-obviousness of the claim. I am not currently aware of any such evidence for the

claims of the ’227 patent and reserve my right to review and respond to such evidence if presented.

28. I also understand that, at least in IPR proceedings, admissions in the patent or in the prosecution file history of the patent (Applicant Admitted Prior Art or “AAPA”) can be used to establish background knowledge possessed by a POSITA, to furnish a motivation to combine, to assess whether a patent’s claims would have been obvious, and/or to supply a missing limitation.

C. Claim Construction

29. I understand that, for purposes of my analysis, the terms appearing in the patent claims should be interpreted according to their “ordinary and customary meaning” at the time the alleged invention was made. In determining the ordinary and customary meaning, the words of a claim are given the plain meaning that those words would have had to a POSITA. I understand that the structure of the claims, the specification, and the file history also may be used to in the construction of a claim term. Additionally, treatises and dictionaries may be used, in limited circumstances, to determine the meaning attributed by a POSITA to a claim term at the time of filing.

30. For all claim terms considered in this Declaration, I have applied the ordinary and customary meaning of those terms as they would have been understood by a POSITA at the time the alleged invention was made. To the extent the Patent

Owner proposes any constructions or the Board construes any claims, I reserve the right to address such proposals or constructions. Regardless, under any reasonable construction of the claims, the prior art discloses and/or suggests all the limitations recited in challenged claims 1-20 of the ’227 patent.

D. Person of Ordinary Skill in the Art

31. I understand that my assessment and determination of invalidity must be undertaken from the perspective of what would have been known or understood by a POSITA at the time of the earliest patent application supporting the ’227 patent.

32. I have been informed and understand that the POSITA is not a real person, but rather a legal construct—a hypothetical person. This person is presumed to have known the relevant art at the time of the invention. I have been informed by counsel that relevant factors in determining the level of ordinary skill include (1) the educational level of the inventor, (2) the type of problems encountered in the art, (3) prior art solutions to those problems, (4) the rapidity with which innovations are made, (5) sophistication of the technology, and (6) the educational level of active workers in the field. I further understand that the person of “ordinary skill” is not a person of extraordinary skill in the art. In other words, this person of ordinary skill is not necessarily an expert in the field.

33. As of the alleged December 2014 priority date, a POSITA would have (i) a bachelor’s degree in an exercise-related field or mechanical or electrical

engineering and (ii) three to five years of industry experience in designing cardiovascular exercise equipment (such as treadmills, bicycles, steppers, ellipticals) or in a similar field. A POSITA could substitute additional education for experience, e.g., substituting an advanced degree relating to the design of cardiovascular exercise equipment or biomechanics for industry experience in a related field, and vice versa.

34. At the time of the alleged invention, I was a person of at least ordinary skill in the art, and I have applied the perspective of the POSITA in forming and expressing my opinions below.

III. THE STATE OF THE ART

A. History of the Treadmill and Its Components

35. Aerobic exercise is one of the staples of the exercise industry. Treadmills, steppers, stationary bikes, and ellipticals are some of the more common aerobic exercise devices. Most aerobic exercise devices will not operate unless the user is actively engaged with the device. In fact, the treadmill is one of the few exercise devices that is motor-driven and capable of operating without user effort.

36. As discussed in greater detail below, the ability of the treadmill to operate without user effort introduces a unique set of issues, including: (1) safety considerations (as it is not safe to have a treadmill running when not being actively used), and (2) the need for data verification when a third party requires confirmation that a user is actually exercising on the device (as opposed to allowing the treadmill

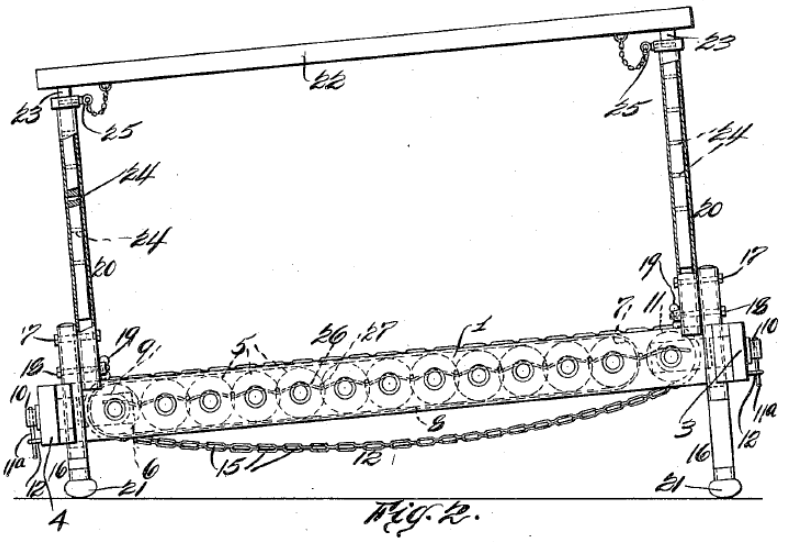
to run without the user actually exercising). For any exercise device that will only operate when the user is exercising, verifying exercise compliance is not necessary. In those cases, if the device is operating, then the user is exercising and is directly responsible for any effort/work/calories/etc. that are being measured by the device.

37. A motorized exercise device such as a treadmill is able to operate with or without user effort. A typical treadmill has a motor that drives a continuous belt at a preset speed, regardless of whether a user is engaged with the device. Treadmills have typically reported exercise data (e.g., speed, distance and calories) based on the movement of the belt, not the actual exercise of the user. As the belt is traveling at a set speed and incline, the reported exercise data typically assumes that the user is engaged with the belt. Thus, in order to verify exercise compliance on a treadmill, it is necessary to obtain some additional data to determine if the user is engaged with the moving belt of the treadmill. This may involve, for example, the use of a load sensor in the deck to detect the weight of a user based on his or her footstrikes; the use of a current sensor on the motor to detect the additional strain on the motor caused by a user running on the deck; or the use of a heart rate sensor to be used to verify whether a user is engaging in exercise. These are just a few of the ways user engagement could be confirmed to verify exercise compliance.

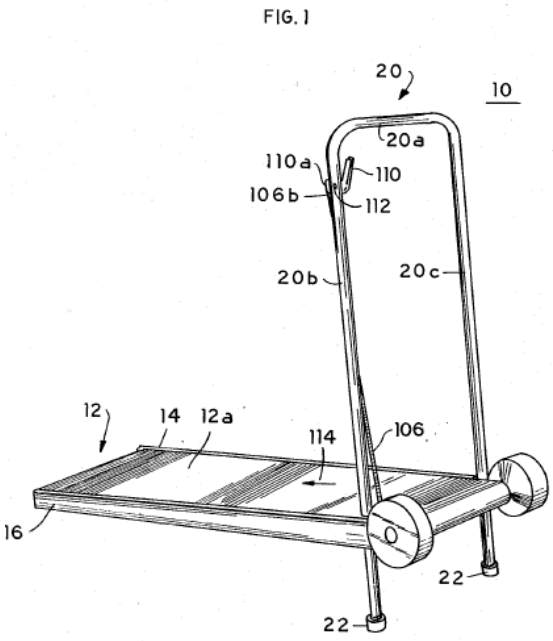
1. Examples of Passive Treadmills

38. Treadmills have been around for a very long time and their components and operation are very well known and understood. Treadmills enable a user to run in place. The first treadmill patent, entitled "Training Machine," issued on June 17, 1913 as U.S. Patent No. 1,064,968 to C.L. Hagen ("Hagen") from an application (App. No. 655,827) filed October 20, 1911. (Appendix B.)

39. Hagen includes many of the common components we see today, including a frame, belt, and rollers. (*Id.*, 1:23-33 & claim 1.) Hagen is directed to a treadmill that would be understood as a "passive" treadmill. (*Id.*, Fig. 2 (reproduced at right).) The motive power for this type of treadmill is gravity; the treadmill deck is positioned at an incline and the user's weight causes the user to be drawn down the incline on the moveable belt. As the user is pulled backward down the incline, he or she must continually step up and forward on the deck to keep from falling off the back.



40. A more recent example of a passive treadmill is seen in U.S. Patent No. 4,544,152, entitled "Passive-type Treadmill," which issued to Charles M. Taitel ("Taitel") on October 1, 1985 (based on App. No. 517,079, filed on July 25, 1983). (Appendix C.) As seen at right, the deck of this treadmill is inclined so that the user's body weight will drive the belt. (*Id.*, Fig. 1.) This treadmill is very simple and uses a mechanical centrifugal braking governor to control the speed of the deck. (*Id.*, Abstract (describing "[a] passive treadmill having a governor to adjustably limit the rate of speed of the treadmill belt").) No motor or modern controller are required in such a treadmill.



2. Examples of Motorized Treadmills

41. Modern treadmills are typically, but not always, motorized. It is believed that Wayne Quinton developed the first motorized treadmill while working at the University of Washington in 1959. The early Quinton treadmills were primarily designed for research and commercial use. After subsequent research on the benefits of aerobic exercise in the late 1960s, motorized treadmills were developed for the home market. As discussed in greater detail below, modern

motorized treadmills typically include a base, belt, motor, sensors, controller, and communication interface.

42. A motorized treadmill will typically have a main drive motor and a motor for changing or maintaining the incline of the deck. Motorized treadmills may also have various sensors to measure the speed of the belt, determine the presence of a user on the treadmill, detect foot strikes on the deck, etc. Motorized treadmills typically have a user interface including a keyboard for user input, but many also include the ability to send and receive instructions/data wirelessly through the internet or local devices. Motorized treadmills also typically have a device for presenting meaningful feedback to the user throughout the course of the exercise and summarizing the workout at the end of the exercise (e.g., a display screen).

43. In addition, as discussed with varying levels of detail in the treadmill prior art references, powered treadmills include components that are typically referred to as a "controller," "microcontroller," "microprocessor," or similar term. While such terms can refer to the specific component of the treadmill that controls the motor, the controller in a treadmill typically handles multiple functions, not just motor control. In the broader sense, the function of the controller is to sense, integrate and control any or all of the different operations of the treadmill.

44. The use of terms such as "micro" or "microprocessor" in connection with the control terminology is a reference to the fact that any modern treadmill

controller uses a microprocessor to analyze and manipulate digital signals. Before the age of microprocessors, a treadmill controller would have used and manipulated analog signals without a microprocessor.

45. A treadmill controller is the processing hub for the treadmill's functions and controls. As will be understood from the above discussion, a treadmill controller does many things and may have many different components for accomplishing its various tasks. That grouping of components, whether located on a single PC board or on a few interconnected PC boards and components, comprises what is commonly referred to as the "controller."

46. The controller may interact with various other components of the treadmill and perform a number of different functions. For example, the controller may: 1) sense and control the treadmill belt speed, 2) sense and control the incline of the treadmill deck, 3) keep a running tabulation of time, speed, distance and incline and provide feedback to the user based on those values (e.g., duration, distance traveled or calories burned), and 4) send and/or receive user exercise data or program data across a wide area or local area network.

47. The way that a microprocessor controller performs these functions is by sampling the output of the many sensors it is monitoring. Based on the data sampled, the controller could send a signal to maintain or adjust the belt speed, deck incline, accumulate exercise use data points or update the user feedback display.

Sampling rates could be fairly fast (100 Hz or more) or slow (1 Hz), depending on the desired results of the control system. The belt speed motor control, for example, might benefit from a fast sample rate for smooth operation, while the performance of the elevation/incline motor would likely not require a fast sample rate.

48. In addition, motorized treadmills have long been able to connect to the internet (e.g., to send data to third parties). Linking exercise systems through local or wide area networks has been a goal of exercise device manufacturers since the capability was in its infancy. Offering exercisers the tools to monitor or track their exercise progress, plan their exercise program beyond today's workout and be able to review objective analysis of their progress has been an effective marketing tool since at least the 1990s.

49. Early versions of Fitlinx were available in the 1990s and primarily allowed users to track and control their workouts using the local network (LAN) within a club. When internet speeds increased and broadband wide area networks became more common, Fitlinx and others took advantage of that capability to offer broader capabilities using the internet. For example, numerous prior art references disclose communicating user exercise data over the internet to third parties for a variety of prescriptive, diagnostic and analysis purposes. (*See, e.g.*, Ex. 1004 (Ray), 3:47-51, 7:4-8); Watterson, Abstract, 3:44-4:3).

a. U.S. Patent No. 8,690,735 ("Watterson")

50. An example of a typical motorized treadmill is seen in U.S. Patent No. 8,690,735, entitled "Systems for Interaction with Exercise Device," which issued on April 8, 2014 to Scott R. Watterson et al. ("Watterson") from an application (App. No. 13/184,194) filed on July 15, 2011. Figures 2 and 4 (below) depict a "typical motorized, reorienting treadmill." (*Id.*, 8:6-7.) As seen below, the treadmill 12 includes standard features found in a motorized treadmill, including a base 26, a continuous belt 42, a motor 46, and a controller 56. (*Id.*, 8:11-56.)

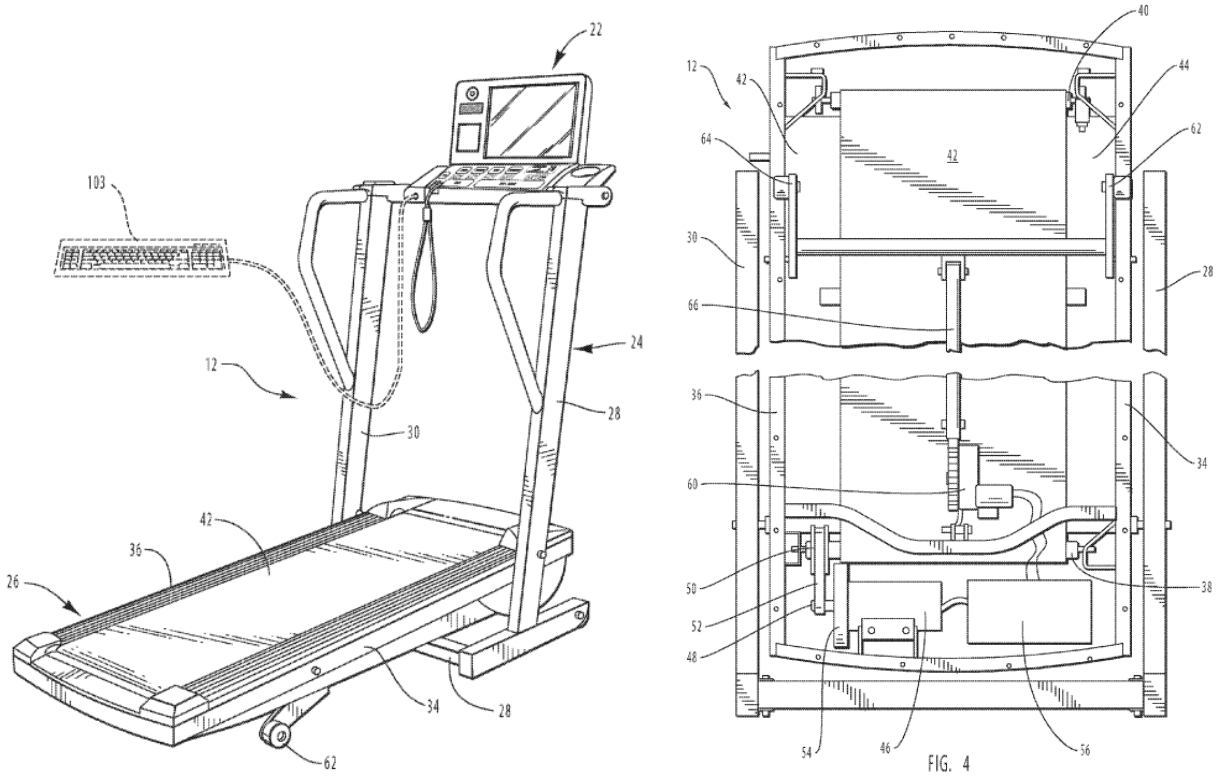


FIG. 4

51. As seen in the schematic block diagram of Figure 8 (reproduced below), Watterson '735 also describes a communication system (*id.*, 18:38-47 & Fig. 8):

As depicted, communication system **18** includes an interface **190** that communicates with a control processor **192** and an interface **198**. Interface **190** is configured to transceive one or more signals to and from computer **14** and treadmill **12** via network **16**. Such signals may include audio and visual signals of the user exercising, the status of the exercise device, such as active status, deactivated status, standby status, data and information about the user, such as heart rate, blood pressure, and the like that has been gathered by one or more health monitoring devices.

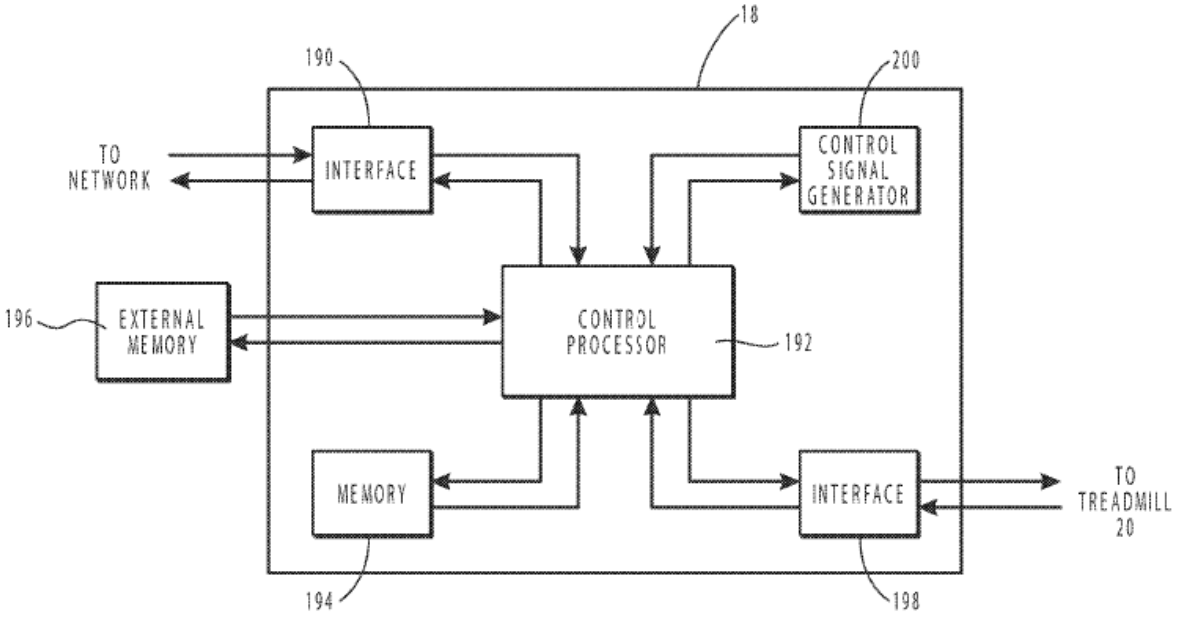


FIG. 8

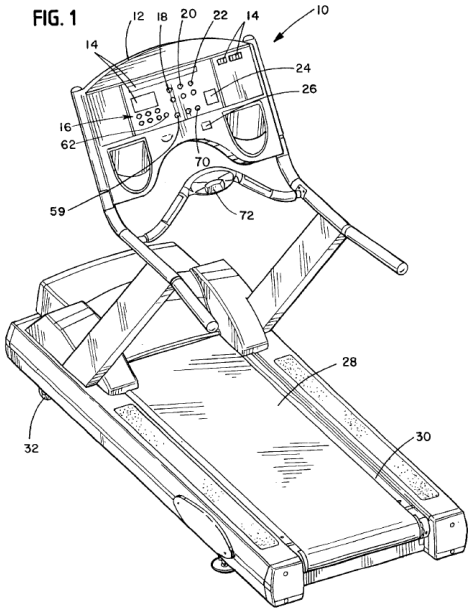
52. A motorized treadmill of this type is capable of operation when the deck is horizontal as well as when the deck is inclined. Treadmills of this type use a motor in conjunction with a controller to monitor and control the motor's speed based on user input/selection. At the time of the alleged invention, a base, belt, motor, and controller were standard features of this type of treadmill. Today, the vast majority of treadmills on the market (and in use in gyms or in homes) are motorized.

b. U.S. Patent No. 6,783,482 B2 ("Oglesby")

53. U.S. Patent No. 6,783,482, entitled "Treadmill Control System," issued August 31, 2004 to Gary E. Oglesby et al. (Appendix D.) Oglesby describes a microprocessor-based exercise treadmill control system (*id.*, Abstract & Fig. 1):

(57) **ABSTRACT**

A microprocessor based exercise treadmill control system is disclosed which includes various features to enhance user operation. These features include programs operative to: permit a set of user controls to cause the treadmill to initially operate at predetermined speeds; permit the user to design custom workouts; permit the user to switch between work-out programs while the treadmill is in operation; and perform an automatic cooldown program where the duration of the cooldown is a function of the duration of the workout or the user's heart rate. The features also include a stop program responsive to a detector for automatically stopping the treadmill when a user is no longer on the treadmill and a frame tag module attached to the treadmill frame having a non-volatile memory for storing treadmill configuration, and operational and maintenance data. Another included feature is the ability to display the amount of time a user spends in a heart rate zone.



54. As seen in Figures 1 and 2, Oglesby discloses a treadmill 10 having a belt 28, a deck 30, a motor 38, a motor controller 36, various sensors (user sensors 50, pulse sensors 46, weight sensor 74, foot pressure sensor 76), and a microprocessor-based system controller 40. (*Id.*, Figs. 1-2; 2:57-58, 65-67; 3:8-9; 4:55-63.) Oglesby clearly describes and depicts a central control system that interacts with all other hardware components. Oglesby acknowledges that "exercise treadmills that operate using a microprocessor control system have reached a relatively high state of development." (*Id.*, 1:26-28.)

55. As shown in Figure 2 (below), the Oglesby control system 34 "controls an AC motor 38 having a motor controller 36 to propel the belt 28," "uses a microprocessor based system controller 40 to control the control panel displays 14," "serves to control a heart rate monitoring system … utilizing a set of pulse sensors 46 and a deck or belt lubrication system 48," and "also controls a user detect or sense system 50." (*Id.*, Fig. 2 & 2:61-3:9.)

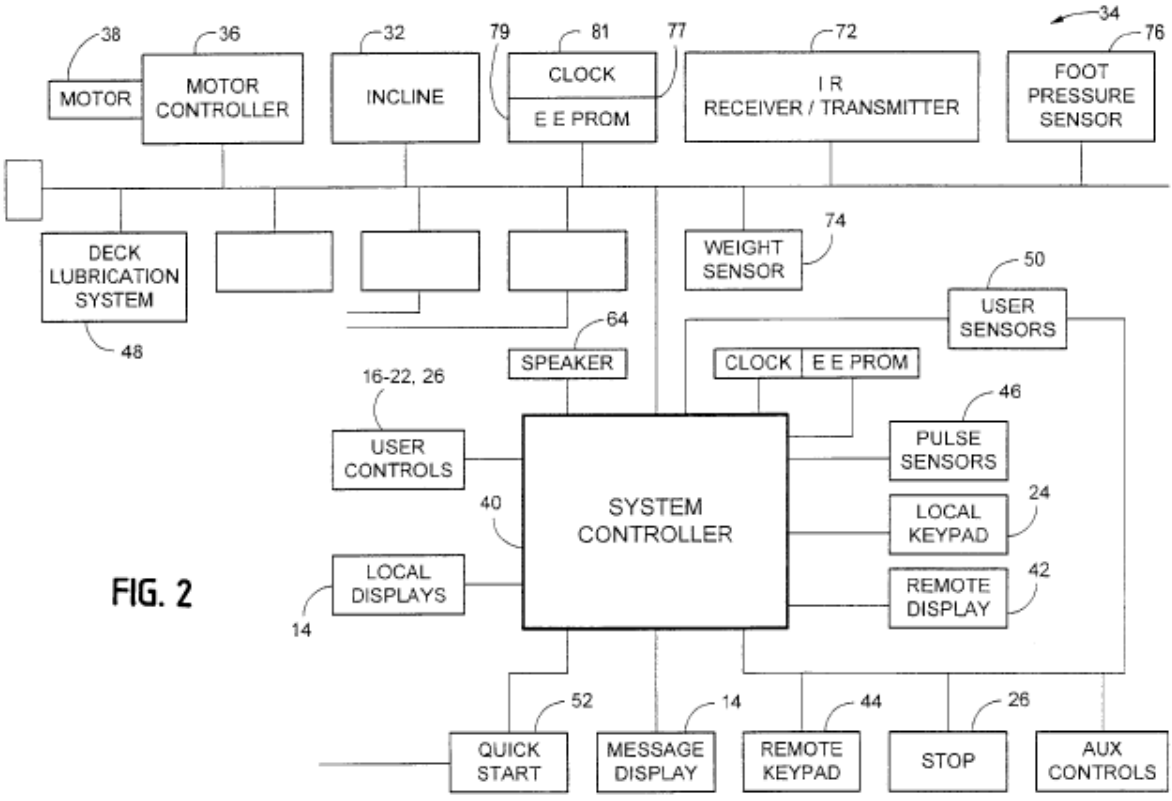


FIG. 2

56. Oglesby describes the system controller's implementation of a user detection feature based on infrared (IR) detection technology to stop the operation of the treadmill in response to information obtained from the other components. (*Id.*, 1:65-2:6, 4:44-67.) (S*ee also, e.g., id.*, Figs. 11, 12A-C.)

B. Importance of Detecting Whether a User is on Treadmill

57. It has long been understood that the ability of treadmills to operate independent of user effort poses a safety risk to treadmill users. As treadmills and gym culture became more and more mainstream, improvements were made to the design of treadmills, including the addition of safety features. If a treadmill user is unable to keep up with the speed of the belt, they may move farther and farther back on the deck until they eventually fall off. Consequently, every treadmill that I am aware of (at least since the 1980s) has some sort of safety device to determine if a user is in the proper location (near the front) of the treadmill deck while exercising, along with a method of automatically stopping the deck if it determines that the user is not where they are expected to be. This type of "kill switch" or "automatic shutdown" ensures that the treadmill ceases to operate in the event that a user slips, falls, or is no longer present on the device and prevents the treadmill from endlessly running by itself. This is a standard feature of any reputable treadmill.

58. An early and still common type of kill switch is a safety lanyard that the user attaches to their clothing while running on a treadmill. If the user drifts too far back on the treadmill deck, the lanyard reaches its limit and its key detaches from its attachment point, killing the power to the motor and stopping the deck. Other methods of performing this function are discussed below; however, the lanyard

continues to be in wide use (in addition to other sensor and shutdown modes), because it is simple and inexpensive.

59. Below I describe some representative examples of lanyards and other safety devices that function as a kill switch for automatically powering down a treadmill when a user is undetected. While I cite to representative portions of prior art references throughout this Declaration, such citations are intended to be exemplary. In addition, any citation to particular figures within a reference should be construed to incorporate by reference any discussion or additional figures related thereto. Likewise, any citation to disclosures within the text should be construed to incorporate by reference any figures or additional discussion related thereto.

1. Examples of Lanyard and Safety Key Devices

60. U.S. Patent No. 5,034,576 to William T. Dalebout et al., entitled "Console Switch," issued July 23, 1991 from an application (App. No. 482,223) filed February 20, 1990. (Appendix E.) Dalebout describes "electrical safety switches for exercise machines," comprising a keyway and a removable key. (*Id.*, 1:5-9, Abstract.) The key is directly removable from the machine "simply by pulling, to deactivate the machine in an emergency or accident." (*Id.*, Abstract.)

61. In discussing the state of the art, Dalebout acknowledges safety concerns relating to the use of powered treadmills (*id.*, 1:10-23):

2. State of the Art

Safety of the user is a major concern in the design and manufacture of powered machines. Powered treadmills and like machines having exposed moving parts may injure a user who accidently or deliberately misuses the machine. The popular domestic use of such machines recommends use of means to prevent accidental activation by children, pets or others. In addition, the possibility of a user falling on or from a machine makes it desirable to have a mechanism by which the machine may be de-activated in such events. A mechanism to prevent or eliminate "surprise" activation is desirable. In addition, some means to automatically and immediately halt the machine in case of an accident is desirable.

62. In light of these concerns, Dalebout describes the use of the key with a lanyard clipped to the user, so that the machine will immediately stop if the user slips or falls. (*Id.*, 1:42-45 ("[A] lanyard may connect the key to a clip attached to the user's clothing. If the user slips or falls on the machine, the key will be pulled from the keyway to immediately stop the machine."); *see also id.*, 2:40-47, 3:49-55, Figs. 1 & 9 (showing lanyard, reference no. 35)):

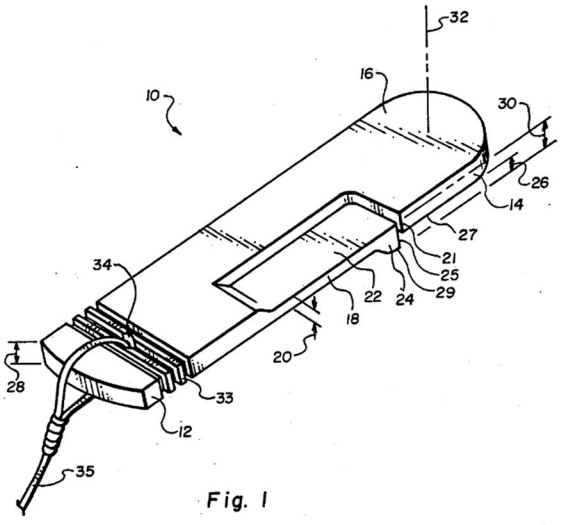


Fig. 1

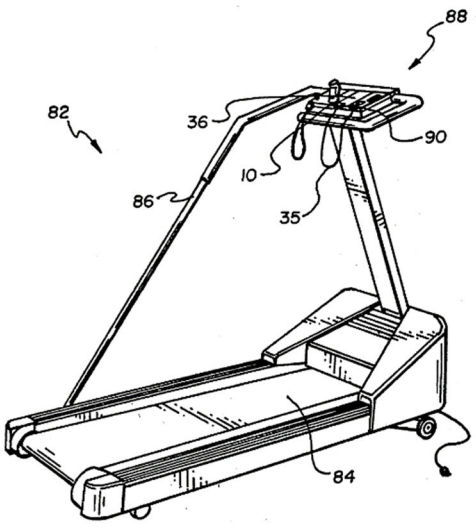


Fig. 9

63. There are many other patents and publications that describe the use of lanyard, such as U.S. Patent No. 8,986,165, to Ashby.

2. Examples of Other User Detection Devices and Automatic Shutdown Functionality

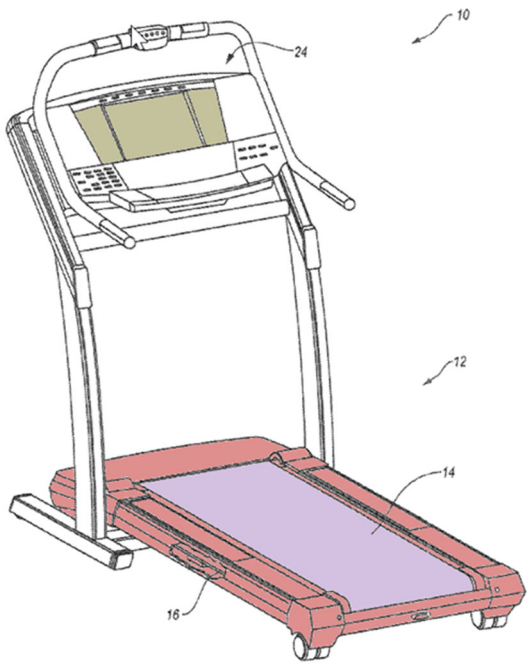
64. One drawback to the safety lanyard device is that, as long as the lanyard's safety key is inserted in the machine, the treadmill can operate even if the lanyard is not clipped to the user. Thus, for safety reasons and to verify exercise compliance, there was a need for a device that did not require any action on the part of the user and that could not be easily defeated by the user. Such a passive system for verifying that the user is engaged with the treadmill introduced a different set of requirements.

65. The problem of treadmill operation being able to continue in the absence of a person running on the treadmill deck has long been solved with various solutions. There are (and have been for some time) many reliable methods for determining if a person is in fact exercising on a treadmill when the treadmill is otherwise in motion. The prior art includes numerous examples of how to do this, including the use of various types of sensors (such as optical, pressure, and current sensors). In addition to providing safety benefits, sensors provide the added advantage of allowing a user to collect verified data regarding their use of the treadmill and to provide such information to a third party (e.g., a trainer, a doctor, or

an insurance company), as the prior art recognizes. While some of these prior art inventions are not invented for the purpose of verifying that a person is actually exercising, it would have been obvious to a POSITA at the time of the alleged invention that any one of the following inventions inherently serve this foundational purpose. I describe below multiple references directed to detecting whether a user is engaged with the treadmill belt.

a. U.S. Patent No. 9,072,930 ("Ashby")

66. U.S. Patent No. 9,072,930 entitled "System and Methods for Measuring Running Efficiencies on a Treadmill," issued July 7, 2015 to Darren C. Ashby et al., and has a priority date going back to April 11, 2012. (Appendix F.) As shown in Figure 1 (right), Ashby is directed to a treadmill with generic components including a drive motor, deck, belt, sensor, controller and console. (*Id.*, Fig. 1; *see also id.*, 1:55-67.)



67. Ashby generally describes a treadmill that can sense and analyze data regarding exercise use. (*See, e.g.*, *id.*, 4:65-5:5.) (*See also id.*, Abstract):

(57) **ABSTRACT**

A treadmill may comprise a deck, a treadbelt covering at least a portion of the deck, and a drive motor configured for driving the treadbelt. The treadmill may further comprise a sensor, a console, and a computer. The sensor may be configured to detect an amount of power utilized by the drive motor, and the console may be configured to convey information to a user. The computer may comprise a memory and a processor, and be configured for electric communication with the sensor and the consol. The computer may be programmed to analyze data received from the sensor, to provide a communication to a user through the consol that provides information about the user's running form based on the analyzed data received from the sensor, and to provide a communication to the user through the consol that provides information on how the user may change their current running form to improve running efficiency.

68. Ashby discloses the use of a specific type of sensor—a current sensor—that is configured to detect the amount of power or energy usage by drive motor 18 (which controls movement of the belt) (*id.*, 5:43-55, Fig. 2) when a user is running or walking:

The treadmill **10** may also include one or more sensors for collecting data while a user is running and/or walking on the treadmill **10**. A sensor may be positioned to sense the energy utilized by the drive motor **18**. For example, an electrical current sensor **42** may be positioned and configured to sense electrical current utilized by the drive motor **18**, as shown in FIG. **2**. Similarly, load sensors may be positioned to detect loads on the deck **16**. In some embodiments, at least one load cell **44** may be associated with the deck **16** and configured to detect forces acting on the deck **16**, as shown in FIG. **4**. As a non-limiting example, a load cell **44** may comprise one or more of strain gauges, a hydraulic load cell, a diaphragm load cell, a spool-type load cell, and/or a ring-type load cell.

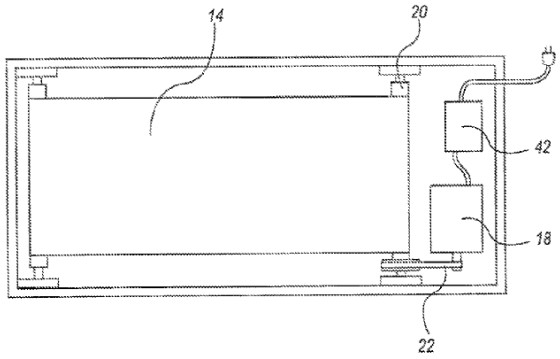


Fig. 2

69. A computer 46 (equipped with processor 48) is configured to receive data signals from current sensor 42 for analysis. (*Id.*, 5:63-66.) Computer 46 determines a runner's efficiency, form and cadence by comparing the energy

consumed by drive motor 18 during a user's exercise regimen with energy consumption contributed to baseline operation of the treadmill. (*Id.*, 6:18-27, 8:1-13.)

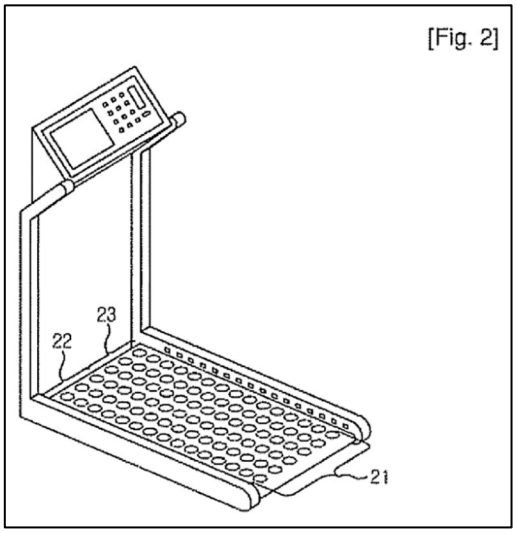
70. For example, baseline energy consumption may be calculated (Figure 7); energy data may be shifted by the baseline energy consumption amount (Figure 8); and positive data can be integrated by the computer 46 (Figure 9) and utilized to determine efficiency, form, and cadence. (*Id.*, 7:7-32; Figs. 7-9.)

71. In some embodiments, Ashby teaches instructions may be communicated in audiovisual form to make the user's form more efficient, such as by showing a video of a runner with efficient foot placement (*id.*, 8:35-38):

> In some embodiments, the instructions may be communicated in an audiovisual presentation via the console **24**. For example, a video may show an example of a runner displaying efficient foot placement and form while running.

b. U.S. Patent App. Pub. No. 2009/0176629 ("Yi")

72. U.S. Patent Application Publication No. 2009/0176629, entitled "Automatic Velocity Control Treadmill Using Pressure Sensor Array and Fuzzy-Logic," issued July 9, 2009 to Hwa Cho Yi (corresponding to a PCT application filed May 22, 2007). Yi is directed to a treadmill with generic components including a drive motor,



deck, belt, sensor, controller, and console. (*Id.*, ¶ [0002]; *see also* Fig. 2, reproduced above).

73. Yi generally relates to a treadmill with pressure sensors which send signals to automatically control the speed of the treadmill belt. (*Id.*, Abstract, ¶ [0001].)

74. Yi discloses a specific type of sensor for use with a treadmill—a pressure sensor array including a plurality of pressure sensors that detect loads of (or pressure exerted by) the user's feet and output load detection signals to indicate engagement of the treadmill by the user. (*See, e.g., id.*, ¶¶ [0009], [0043].)

75. Control unit 40 is operable to receive a load detection signal from pressure sensor array 47 to control the motor running walking belt 44 in response to the rate of the user's exercise. (*Id.*, ¶ [0042].) Yi, therefore, discloses a treadmill with pressure sensor arrays that detect user engagement and send load detection signals to a control unit, which controls the speed of the walking belt. (*Id.*, ¶ [0046].)

c. U.S. Patent Pub. No. 2010/0160115 A1 ("Morris")

76. U.S. Patent Publication No. 2010/0160115 A1, entitled "User Detection for Exercise Equipment," was published on June 24, 2010, listing inventors David Wayne Morris et al. (Ex. 1006.) Morris describes the use of sensors to determine whether a user has mounted the treadmill belt. (*See, e.g.*, *id.*, Abstract):

(57) **ABSTRACT**

Embodiments of the present disclosure include a user detection system for exercise equipment, such as a treadmill. In an embodiment, a sensor monitors displacement between a deck supporting a moveable treadmill belt and aspects of a treadmill frame. As users interact with the treadmill, a processor uses a sensor signal indicative of the displacement to determine whether a user has mounted the treadmill belt.

77. Morris provides background regarding user detection features included in prior art treadmills (*id.*, ¶¶ [0003]-[0005]), as well as the desirability of including user detection features. (*Id.*, ¶ [0006].)

78. Morris describes the use of various types of user detection sensors (magnetic sensors, optical sensors, etc.) in connection with treadmills, and particularly discusses slowing down and ultimately shutting down the treadmill operation when the sensors no longer detect a user. (*See, e.g., id.*, ¶¶ [0007], [0008], [0033], [0045], Fig. 9.)

[0045] FIG. **9** illustrates an exemplary embodiment of an "in use" process **900** for using the user detection features during a user's workout. Constantly, at periodic intervals (such as through an interrupt **848**), at random intervals, or the like, the user detection inductance coil **214** readings may be interpreted to determine whether or not a user is still present (block **850**). When a user is detected, the program will not be interrupted for user detect issues (block **862**). A user timeout counter is reset or remains at a baseline (block **864**), and the routine ends. When a user is not detected (block **850**), the FIT processor alters the display, such as by asking that the user return to his or her workout (block **852**). For example, the display may read "Please return to the treadmill to complete your workout or stop the machine." The user timeout counter increments (block **854**), and the processor checks the counter to see if it has surpassed a threshold (block **856**). If not, the process exits and is rerun upon receipt of the next user detect signal after the interrupt (block **848**), and repeats the process. If the user returns, the display returns to normal, and the program proceeds. If the user does not return in time, the user timeout counter will ultimately meet the time delay (block **856**) and trigger a controlled slowdown (block **860**) to stop the treadmill.

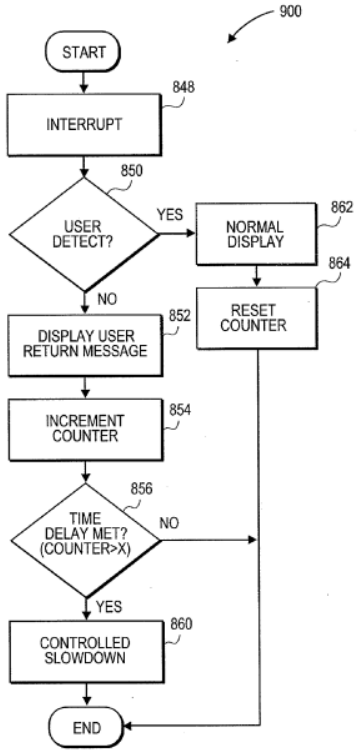


FIG. 9

79. Morris is further discussed in more detail in connection with the invalidity grounds in my Declaration.

d. U.S. Patent No. 6,575,878 ("Choy")

80. U.S. Patent No. 6,575,878, entitled "Automatic Safety Shut-off Switch for Exercise Equipment," issued June 10, 2003 to Rick Choy. Choy describes the use of foot impacts to determine whether a user has left a treadmill device and the automatic powering down of the treadmill when a user is no longer present. (*See, e.g., id.*, Abstract.)

81. Choy acknowledges the safety concerns posed by a treadmill continuing to operate without a user (*id.* at 1:14-23, 34-41):

> Treadmill exercise devices are an integral part of the habitual, aerobic workouts of a culture focused on health and fitness. In the wake of the popularity of treadmill exercise devices, however, certain concerns arise as to the safe and proper use of treadmill exercise devices. In this regard, it is particularly desirable to prevent a treadmill exercise device from being inadvertently left operating after a user has left the device. This is desirable to conserve energy and also to prevent possible risk of someone getting injured by the moving parts of a treadmill exercise device left running.
>
> ***
>
> What is needed is a system and method for automatically powering down the treadmill exercise device when the user has left the treadmill. Accordingly, safety for future users would be enhanced if the treadmill exercise device had the capability of sensing when the previous user has left the treadmill exercise device so that the treadmill exercise device can subsequently, automatically power itself down for future users.

82. To address this concern, Choy describes "a treadmill exercise device comprising means for determining when the treadmill exercise device is not being used and means responsive thereto for automatically powering down the treadmill exercise device." (*Id.*, 1:49-53.) For example, Choy describes the use of current sensors and related circuitry to detect whether a user is present on a treadmill. (*See, e.g., id.*, 1:54-64, 2:66-3:4, 5:44-50.)

83. There are many other prior art references, such as U.S. Patent No. 5,368,532 to Farnet (1994), U.S. Patent No. 6,135,924 to Gibbs et al. (2000), U.S. Patent No. 7,507,187 to Dyer et al. (2009), U.S. Patent No. 8,480,541 to Brunts et al. (2013), U.S. Patent Application Publication No. 2006/0276306 to Pan et al. (2005), and U.S. Patent Application Publication No. 2007/0219059 to Schwartz et al. (2007), which describe sensing a user's presence or absence on a treadmill and stopping the treadmill for safety and for practical reasons.

C. Health data tracking and reporting to third parties

84. User detection devices and sensors to determine whether a user is exercising have long been used in systems for tracking and reporting exercise data to third parties (e.g., insurance companies, personal trainers, and medical professionals). It is important to accurately track exercise data for many reasons, including to ensure that the user is complying with an exercise program (and not

providing false or inaccurate information) or for competition purposes. Examples of prior art describing the tracking and reporting of such data are discussed below.

1. U.S. Patent No. 9,785,827 ("Ray")

85. U.S. Patent No. 9,785,827, entitled "Process to Aid in Motivation of Personal Fitness, Health Monitoring and Validation of User" (corresponding to U.S. App. No. 14/489,349, filed September 17, 2014) issued on October 10, 2017 to Salina Dearing Ray. (Ex. 1004.) Ray discloses using video capture of an individual while exercising to both validate that the correct person is exercising and that they are indeed exercising. (*See, e.g.*, *id.*, Abstract):

(57) **ABSTRACT**

A system for displaying a motivational image of a user on an electronic device that includes at least a camera and a display. The system includes an adjustable mount for the electronic device that is adapted to orient the camera and display of the electronic device towards the user. The electronic device, upon detection of movement by the camera, is adapted to display the motivational image, such as a thinner representation of the user, on the display in accordance to the speed or duration of the detection of the movement of the user. The electronic device may be adapted to further receive an input from the user in order to calculate the amount of exercise required for the user to achieve the desired weight. Further, the system is able to validate the user's identity and exercise achieved as well as providing health screenings using biometric testing.

86. Discussing the prior art, Ray notes that devices such as swipe cards and pedometer devices "can fail to accurately validate identify the user" and "can be easily manipulated by wellness program participants." (*Id.*, 3:14-16.) In light of this, Ray notes that "[t]here is undoubtedly a need for a device that unmistakably validates

the true identity of the user." (*Id.*, 3:30-31; *see also id.*, 9:40-47 ("There is a need for the unique features of this invention that solve the problem intrinsic in today's wellness programs by validating the identity of the user and the exercise performed which cannot be accomplished with the use of a swipe card at the gym or a pedometer due to the ease of providing those devices to a friend who will record erroneous exercise data for the defrauding employee to use to obtain discounts and other company benefits.").) Because "[m]ost wellness programs provide financial incentives for completion of fitness goals," Ray's "validation feature would ensure that the program participants that truly deserve this credit would receive it while the dishonest program participants would not." (*Id.*, 3:37-42.)

87. Ray discloses detecting when a user is on the treadmill and the associated exercise data using various sensors (*Id.*, 10:47-50; Fig. 1 (at right).)

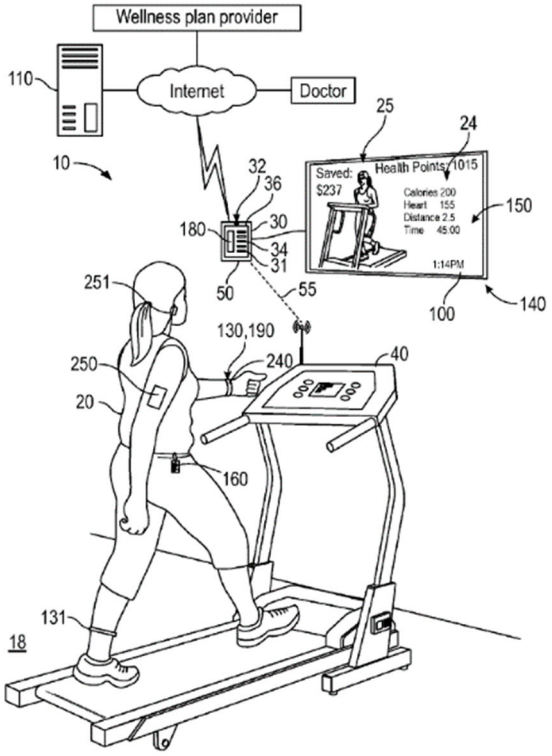


FIG. 1

88. Ray further discloses transmitting data to third parties, explaining that "information is easily transferred over the internet to a wellness manager or medical advisor as a live feed or stored on a computer or remote server such as a cloud-

based server in order to obtain data at any time or location." (*Id.*, 3:47-51; *see also, e.g., id.*, 5:59-6:5, 7:4-10, Fig. 1.)

89. Ray is further discussed in more detail in connection with the invalidity grounds in my Declaration.

2. U.S. Patent No. 8,690,735 ("Watterson")

90. Watterson, described earlier in my Declaration, disclosed the use of sensors to track parameters of the user while the user is exercising and transmit data regarding those parameters to a remote system or third party (e.g., a trainer). (*See, e.g.*, *id.*, Abstract; 3:44-4:1.) (*See also* Fig. 1):

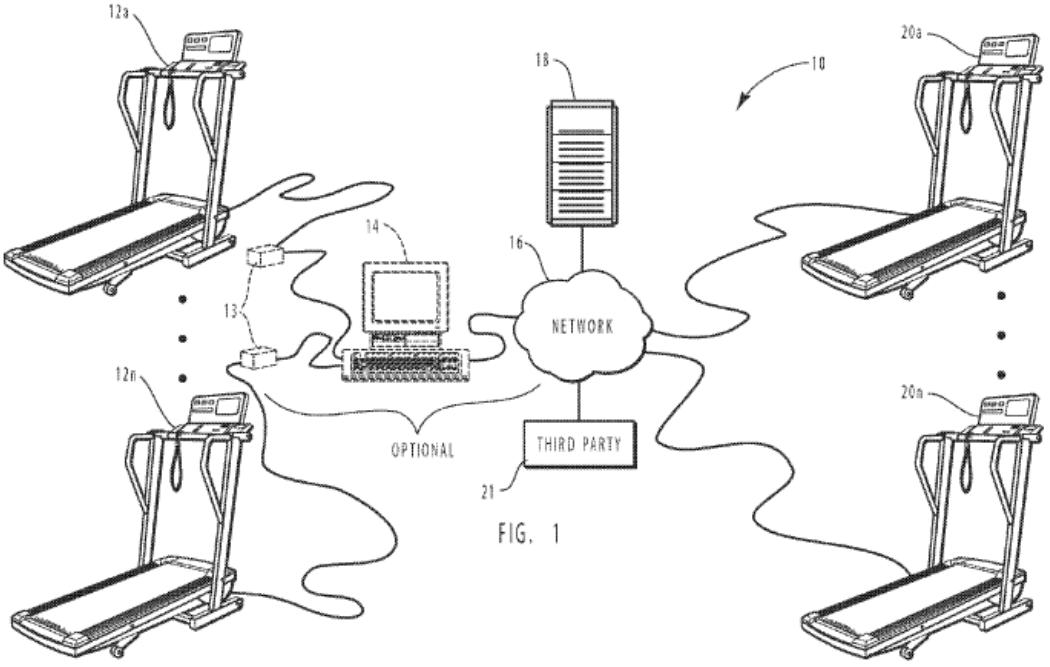


FIG. 1

91. Figures 2 and 4 (below) show a treadmill 12 with a tread base 26, continuous belt 42, motor 46, and controller 56. (*Id.*, 8:6-56; Figs. 2, 4.)

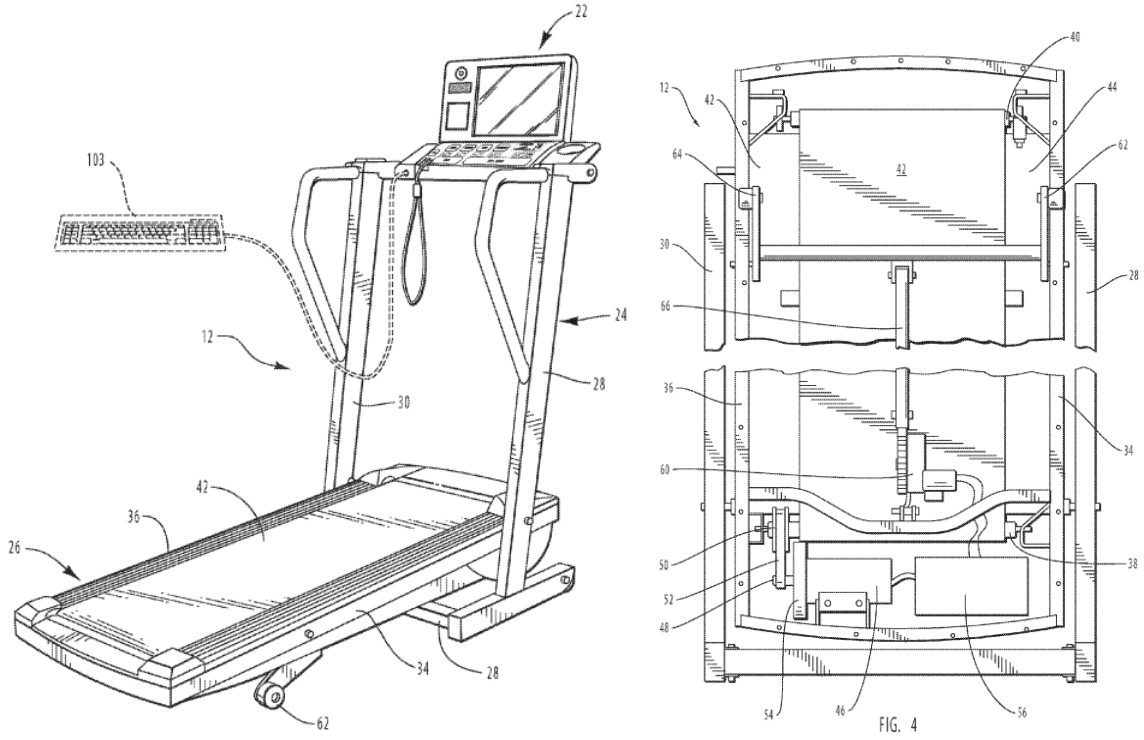


FIG. 4

92. Watterson describes the use of various sensors with the treadmill, such as speed sensor, incline sensor, pulse and heart rate sensors that can be used to determine if an individual is actually exercising on the treadmill. (*See, e.g., id.*, 24:44-62.)

93. Watterson recognizes that the sensors of the exercise device can be used to determine whether a user is actually exercising and track their level of activity (*see, e.g., id.*, 45:43-50):

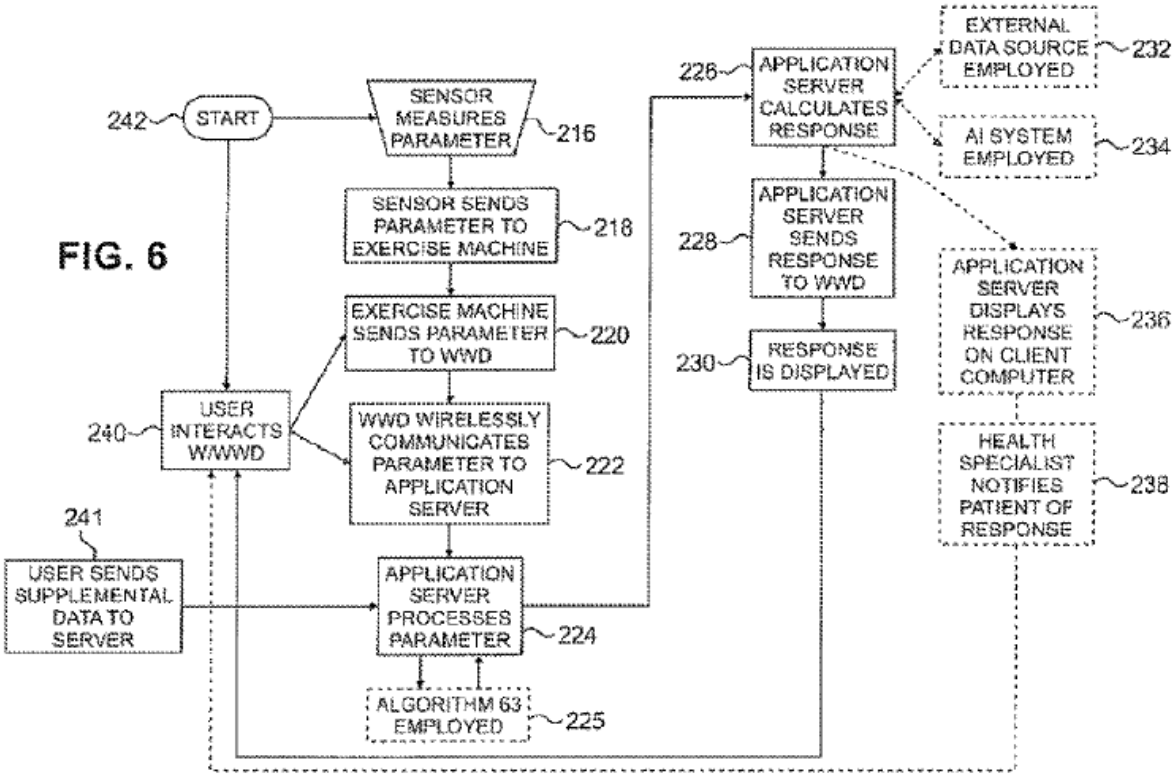
> According to one aspect of the present invention, an exercise device is disclosed that incorporates various audio/video features into the device or exercise device itself rather than having external audio/video features connected thereto. The exercise device may also include sensors that track the activity level of an individual on the exercise device, to determine whether a user is actually exercising or to determine whether the user is old enough to be using the exercise device.

3. U.S. Patent No. 8,277,377 ("Quy")

94. U.S. Patent No. 8,277,377 B2, entitled "Method and Apparatus for Monitoring Exercise with Wireless Connectivity," issued October 2, 2012 to Roger J. Quy. (Appendix G.) Quy describes a method and device for wireless monitoring of exercise, fitness and nutrition. (*See, e.g., id.*, Abstract.)

95. Quy specifically discusses an embodiment directed to the tracking of exercise data in connection with exercise machines including treadmills. (*See, e.g., id.*, 3:6-13, 3:21-27, 3:33-51.)

96. In connection with Figure 6 (below), Quy discusses the use of sensors to measure a health parameter and transmit the data. (*Id.*, 10:20-38, 10:47-53.)



4. U.S. Patent No. 9,460,632 ("Watterson '632")

97. U.S. Patent No. 9,460,632, entitled "System and Method for Rewarding Physical Activity," issued on October 4, 2016 (from Application No. 13/911,706, filed June 6, 2013) to Scott R. Watterson, claiming priority to Provisional Application No. 61/656,768, filed June 7, 2012. (Appendix H.) Watterson '632 describes the tracking of a person's physical activity for purposes of determining his or her eligibility for a reward. (*See, e.g.*, *id.*, Abstract, 4:66-5:13.)

98. Watterson '632 specifically contemplates the use of a treadmill device (reference no. 118 in Figure 1 below) to transmit exercise information (e.g., duration, distance, intensity, calories burned, average heart rate, etc.) over a network (*id.*, Fig. 1, 7:47-65):

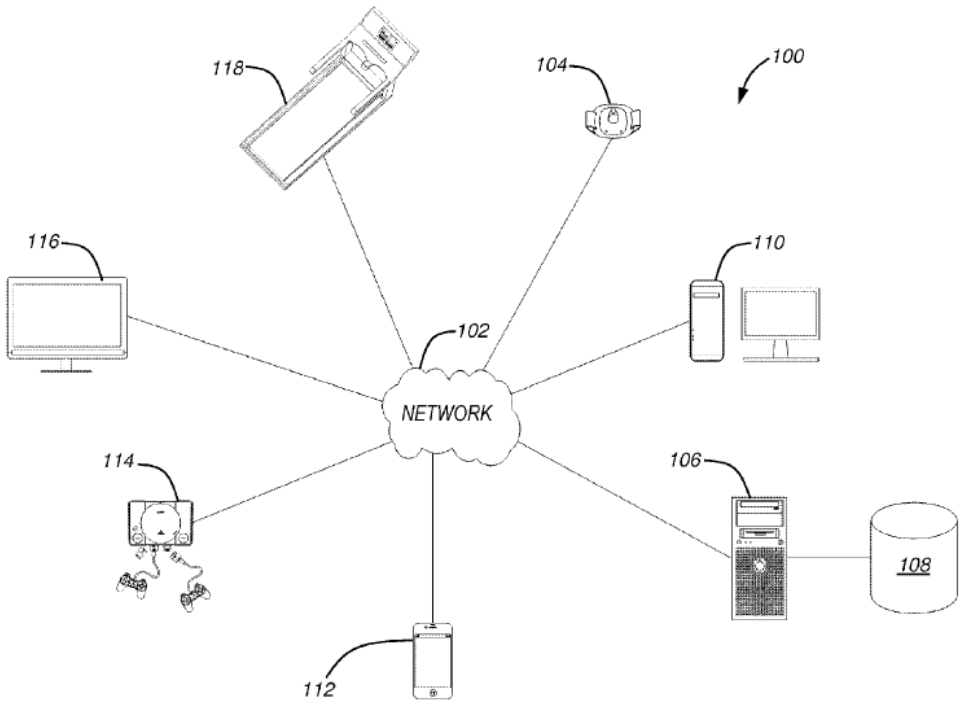


Fig. 1

Also illustrated in FIG. **1** is an example exercise device **118**. The exercise device **118** can take any of a number of different forms. The illustrated device **118**, for instance, is a treadmill-type device, although other devices may include stationary bicycles, elliptical machines, steppers, rowers, weight systems, and the like. The exercise machine **118** may also optionally be connected to the network **102** to communicate with one or more other devices **104-116**. In some cases the exercise device **118** may operate in addition to, or instead of, the sensing device **104** to provide information about a user's physical activity. For instance, a user may begin a workout using the exercise device **118**. During the workout, or upon completion thereof, information about the workout (e.g., duration, distance, intensity, calories burned, average heart rate, etc.) may be communicated over the network **102**. The information may be used by the computing system **106** to identify rewards available to the user, and such rewards may optionally be available for redemption on the computing devices **110-116**. In other embodiments, the

99. Watterson '632 describes the use of a sensing device 300 (including sensors 324) integrated into exercise equipment (such a treadmill) for tracking exercise. (*Id*., 14:8-9 ("[T]he sensing device 300 may be integrated into other equipment, such as a treadmill …."); Fig. 3).

100. Watterson '632 further acknowledges that "insurance companies, cell-phone providers, or employers may allow people to opt-in to monitoring systems and provide benefits associated with wellness programs they administer." (*Id.*, 26:67-27:3; *see also id.*, 27:40-42 ("A fitness tracking website, employer, or other person or entity may also track such information to provide still additional rewards.").)

5. U.S. Patent No. 9,403,053 ("Kaiser")

101. U.S. Patent No. 9,403,053, entitled "Exercise Promotion, Measurement, and Monitoring System," issued August 2, 2016 to William J. Kaiser et al., corresponding to PCT/US2012/039714, filed May 25, 2012. (Appendix I.) Kaiser describes an exercise cycle having a sensing unit to track, display, and transmit exercise data. (*See, e.g., id.*, Abstract, Fig. 1):

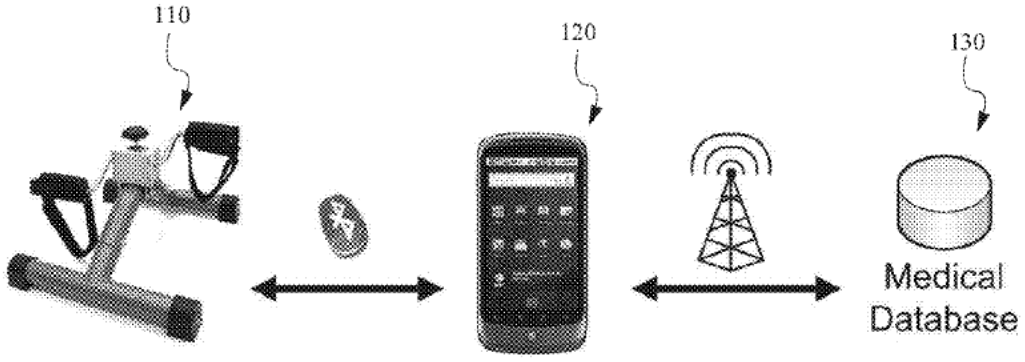


Fig. 1

102. Kaiser discusses the need for the tracking of an exerciser's "actual workload" to allow a third party (e.g., a caregiver or healthcare enterprise) to monitor the individual to "ensure adherence to an exercise protocol." (*Id.*, 1:46-57 ("energy expenditure … is critical to establishing whether a subject user is meeting a prescribed exercise regimen…").) Kaiser thus proposes a sensor-equipped exercise cycle that measures physical activity and transmits data to third parties (*see, e.g., id.*, 4:57-63, Fig. 7):

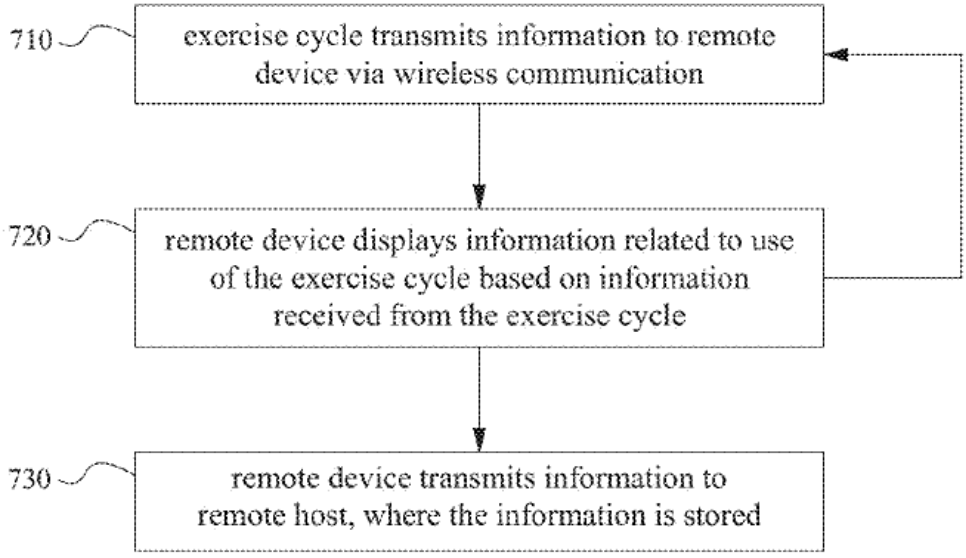


Fig. 7

D. Validation of exercise data to prevent fraudulent reporting

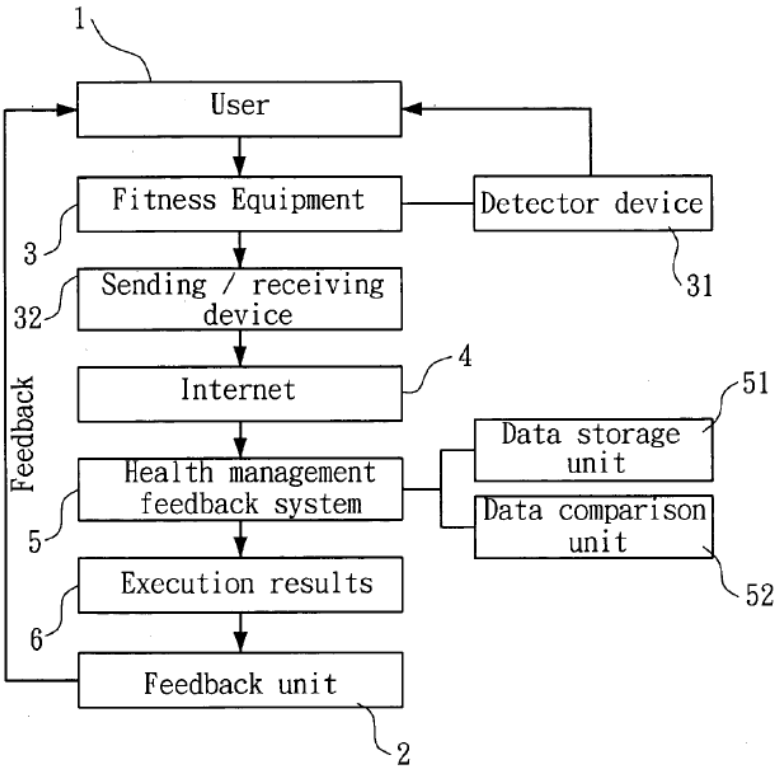
103. The prior art also recognized the desire to ensure that exercise data is validated to ensure that any reported data is accurate and has not been falsified by the user. Such information allows an insurance company to determine whether a policyholder is eligible for premium discounts based on exercise. Examples of prior art discussing this issue are included below.

1. U.S. Patent App. Pub. No. US 2009/0239709 A1 ("Wu")

104. U.S. Patent Application Publication No. US 2009/0239709 A1, entitled "Health Management Feedback Method Using Fitness Equipments," published September 24, 2009 (corresponding to App. No. 12/076,700, filed March 21, 2008), and named Shen Yi Wu as the inventor. (Appendix J.) Wu describes a health

management feedback method using detector devices in connection with fitness equipment (*id.*, ¶ [0002], Fig. 1):

> **[0002]** The invention is related to a health management feedback method using fitness equipments, more particularly to a health management feedback system to allow users to obtain feedback by using fitness equipments.
>
> ***



105. Wu discusses the problem of insurance policyholders "cheating" in connection with reporting information to insurance companies. (*Id.*, ¶¶ [0005]-[0007].)Wu describes using fitness equipment (including a "running machine") having a detector device for detecting the fitness data of the user during exercise.

The fitness data that may be tracked includes, for example, exercise parameters (such as the time or distance ran by the user). (*Id*., ¶¶ [0015]-[0016].)

106. Wu specifically discusses the transmittal of data obtained from the use of an "electrical running machine" (a treadmill) to an insurance company for purposes of obtaining a premium discount (*id.*, ¶ [0019]):

[0019] For instance, if feedback unit **2** is an insurance company for communication with health management feedback system **5** through internet **4**, the feedback plan is an insurance policy which is either a new one to be joined by user **1**, or an existing one for obtaining feedback, the resource obtained by insurance company is the insurance premium paid by user **1**, wherein the seductive factor proposed by insurance company is to provide a premium discount to user **1** when the execution result **6** defined by the feedback plan is reached by using fitness equipment **3**. If the feedback plan period is one year and fitness equipment **3** is an electrical running machine, pre-defined result of feedback unit **2** is that user **1** is required to maintain exercise in five days per week and minimum one hour per day within the one year period, wherein pulse of user **1** in exercise using fitness equipment **3** is detected by a detector device **31** installed thereon to obtain a pulse wave shape, whereby physical data of user **1** is further through sending/receiving device **32** to be directly or indirectly transmitted back to health management feedback system **5** through internet **4** for access by data storage unit **51** of system **5** to compare with the pulse wave shape of user **1** for self-use in the exercise. After the one-year feedback period is over, the execution result **6** of five days per week and minimum one hour per day exercise is transmitted back to feedback unit **2** through health management feedback system **5**, and if execution result **6** conform to the one predefined by feedback unit **2**, the feedback unit **2** then provide premium discount feedback to user **1** due to realization of the seductive factor. ...

2. U.S. Patent App. Pub. No. 2011/0082007 A1 ("Birrell")

107. U.S. Patent Application Publication No. 2011/0082007 A1, entitled "Exercise Community System," published on April 7, 2011 (corresponding to Application No. 12/572,444, filed October 2, 2009), and names James S. Birrell et al. as inventors. (Appendix K.) Birrell describes the use of fitness exercise equipment (including treadmills, (*id.*, ¶ [0008])) connected to a hub of one or more servers, which communicate with third parties, including insurers (*id.*, Fig. 1, ¶ [0023]):

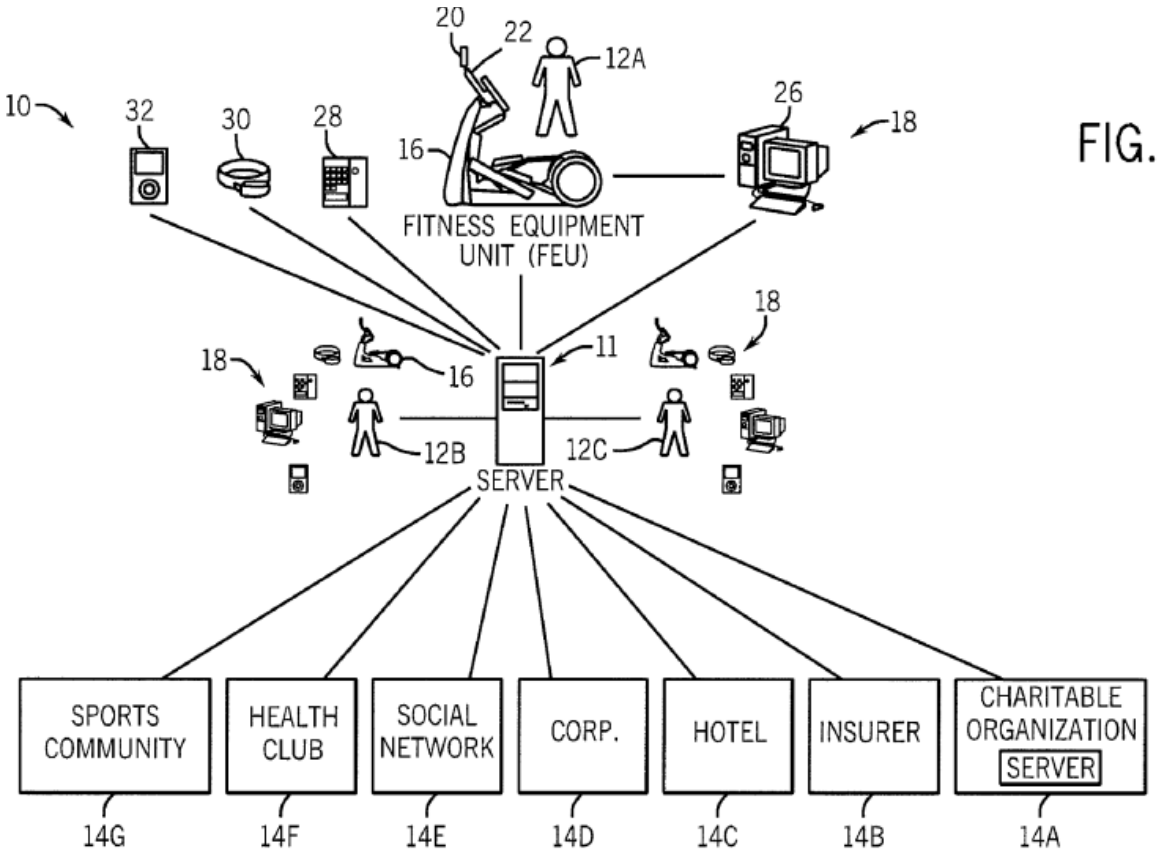


FIG. 1

[0023] In addition to facilitating sharing, belonging and competition amongst individuals **12** who share the common interest or objective of fitness, hub **11** further facilitates the sharing of such information with third party entities **14**. As shown in FIG. **1**, examples of third-party entities include, but are not limited to, charitable organizations **14**A, insurers **14**B, hotels **14**C, corporations **14**D, social networks **14**E, health clubs **14**F and sports communities **14**G. Each of such third-party entities may provide an individual **12** who is exercising with additional sources of motivation facilitated by hub **11** of system **10**.

108. Birrell discusses the fitness equipment unit transmitting exercise data to the hub for purposes of determining eligibility for an insurance premium discount. (*Id.*, ¶¶ [0024]-[0026].) (*See also id.*, Fig. 3):

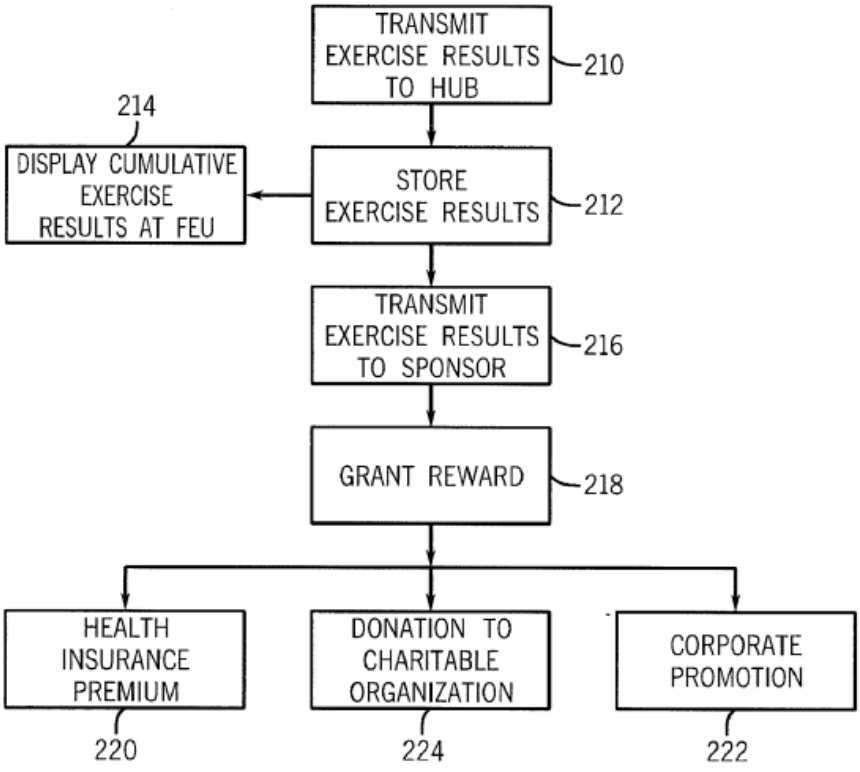


FIG. 3

3. U.S. Patent App. Pub. No. US 2004/0010420 A1 ("Rooks")

109. U.S. Patent Application Publication No. US 2004/0010420 A1, entitled "System for Developing Implementing and Monitoring a Health Management Program," published January 15, 2004 (corresponding to U.S. Application No. 10/398,389 and PCT No. PCT/US01/41957 filed August 30, 2001) named Daniel S. Rooks as the inventor. (Appendix L.) Rooks describes a system for monitoring an exercise program and reporting data to third parties including insurance providers. (*Id.*, Abstract.)

110. Rooks describes the use of exercise equipment (including a treadmill) to collect data regarding exercise performance (*id.*, ¶ [0026]):

> **[0026]** The monitoring of the client's exercising (step **520**) is described in further detail with respect to **FIG. 6**. At step **602**, the exercise program is started and data on each exercise as it is performed is recorded at step **604**. This data includes, but is not limited to, heart rate, blood pressure, temperature, blood oxygen saturation, and the like and exercise performance variables, including but not limited to, equipment settings (e.g., time, treadmill speed, resistance level) and technique (e.g., range of motion and speed of movement of resistance equipment).

111. Rooks further discusses the transmittal of a report to the participant's health insurance provide to verify compliance and eligibility for reimbursement of premium fees. (*Id.*, ¶ [0035].)

E. Summary assessment of state of the art prior to December 2014

112. The previous discussion illustrates that all the concepts that the ’227 patent is purporting to be its invention were well-known and mature many years prior to the December 2014 filing date of the ’227 patent. The claims of the ’227 patent (discussed further below) recite the very basic features and functionalities of a treadmill that were clearly and unambiguously known many years prior to the alleged invention date in December 2014.

113. Based on my own knowledge of having worked in this field for many years, and based on myriad prior art references (including those described above and those used in the IPR invalidity grounds), it is my opinion that all of the claim limitations in the ’227 patent were known and obvious to persons of ordinary skill by the 2014 timeframe. These well-known and obvious features include an exercise machine such as a treadmill that has (1) a motor, (2) a belt, (3) a sensor that is used to detect if the user is present, is exercising on the treadmill, and/or is not on the treadmill, (4) a processor that receives and processes signals from the sensor and performs other operations including generation of exercise data, (5) transmission of exercise data to a remote location, (6) detecting that a user is not present and taking subsequent actions, and other operations that the ’227 patent claims purport to be novel.

IV. THE ’227 PATENT

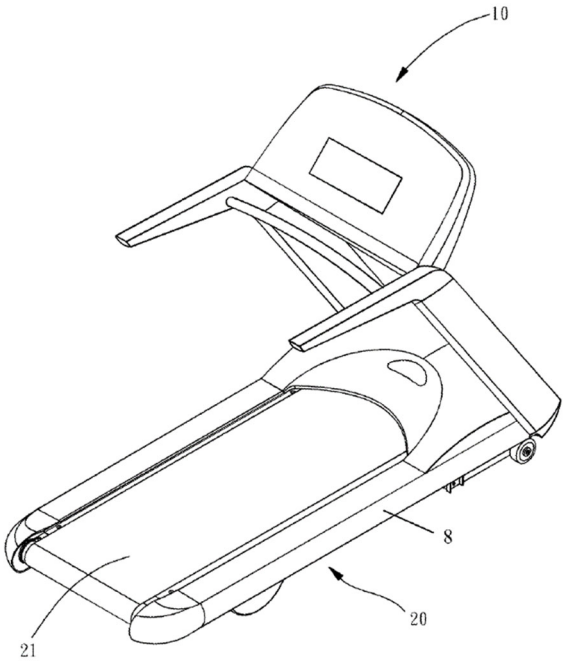
A. Overview of the ’227 Patent

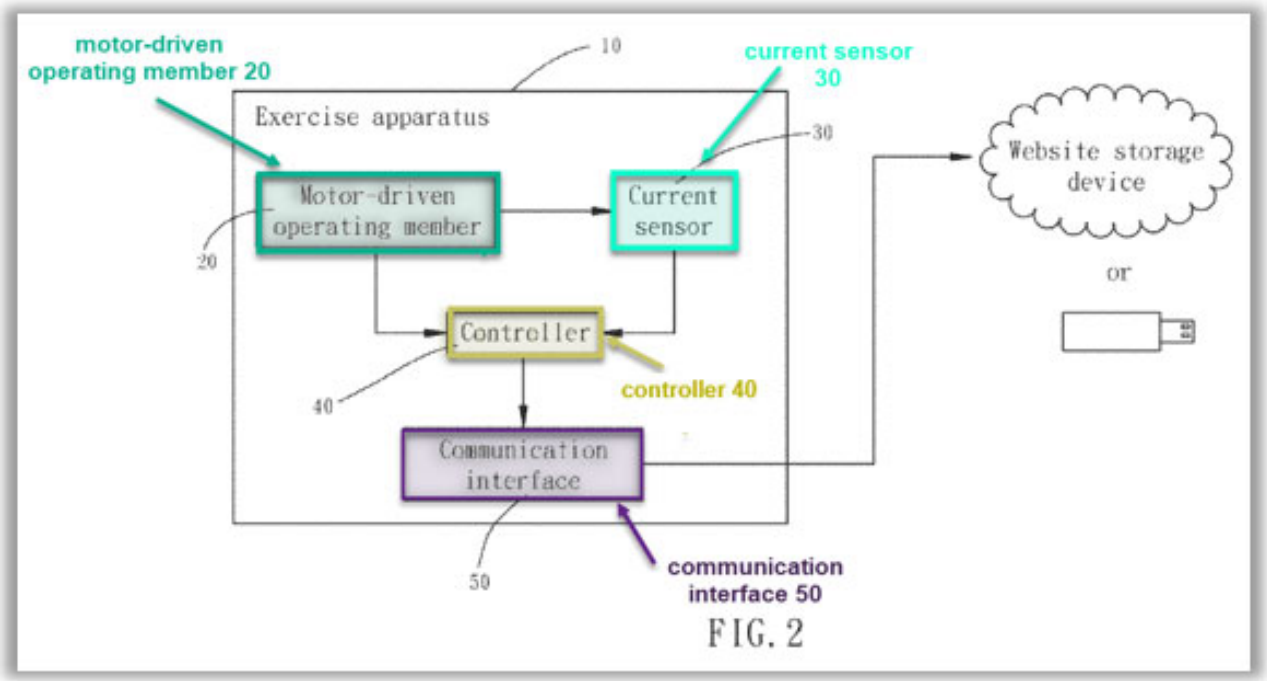
114. The ’227 patent describes a “conventional exercise machine,” such as a treadmill, and a way to verify whether a user is exercising on that machine. (Ex. 1001, Abstract.) By way of background, the ’227 patent discusses that some insurance companies give their customers incentives, such as savings on insurance premiums, when they demonstrate “measurable healthy habits, including proof of regular exercise.” (*Id.*, 1:18-34.) A customer thus may report their exercise data to an insurance company to prove they exercise regularly. (*Id.*, 1:35-50.) While the ’227 patent describes “conventional exercise apparatus[es] that can provide exercise data therefrom for a user,” it explains that reported exercise data can only be trusted from a user-driven (as opposed to a motor-driven) exercise machine. (*Id.*, 1:35-53.)

115. Specifically, the patent explains that exercise data reported from a motor-driven exercise machine—such as a motorized treadmill—is not trustworthy. This is because a user could simply turn on a treadmill and allow the belt to run, thereby generating exercise data even though the user is not actually exercising on the machine. (*Id.*, 1:51-2:15.) The user could then submit this “faked” exercise data to fraudulently receive insurance discounts or credits. (*Id.*) This falsified data issue is not present with user-driven devices because the user must actually be using the

machine to generate exercise data via a user-driven device. (*Id.*, 1:43-50.) The ’227 patent purports to address the issue of how to validate exercise data generated by a motor-driven exercise apparatus by including a “verification function and verifying method” that can “verify an exercise use thereof” and “demonstrate his (or her) exercise habit to their insurance company.” (*Id.*, 2:23-36.)

116. Figure 1 (at right) illustrates the conventional motor-driven treadmill discussed in the ’340 patent, including admittedly known components of a base 8 (*id.*, 3:45-51), motor-driven operating member 20 (also known as a belt (*id.*, 3:54-56)), sensors (*id.*, 3:45-51, 4:8-14, 5:38-50), controller 40 that generates exercise use data when powered on (*id.*, 4:19-23), and communication interface 50 configured to report out the exercise data to a display or over a network (*id.*, 1:45-51, 6:5-54). (*See also id.*, Fig. 2 (annotated below)):





117. The alleged invention of the ’227 patent takes these (admittedly known) components and uses them for the limited purpose of distinguishing the treadmill-generated exercise use data based on when the user is detected on the moving belt (validated exercise use data) versus when the belt is moving without a user detected (non-validated exercise use data). (*Id.*, 2:29-36.) The decision flow chart in Figure 6 (below) provides an overview of the validation process of the ’227 patent.

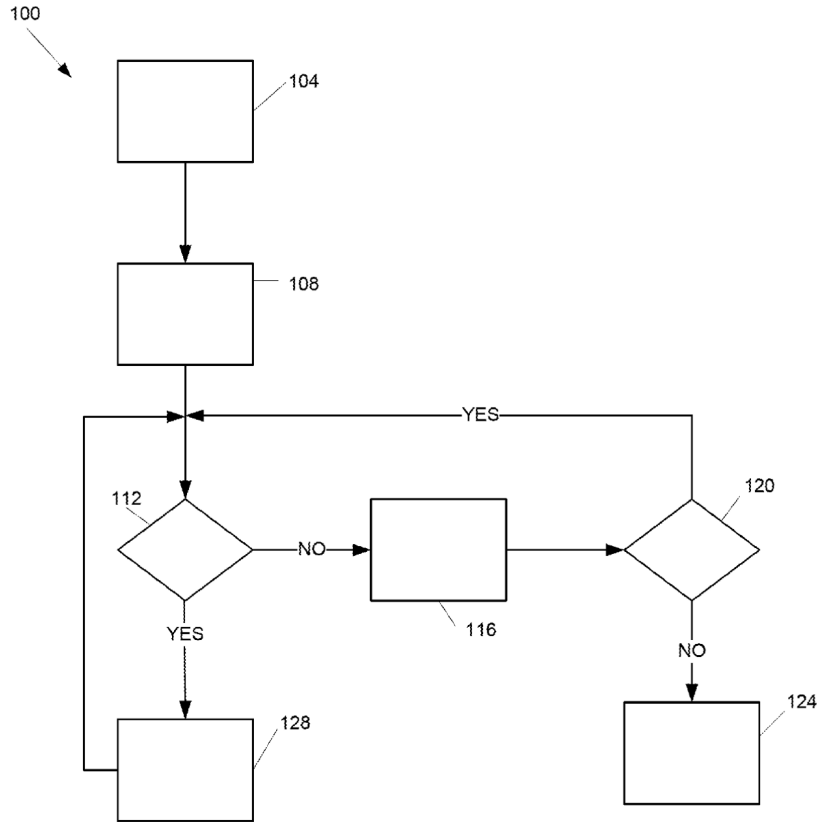


FIG. 6

118. Following the flowchart of Figure 6 above, in step 104, the treadmill is powered on and its controller 40 starts generating exercise use data (time and distance) while receiving data from known sensors 30 (including pressure, current, or optical sensors) at step 108. (*Id.*, 6:66-7:11.) At step 112 and based on the signal received from the sensors, controller 40 determines whether a user is engaged with the machine while the treadmill belt is moving. (*Id.*, 7:12-29.) If controller 40 determines that a user is not present, the generated exercise data is categorized as "non-validated exercise data" at step 116, and the process is repeated at step 120 (if the motor continues moving the belt) to determine if a user engages with the

machine. (*Id.*, 7:30-40.) Conversely, if controller 40 determines that a user is engaged, the generated exercise data is recorded as "validated exercise use data" at step 128. (*Id.*, 7:41-47.) Validated and non-validated exercise use data is stored locally, communicated to a user on a display, or reported out to third parties (such as an insurance company) over a network. (*Id.*, 7:44-47.)

119. The claims of the '227 Patent itself are do not expressly draw a distinction between validated and non-validated data as mentioned in its specification. Instead, the '227 Patent claims more broadly describe that when a user is detected on the belt, reporting that exercise data to the communication interface and ceasing to report the data when a user engagement is not detected. (*Id.*, Claims 1 and 16.) The report out feature is ultimately used to communicate the user's exercise data to "an interested third party (e.g., a physician, a medical provider, etc.), a demander (e.g., an insurance company, an insurance provider, etc.) and/or the user (via a display device)." (*Id.*, 6:5-9.) The user's exercise data may also be transmitted to a web-based database. (*Id.*, 6:19-22.)

120. Notably, the "Background" of the '227 patent admits conventional exercise apparatuses have long been able to report exercise data to a display or even to a third party (including insurance companies); in fact, the '227 patent discusses two prior art patents that teach this concept. (*Id.*, 1:35-50; *see also id.*, 1:31-34; U.S. Patent Nos. 8,287,434 and 6,638,198.)

B. Prosecution History

The ’227 patent issued on July 24, 2018 and claims priority to a provisional application filed on December 30, 2014. (*Id.*, Face.) During the prosecution, claims 12-17 were withdrawn (Ex. 1003, 42-49), claims 1-11 and 19-20 were considered allowable, and independent claim 18 was rejected as anticipated by Yi (U.S. Publication No. 20090176629). (Ex. 1003, pp. 29-33.) Applicant amended independent claim 18 (which ultimately issued as claim 14) to include the purportedly novel limitations of claim 19 related to a pressure sensor to detect engagement of the user with the belt (Ex. 1003, p. 24.) A Notice of Allowance was subsequently issued. (*Id*., pp. 8-12.)

V. OVERVIEW OF KEY PRIOR ART

A. Morris

121. Background information regarding Morris is provided above and incorporated herein by reference.

122. Morris is directed to accurately detecting when a user is on a treadmill for both safety and data analysis purposes. (Morris, Title, [0004]-[0005].) Morris explained that while nearly all treadmills include a kill function to stop a treadmill in the case of an emergency, there remained “a need to be able to detect the presence or absence of a user.” (*Id.*, [0004].) It also explained that prior art user detection sensors had limitations, such as inaccuracies presented by lighting conditions (in the

case of an infrared emitter and detector), a need for the belt to be moving (in the case of a load detection sensor for a motor), and inaccuracies relating to the incline of the treadmill (in the case of a load detection sensor for the belt). (*Id.*, [0004]-[0005].) Addressing these issues, Morris disclosed an exemplary "reluctance-type sensor comprising a magnet and induction coil to detect induced current based on the movements of a treadmill deck with respect to the treadmill frame caused by movements of a user." (*Id.*, [0007].) The user detection and reporting process of Morris is shown in Figure 9, at right.

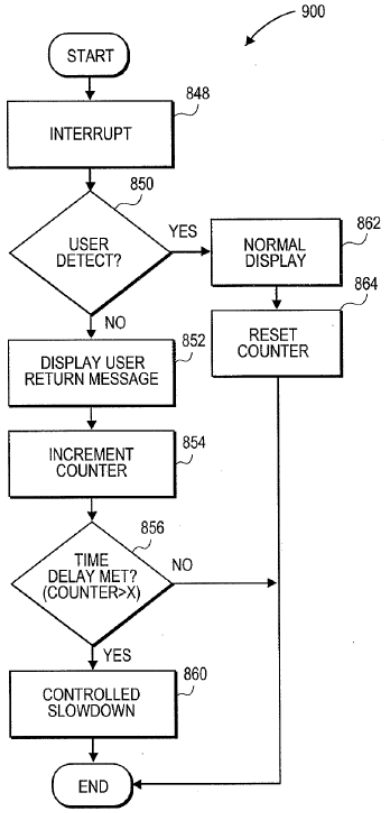


FIG. 9

123. During a workout, Morris' user detection sensor determined whether a user is present on the exercise machine. (*Id.*, [0045].) When a user was detected, the workout program would continue without interruption. (*Id.*) If a user was not detected, Morris' FIT processor would use a timeout counter to determine how long a user was not present. (*Id.*) If the user did not return to the machine before a timeout threshold was surpassed, a controlled slowdown was triggered to stop the treadmill. (*Id.*) Importantly, during a period when a user was not detected, the FIT processor

could pause or suspend a workout and then resume that workout when a user was again detected. (*Id.*, [0045]-[0046].)

B. Ray

124. Background information regarding Ray is provided above and incorporated herein by reference.

125. Ray was directed to a similar problem to the one discussed in the '340 patent's specification, namely, preventing a person from fraudulently obtaining credit for exercise that the person did not perform, with the intent of manipulating wellness programs and insurance companies for discounts. (Ray, 3:14-16, 3:17-42, 4:37-44, 7:30-33, 9:17-36.) There were two aspects to Ray's invention: (1) an exercise "validation" feature that verified the user's identity and the exercise performed, and (2) a "motivation" feature that displayed a real-time virtual image of the user's physical improvements (thinning) as they exercised, based on the generated exercise data. (*Id*., 4:53-55, 5:40-46, 6:36-42.)

126. Ray explained that prior art exercise devices failed "to accurately validate [the] identity of [a] user . . . thus enabling inactive wellness program participants to obtain false wellness program credit for exercise performed by another." (*Id.*, 3:17-29, 8:25-28.) As examples, Ray described how a dishonest user could shake a pedometer to generate false exercise information "while sitting on the couch watching television" (*Id.*, 3:21-29) or give their gym card to a friend to swipe

in order to obtain credit for exercise that they did not perform. (*Id.*, 3:17-21.) To solve these problems, Ray disclosed a process for validating exercise data through use of a sensor that detects whether a user is engaged with an exercise machine.

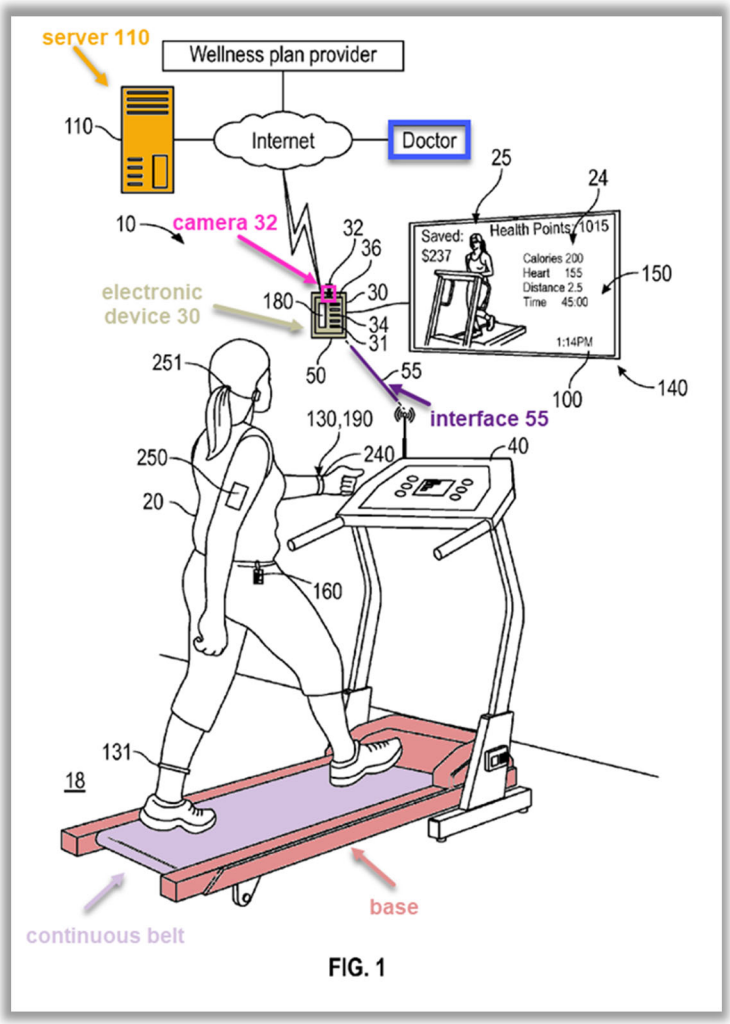


Figure 1 - Ray's treadmill (annotated)

127. As depicted in Figure 1 (above), Ray described its exercise validation invention in connection with a treadmill. Figure 1 depicted and described an admittedly conventional treadmill 40 including a camera 32, which acts as a sensor that tracks a user's movement in real-time to confirm the user is engaged with the

machine. (*Id.*, 6:43-46, 12:36-40, 14:6-14.) The treadmill disclosed in Ray also generated exercise data 24 displayed on the treadmill screen in the form of data or a virtual image. (*Id.*, 5:41-58, 12:61-64, 13:50-67, 14:3-5, 16:51-54, 17:61-18:19.) Ray explained that the user's exercise data was stored on server 110 (*id.*, 13:30-36), or transmitted over the Internet to third parties, such as a user's doctor, insurance company, or wellness practitioner (*id.*, 5:41-58, 13:7-10).

128. Ray also taught reporting exercise data when a user is engaged in an exercise program as well as ceasing to report exercise data when a user is not detected on the exercise machine. With respect to the "motivation" aspect of Ray's invention, Ray described that as a user exercised, a computer caused a user's virtual image to become thinner and healthier-looking. (*Id.*, 5:41-46.) The image was thinned based on the intensity and length of the user's workout. (*Id.*, 5:44-46, 10:59-67.) As long as a user was exercising on the machine, the camera 32 captured a real-time video of the user or images in preset intervals according to the generated exercise data. (*Id.*, 14:31-46.) In other words, Ray's motivational image was generated "in accordance to the speed or duration of the detection of movement of the user 20 by the camera 32." (*Id.*, 13:50-67; *see also id*., 13:20-30.) This image was displayed to the user (Figs. 1 & 2) or even transferred in real time to a third-party, such as a doctor or wellness manager. (*Id.*, 5:49-51, 13:65-67.) But "[i]f the user stops exercising, the camera will no longer record images. This is used to keep

the user engaged and motivated." (*Id.*, 6:55-57; *see also id*., 13:20-24 ("the camera to record a still or video image or produce a live feed of the patient or exercising user 20 when movement is detected by the camera 32").)

C. Cox

129. U.S. Patent No. 7,736,273, entitled "Electrical Signal Analysis to Assess the Physical Condition of a Human or Animal," issued June 15, 2010 to Daryl F. Cox et al., based on an application (No. 12/401,139) filed March 10, 2009. (Ex. 1005.) Cox was directed to a treadmill data acquisition and diagnostic system that used a current sensor to detect a user to generate a stride frequency analysis. (Cox, Abstract, 6:40-54.)

130. Cox specifically disclosed using a current sensor to detect electric current signals of the treadmill "as a person walked on the treadmill" to "enable[] a calculation of power" or energy usage by the motor of treadmill 30. (*Id.*, 2:56-64.) Cox recognized that "[l]oad and speed variations in electromechanical systems generally produce correlated variations in current and voltage" and that this can "reflect loads, stresses, and wear throughout the system and provide the basis for assessing the operational condition of the monitored equipment." (*Id.*, 3:49-56.)

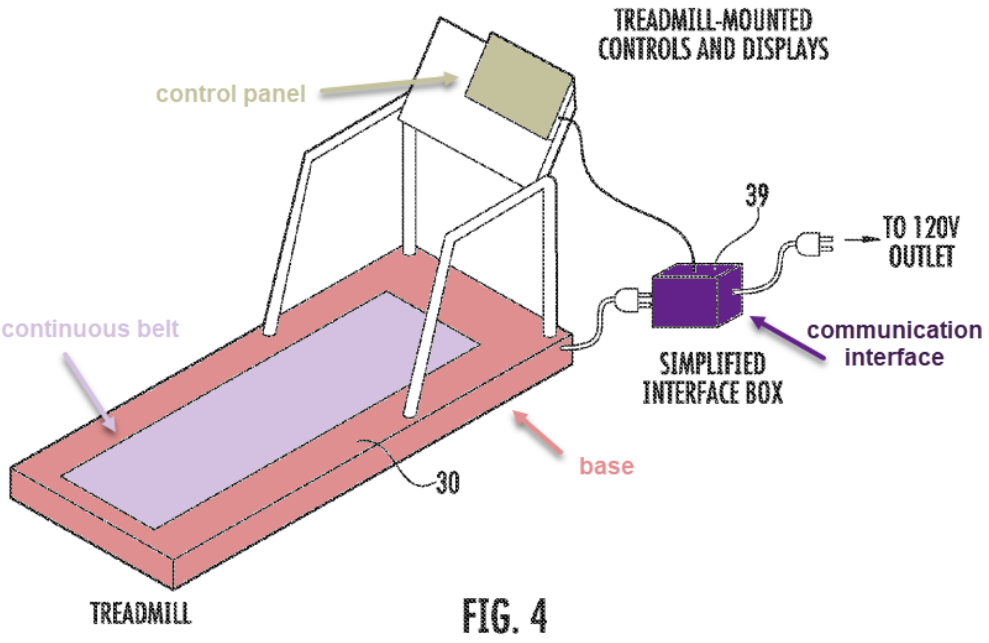


FIG. 4

As shown in Figure 4 (above, with annotations), Cox disclosed that a simplified interface box 39 was placed between the motor of the treadmill and power source for obtaining current signals. (*Id.*, 4:27-31.) Cox also disclosed other embodiments, including a "fully integrated treadmill wherein all components of the invention are built into the treadmill." (*Id.*, 4:37-39.)

131. As taught by Cox, the load on the treadmill (and thus the current drawn by the treadmill motor) was sensitive to several factors that could be used to determine a user's stride profile and whether a user was engaged in exercise. (*Id.*, 6:40-54.) After the data gathered by the current sensor was rectified and analyzed, it could be used to generate a stride frequency analysis, or a stride profile for a user walking, such as shown in Figure 9 of Cox, below. (*Id.*, 2:35-36, 5:56-64.)

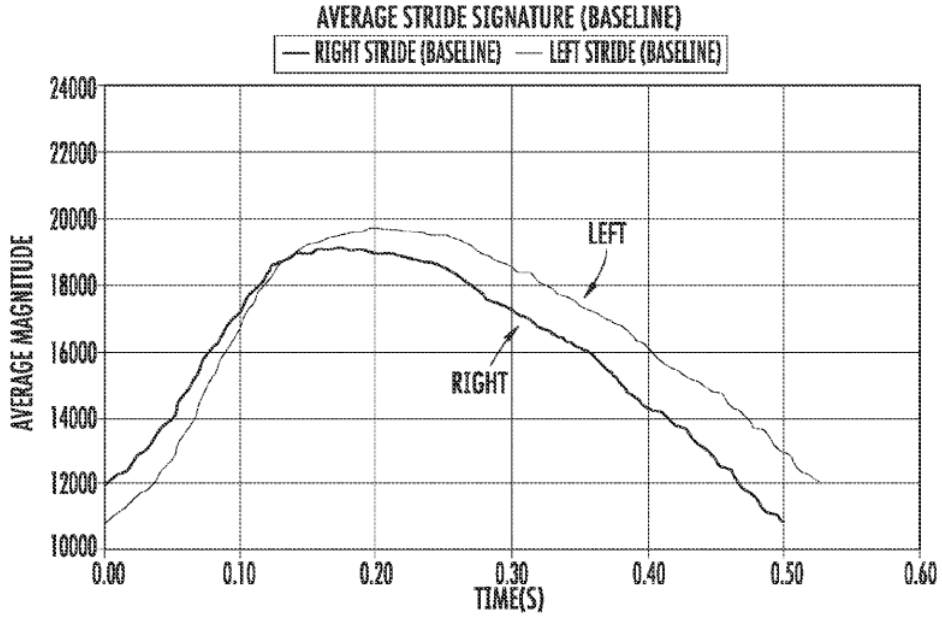


FIG. 9

132. Cox explained that its invention could be used to monitor and quantify the physical and rehabilitation progress for people recovering from injuries and surgeries, where its direct results measurement could be reported to insurance companies. (*Id.*, 2:65-3:9.)

D. Daly

133. U.S. Patent No. 8,574,131, entitled "Sensing Applications for Exercise Machines," issued to Juliette C. Daly et al. on November 5, 2013. (Ex. 1011.) Daly disclosed a treadmill with a plurality of pressure sensors for detecting user engagement and providing exercise metrics to the user. (*Id.*, 5:58-63, 7:39-47.)

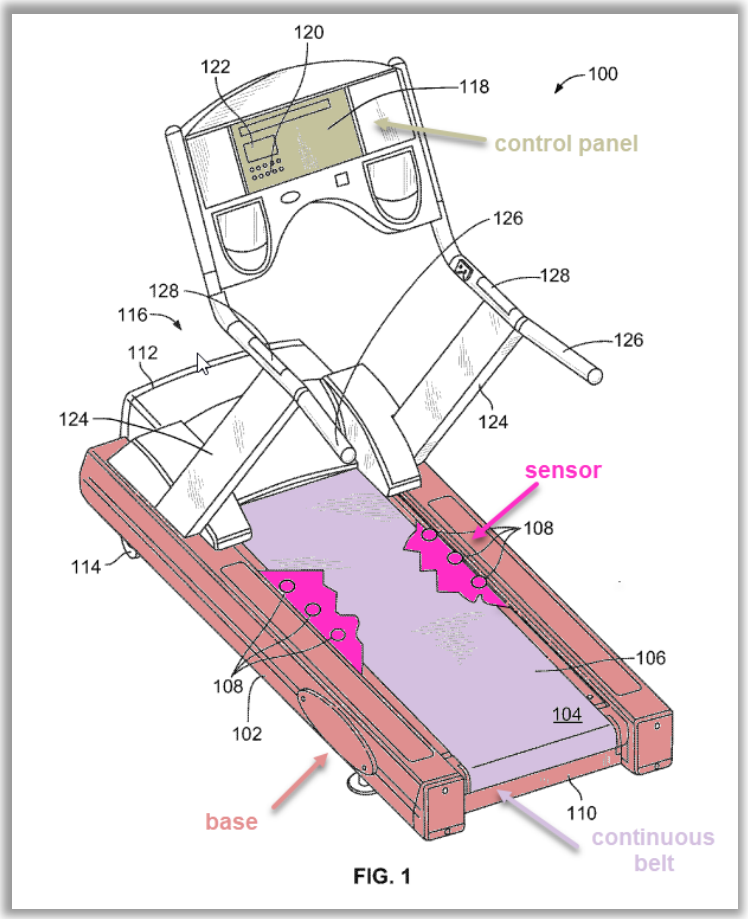


Figure 1 (Annotated) - Daly's Treadmill

134. Daly taught incorporating pressure sensors into the treadmill's belt to provide an output signal in response to deformation or deflection in the deck of the treadmill caused by the user's impact. (*Id.*, 6:37-54.) Daly's control system 206 received output signals communicated by sensor interface 224 to determine whether a user was engaged in exercise (such as walking or running) so that it could provide feedback information to the user regarding their cadence. (*Id.*, 5:57-62, 7:39-47.)

VI. GROUNDS FOR CHALLENGE

A. Ground 1: Claims 1-9, 12, and 14-20 are Obvious over Morris and Ray.

1. Motivation to Combine

135. It is my opinion that a POSITA would have been motivated to combine Morris and Ray. Morris and Ray were prior art references that described exercise equipment, with specific teachings related to treadmills. Both references explained techniques for detecting if a user was present (or not) on a treadmill, and described similar actions such as displaying exercise data (e.g., time, distance, etc.) while the user was exercising on the treadmill. (Morris, Abstract, [0006]; Ray, Abstract, 5:23-25, 5:41-48, 13:20-30.) Therefore, a POSITA would have known that features and functionalities of Morris and Ray could complement one another, and that the invention of Ray could be combined with Morris (by using the device of Ray in connection with the treadmill of Morris) to achieve predictable results.

136. In addition, both Morris and Ray addressed the same two goals: 1) the desire to detect whether a user is present when a treadmill is running, and 2) the desire to increase the user's motivation to exercise on the treadmill. In particular, Morris (titled "User Detection for Exercise Equipment") recognized that the detection of a user's presence could allow for a number of benefits, including motivation for the user to exercise. (Morris, [0025] ("As stated the detection of a user's presence on exercise equipment can provide a number of benefits, including

safety, power savings, **motivation**, training and the like.").)[1] Morris also used motivational messages to entice the user to use the exercise machine. (Morris, [0044] ("In an embodiment, when a user is not detected, the display processor **522** may cause display **524** to show ***a user attraction message*** (block **742**). The message can be words or phrases (such as, "Have you gotten your run in today?" or "Burn [X] calories an hour with a good jog!"), pictures, sounds, video, combinations of the same, or the like—in general, anything that may attract a user's attention or get them to use the machine.").)

137. User detection and motivation were likewise the main themes in Ray's invention. (Ray, Title ("Process to aid in ***motivation of personal fitness***, health monitoring and validation of user"); 6:36-39 ("A further goal of the invention is to provide validation of the user or patient's identity while exercising to ***further engage and motivate the user to exercise more frequently and for a longer period of time***."); 8:22-26 ("By ***utilizing the motivation***, validation and biometric screening features disclosed here, ***the patient is motivated to exercise and maintain a goal journal of her workout routine*** which a doctor can easily track and record while monitoring the patient's improved health."); 11:57-65 ("It is a further object [of this

[1] The bold and italicized text are added to provide emphasis and are not part of the original text, unless otherwise specified.

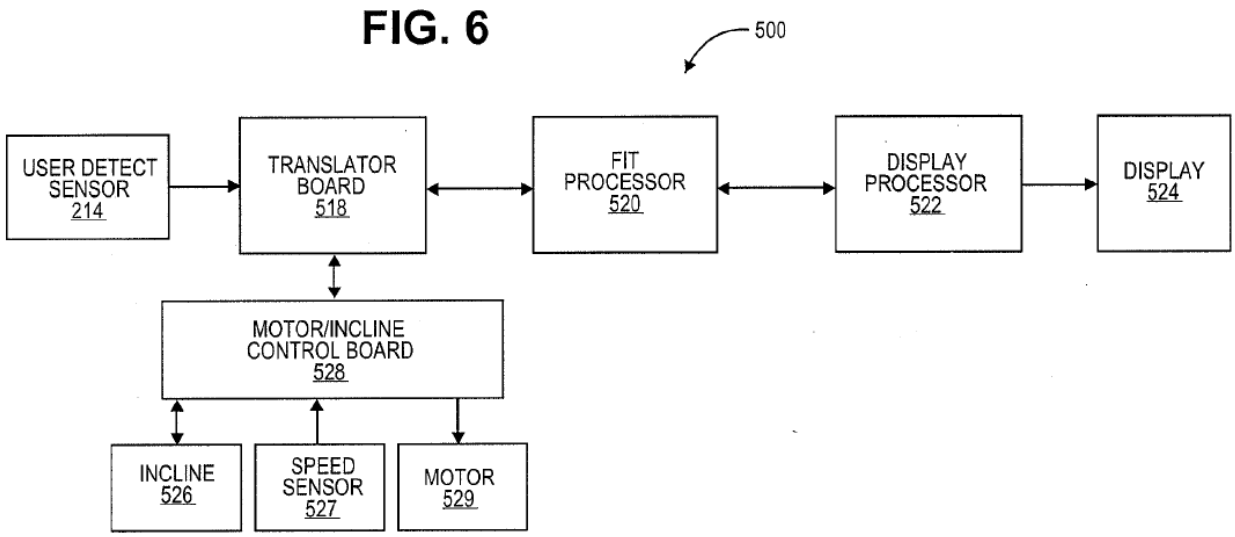
invention] ***to provide a method of intrinsic motivation by using real time thinning self-imagery***; and to create a long last [sic] self-image impression that will enhance healthy food selections; and to provide biometric testing that enhances the user's exercise experience and engages the user's self-autonomy; and to narrow the gap between intention and action for the user by providing motivation to exercise and to participate in prescribed health programs….").) Therefore, a POSITA would have understood that Ray and Morris had a common objective of attempting to both detect and motivate the exerciser. A POSITA would be therefore further motivated to combine the complementary teachings of those references because the combination of features addresses the same goals and together produces a more powerful tool for doing both than Morris alone.

138. Ray's motivational technique entailed, in addition to the regular exercise data such as time, distance, etc., presenting the user's image on the display, and changing the image to appear thinner or fitter, as the user continued exercising for a longer time or with more intensity. (Ray, 5:40-45, 6:20-27, Figs. 1 & 2.) This feature was not described in Morris, and a POSITA would have found it obvious that Morris' treadmill could be enhanced by including the motivational image of Ray.

139. To make this combination, a POSITA would have incorporated Ray's camera and software instructions for validating user exercise data and morphing the user's image into Morris. It was already well-known to include different types of

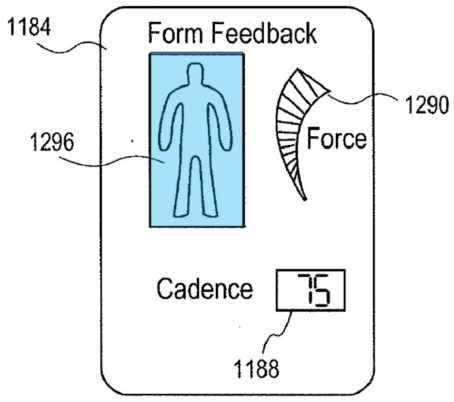
sensors in treadmills and many treadmills already had multiple sensors (*see, e.g.*, Ashby and Yi, described earlier). Morris itself had already explained that its exercise equipment could be fitted with different types of sensors, including optical sensor(s), and that a POSITA would have known how to do this: "In an embodiment, the sensors include a user detect sensor, such as the magnet and coil 214 disclosed herein, other magnetic sensors, ***optical sensors***, or the like…. One of skill in the art will recognize from the disclosure herein a wide variety of sensors and motor feedback systems capable of monitoring the incline and speed of a treadmill 100, including, for example, induction sensors, ***optical sensors***, potentiometers, and the like." (Morris, [0033].) This would have provided an express motivation to install and use Ray's camera for detecting the user, and a POSITA would have known how to do so as part of the routine design of the treadmill.

140. The treadmill of Morris also included plenty of hardware and software processing capabilities to implement Ray's motivational image features, and/or it could have been easily, routinely and in an obvious manner, augmented to include additional components (if needed) to implement what Ray had already described as part its treadmill. In particular, Morris had an information processing system 500 with several electronic circuits and processors (controller). These included the Fit processor 520, display processor 522, translator board 518, and motor/incline control board 528. (Morris, [0032], [0034]-[0036], Fig. 6.)



141. Morris had further explained that these processors could be individual components, or combined together in any combination, (Morris, [0035]); they processed the sensor signals of Morris, determined the presence or absence of the user, communicated with treadmill's motor(s), and presented exercise data such as duration, distance, intensity, incline, cadence, footfall force, on the screen (Morris, [0032], [0034]-[0036], [0050], Fig. 11, claims 29-37); in addition, Morris explained that its treadmill displayed a ***virtual reality content*** and a "***human analog display 1296***" on the screen. (Morris, [0056]-[0058], Fig. 12C.) The human analog would help illustrate the user's running style and could mimic the bouncing motion of the user that had been detected by its sensor. (*Id*.)

FIG. 12C



142. Therefore, Morris already had similar capabilities for modifying a displayed image based on detected sensor signals, and it had the signal processing and display capabilities to accommodate Ray's user detection/validation software and implement it. Morris, however, did not explain the details of using a camera, did not change the real image of the user that Ray provided, and did not transmit that real image to a remote location (such as to a doctor or trainer), as Ray did. Therefore, a POSITA would have found the inclusion of Ray's motivational image, which morphed based on user's exercise intensity/duration, beneficial to include in Morris' treadmill to further motivate the user to continue with his/her exercise, and to provide real-time communication capability with a doctor or trainer. For example, Morris' reluctance sensor, which detected the user's footfall force on the treadmill, would assess the intensity of the exercise and provide input to help with changing the user's virtual image according to that information.

143. A POSITA would be able to easily incorporate the software instructions associated with Ray's features into Morris' treadmill controller and interact with Morris' advanced sensor system to accurately and redundantly detect a user's presence. The treadmill of Morris included the hardware components necessary to implement Ray's software, as I explained above. (*See, e.g.*, Morris, Figs. 1, 6.) The step of incorporating those software instructions into the controller of Morris' treadmill would not require modification of the treadmill hardware and would provide predictable results. Additionally, to the extent it was needed to provide communication capability with a remote location for providing a real-time image, this feature was already well-known much earlier than 2014 (*see, e.g.*, Quy, Watterson '632 and Wu, described earlier in my Declaration); indeed, Ray itself described it. Therefore, a POSITA would have easily combined the relevant features of Ray with Morris.

144. Additionally, Ray expressly stated that its user validation and motivation technology could be "easily and affordably merged" into a fitness manufacturer's treadmill panel screen:

> This invention ***can also be easily and affordably merged into a fitness manufacture's current control and entertainment panel screen on their exercise machines***. Precor for example, is one of the top fitness manufactures and is making the connection with their own network fitness capability with their Preva Network program. Preva Network gives facilities the option of enabling web

> browser capability so users can access their favorite websites during their workout and track their exercise routine. The program also allows owners of the gyms to track the use of each machine remotely.

(Ray, 9:55-65.) Therefore, incorporating Ray's user detection and presentation into a treadmill (such as the treadmill of Morris), would have been obvious and a POSITA would have been able to successfully implement those features into Morris' treadmill.

145. As I explained earlier, adding the above features of Ray would have improved the capabilities of Morris' treadmill in providing the motivational image and thus contributing "to the user's sense of self-worth and self-esteem." (Ray, 11:55-59; 13:50-67.) In addition, Morris had already recognized that its user data could be "output to a computer or saved in memory" for later access, rather than just being displayed to a user (Morris, [0050]). Ray's functionality to share the exercise data with a remote location in real time would have provided an additional useful and beneficial feature by allowing—in the words of Ray—"a more efficient flow of that data to … a physician or personal trainer." (Ray, 7:11-22.) This added benefit would have been an additional motivation for a POSITA to combine Morris and Ray.

2. Independent Claim 1

146. By way of background (prior to my discussion of the limitations of claim 1), it is helpful to address validated and non-validated exercise use data that are recited in Elements 1[g] and 1[h].

147. The ’227 patent and its claims describe “validated exercise use data” as exercise data that is generated while the user is actually exercising on the machine—i.e., when the user is engaged with the operating unit that is moving, such as when the user is walking or running on a treadmill’s belt. (Ex. 1001, Abstract, 1:47-50.) Similarly, “non-validated exercise use data” is described as exercise data generated while the user is not on the exercise machine, but the exercise machine is running—i.e., when the movement of the operating unit is detected without an exercising user. Neither the claims, nor the detailed description, of the ’227 patent, impose additional requirements on these terms.

148. The Background section of the ’227 patent provides some context by explaining that motor-driven treadmills could run unattended and produce fake exercise data without the user actually exercising. (Ex. 1001, 1:51-2:19.) For example, the ’227 patent states:

> Currently, ***if the controller is set to record exercise use data on an exercise apparatus with motor-driven operating member***, such as a treadmill operating member (a motor driven running belt) or a stairclimber operating member (a motor driven staircase), it would be easy to falsify exercise use data on the exercise apparatus. ***The user could just turn on a motor-driven operating member of an exercise apparatus, without actually using the exercise apparatus, and let a controller associated with the operating member create exercise use data.*** A specific example would be a user turning on a motorized treadmill, causing the running belt to move, and letting the treadmill run until the treadmill controller had recorded a large

> distance traveled by the running belt. The user would not need to be present on the treadmill, and yet the treadmill controller would record exercise use data. As a result, the controller thereof would record the exercise use data which is faked.

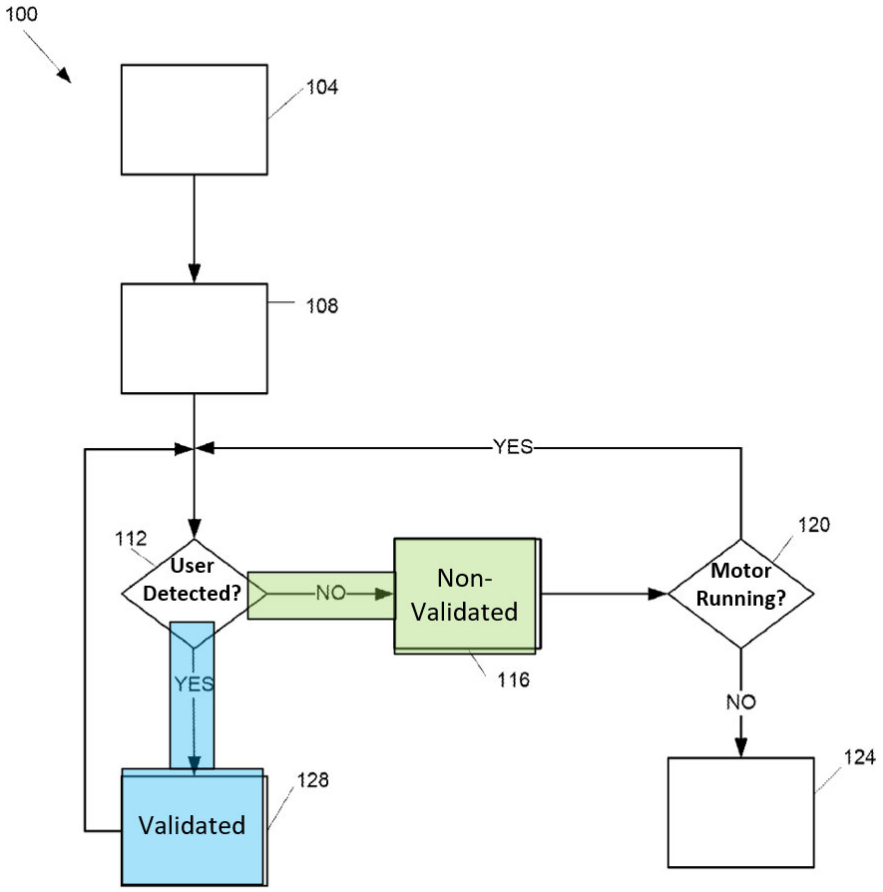
(Ex. 1001, 1:58-2:7.) For this reason, insurance companies would not accept exercise data produced by motor-driven exercise equipment as proof of the user's exercise habits and provide discounts to the user. (Ex. 1001, 1:51-53, 2:7-19.)

149. The '227 patent goes on to explain that to prevent the generation of such fraudulent data, its alleged invention involves a "verification function and a verifying method." (Ex. 1001, 2:29-30.) More specifically, the '227 patent used its Figure 6 to describe "***an example*** of exercise use verification application 100 that uses data acquired from the motor-driven operating member 20 to monitor and verify that a user is using the exercise equipment." (Ex. 1001, 6:55-58). The '227 patent explains as follows (these sections and Figure 6 are annotated and highlighted with different colors to help facilitate the explanation):

> Proceeding to step 112, ***the controller 40 analyzes the data from the sensor to detect whether a user is actively engaging the motor-driven operating member 20.***… ***If the analysis results [in step 112] in a "no," there is no user detected that is actively engaging the motor-driven operating member 20, the process proceeds to step 116***. ***If the analysis results in a "yes," there is a user detected that is actively engaging the motor-driven operating member 20, the process proceeds to step 128,*** the details of which are later described….

At step 116, the process generates non-validated exercise use data. This data can be locally stored, or communicated to an interested third party, a demander, and/or the user as discussed above. Next, at step 12, the process detects whether the motor 22 … continues to operate ….

At step 128, the process generates validated exercise use data. More specifically, the controller can record (or otherwise identify) the non-validated exercise use data as validated exercise use data. The validated exercise use data can be locally stored or communicated to an interested third party, a demander, and/or the user as discussed above. The process returns to step 112 and repeats.



'227 Patent Figure 6 (Annotated)

(Ex. 1001, 7:12-47 & Fig. 6.)

150. While the explanation about figure 6 includes many permissive terms, such as "can" and "otherwise identity," and this is considered an "example" of the verification process, the validated exercise use data corresponds merely to exercise data that is generated during the time when the user is detected to be actively exercising on the treadmill. (*See e.g.*, Ex. 1001, 2:42-52, 5:51-59.) Claim 1 of the '227 patent does not impose any further restrictions and paints even a broader picture, simply reciting that non-validated exercise use data is the data generated "in response to movement of the operating unit relative to the base and the sensor does not detect engagement of the user with the operating unit," and validated exercise use data is the data generated "in response to movement of the operating unit relative to the base and the sensor does detect engagement of the user with the operating unit." (Ex. 1001, Claim 1.)

151. Additionally, in the related '340 patent, claim 19 (dependent on claim 13) recites that "…wherein the reported exercise use data is defined as validated exercise use data." (Ex. 1010, 10:37-38.) Claim 13's reported "exercise use data" is simply the exercise use data produced in response to detecting the user's engagement with the operating member. (Ex. 1010, 10:1-12). While the "reporting" statement is not part of the claims of the '227 patent, all of the references in the invalidity grounds also illustrate that the exercise use data obtained when the user was detected to be exercising is also reported.

1[pre] "An exercise apparatus comprising:"

152. Morris disclosed "an exercise apparatus" in the form of an "exercise machine[] having user detection features." (Morris [0002], Title, Abstract.) Morris further explained the exercise machine can be a treadmill. (Morris, [0007], Claim 29, Abstract, Fig. 1.)

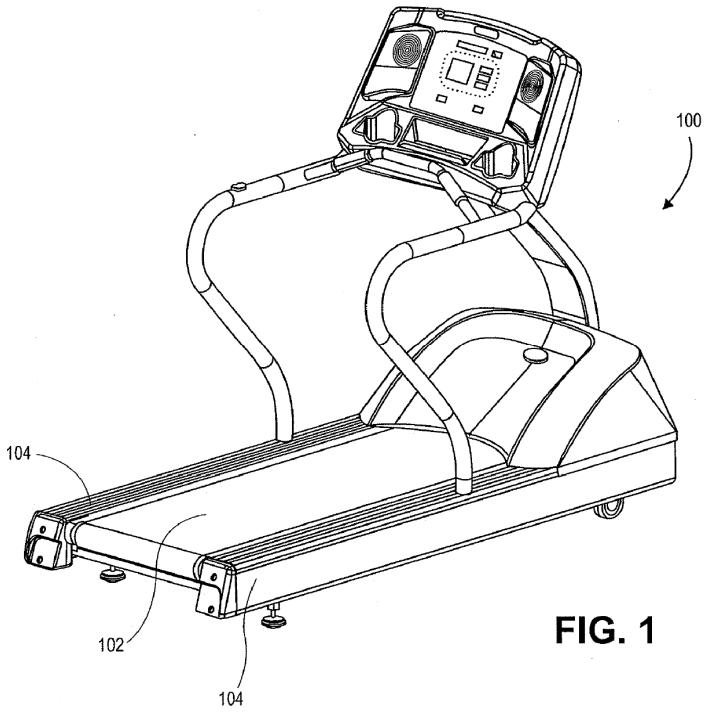


FIG. 1

1[a] "a base;"

153. As seen in Figure 1 (above), Morris depicted a treadmill that included a base 104, including a "[d]eck 206 … generally made of a sturdy material that can withstand the forceful impacts of runners and other users." (Morris [0027], Fig. 2). The belt of the treadmill was positioned above the deck 206. (Morris, Fig. 2 (below).)

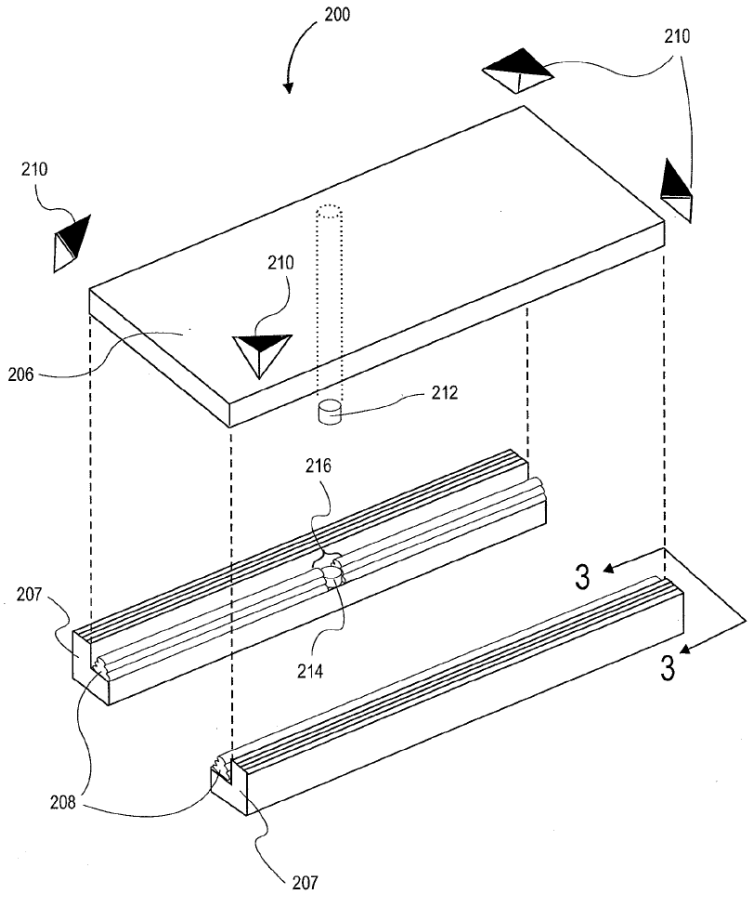
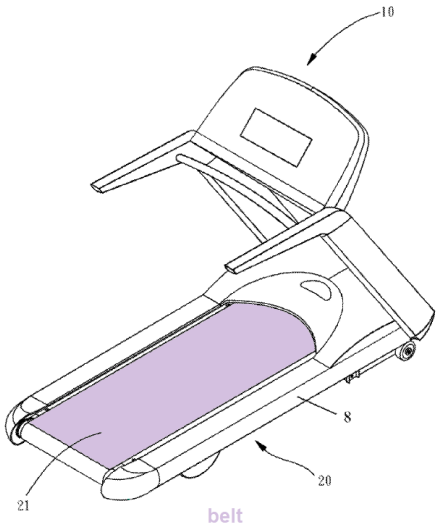
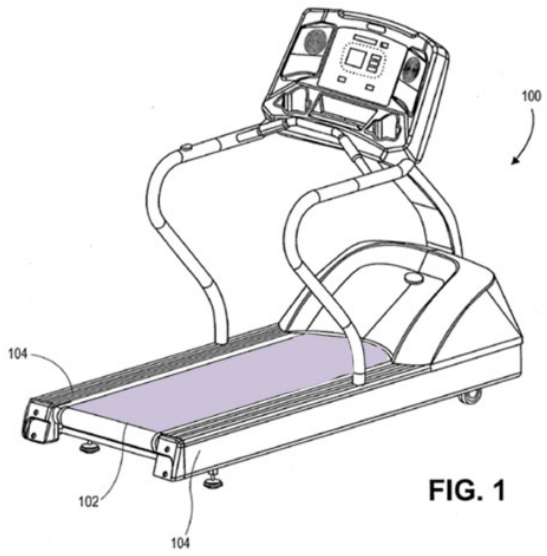


FIG. 2

1[b] "an operating unit movable relative to the base;"

154. Similar to the '227 patent's explanation that the operating member can be an endless belt (Ex. 1001, 2:64-67, 3:54-56), Morris disclosed an operating unit driven by the motor in the form of an endless belt 102. (*See* annotated Fig. 1 (below) and Morris, [0025] ("a frame positioning two rollers stretching an endless treadmill belt 102 for exercising users"); *see also* Morris, [0031] ("[S]light vibrations in the

treadmill caused merely by an electric motor driving the belt may create small, 'baseline' signals").)

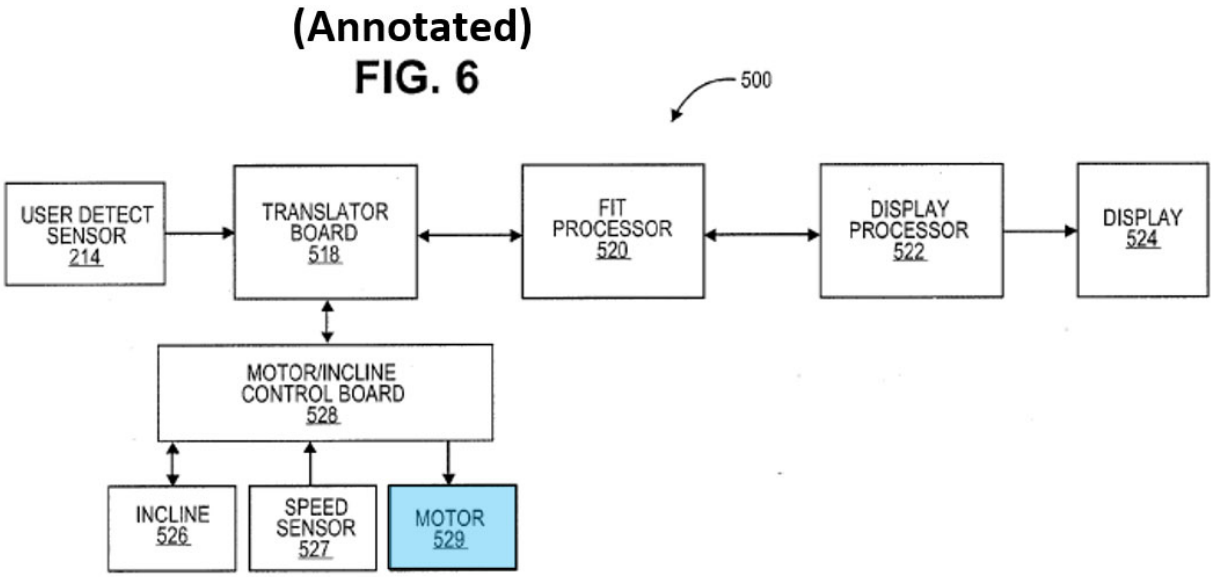
Figure 1 - '227 Patent (annotated)	Figure 1 - Morris (annotated)
	

155. The belt of Morris' treadmill was positioned "above the deck 206" (Morris, [0027]) and moved with respect to the stationary deck. (Morris, [0025] ("Within a loop formed ***by the treadmill belt 102 resides a generally resilient deck surface, preferably with a low coefficient of friction between the surface and the belt 102 that allows the belt 102 to glide over it while in use***.").)

1[c] "a motor coupled to the operating unit;"

156. Morris disclosed that its treadmill included a motor coupled to its belt (operating unit) by explaining that "slight vibrations in the treadmill caused merely by ***electric motor driving the belt*** may create small, 'baseline' signals." (Morris,

[0031].) Morris further described a "motor feedback system [for] monitoring the incline and speed of a treadmill," and drivers for its motor, including motor/incline control board 528 and motor driver 529, as shown in Figure 6 (below). (Morris, [0032]-[0033]).



1[d] "a sensor operable to detect engagement of a user with the operating unit;"

157. Morris disclosed "*a sensor operable to detect engagement of a user with the operating member.*" Morris disclosed user detect sensor, such as a ***"magnet and coil,*** … other magnetic sensors, ***optical sensors*** or the like." (Morris, [0033].) For example, Morris described a reluctance sensor comprised of magnet 212 and induction coil 214, as shown in Figures 3A and 3B, below. (Morris, [0027].)

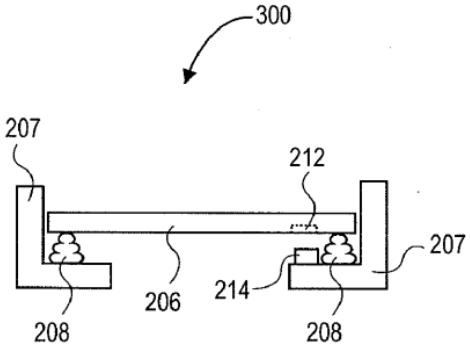


FIG. 3A

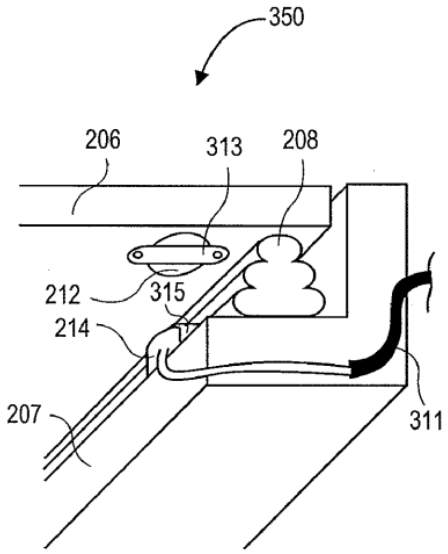


FIG. 3B

158. Morris described that as its deck moved from a user's footfalls, the corresponding movements of magnet 212 induced a current in the induction coil 214 that was communicated through wire 311 to a processor for translation. (Morris, [0027].) Specifically, Morris described:

> [W]hen a user steps onto an exercise machine, such as a treadmill, in an embodiment of this disclosure, the deck 206 will move and/or flex in relation to the frame 207. The magnet 212 will in turn move in relation to the inductance coil 214. This motion changes the magnetic field experienced by the inductance coil 214 and induces an electrical signal (block 582) that can be communicated, in an embodiment, through wires 311…. A processor uses the digital signal strength, duration, or comparison to a previous signal to determine whether a user is present (block 588).

(Morris, [0031]; *see also id.*, [0027].)

159. Ray also disclosed an optical sensor in the form of a camera and associated data processer that was connected to the exercise machine (Ray, 10:36-50), or could be implemented as part of the treadmill. (Ray, 9:55-57.) Ray's camera "record[ed] [] still or video image[s] or produce[d] a live feed of the . . . exercising user 20 ***when movement [was] detected by the camera."*** (Ray, 13:20-24.)

160. Ray explained that:

> For example, as long as the exercise data 24 is being produced by the exercise machine 40, the camera 32 can be instructed to capture the user's image every 10 minutes. Therefore, ***as long as the user 20 continues exercising, the camera 32 will continue to capture the user's image***.

(Ray, 14:35-40; *see also id.* 10:59-64; *id*., claim 1 (reciting "a camera structured to capture live video image of a user while the user is exercising").) Ray's camera also detected when a user was present (and not present) on the moving belt and disclosed that "as long as the treadmill is moving the camera will operate to take their real time image while exercising" and that "[i]f the user stops exercising, the camera will no longer record images." (Ray, 6:53-56.) Ray's camera determined a user's presence when "movement . . . (such as the user's shoulders moving up and down)" was detected, thus making clear that at least Ray's camera *was operable to detect engagement of a user with the operating unit*. (Ray, 14:6-14, 15:55-67.) Ray also described that "by utilizing the camera 32 to sense small changes in facial color

based on blood flow such as the Vital Signs Camera App by Phillips, heart and respiratory rates can be obtained." (Ray, 15:47-50.)

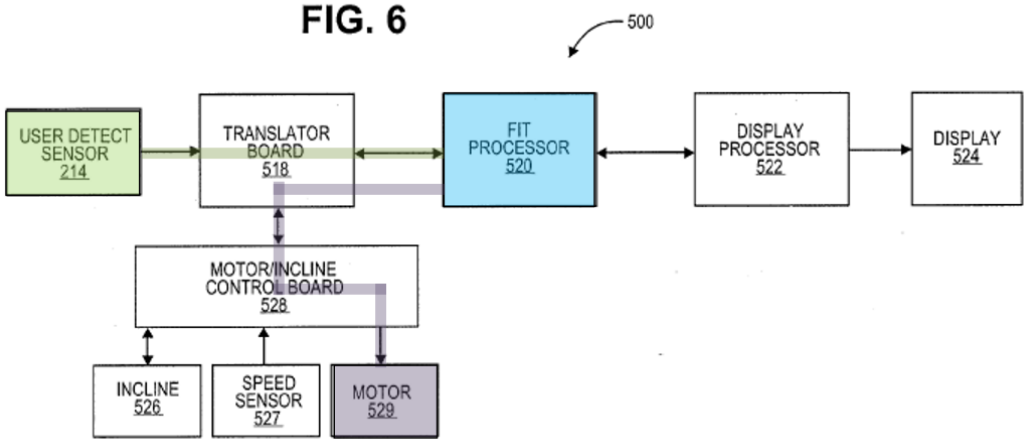
161. Therefore, Ray's camera and its analysis software was a versatile tool that could be combined with Morris' reluctance sensor. The reluctance sensor would provide relevant information about detection of the user's footsteps and the amount of force that it detected, which would be used to accurately or more realistically morph the user's virtual image. As I explained earlier, including multiple sensors or sensor types in treadmills was routine and well-known. The sensors produced different types of information such as speed, time, calories burned, heart rate, foot pressure, pace and others, and could operate separately or cooperatively with each other.

162. The '227 patent itself described that the treadmill's sensor that detected user engagement with the treadmill included multiple sensors, such as multiple pressure sensors 70 shown in Figure 5 (Ex. 1001, 5:41; *id.*, Fig. 5), as well as different types of sensors, such as "an optical sensor 60 that senses a level of IR radiation (see FIG. 4), a pressure sensor 70 that senses (or detects) an amount of pressure on the running belt (see FIG. 5), a speed sensor that senses fluctuations in speed of the operating unit, a thermal sensor that senses a level of heat (i.e., from a human body) on or near the motor-driven operating member, or any other suitable sensor." (Ex. 1001, 5:34-46; *id.*, 7:5-11.)

1[e] "a controller in communication with the operating unit and the sensor; and"

163. Morris disclosed the claimed "controller" in the form of a "FIT" (fitness) processor 520 that was in communication with the motor that drove the belt ("operating unit") and with the user detect sensor ("sensor"), as illustrated in annotated Figure 6, below.

(Annotated)
FIG. 6



164. Alternatively, the combination of translator board 518 and FIT processor 520 (with or without the display processor 522 of Morris) formed the claimed "controller" because Morris described that while those components can be implemented as "physically separate processors and/or electronic boards, one or more [of the translator board 518, FIT processor 520, and display processor 522] can be combined within signal processor." (Morris, [0035].)

165. Based on Morris' teachings, the "controller" in the claim can be mapped to any one of the combinations of Morris' processing components. For

example, the claimed controller can be the combination of Morris' translator board 518, FIT processor 520, display processor 522, and the motor/incline controller board 528. In another example, the claimed controller can be the combination of translator board 518 and FIT processor 520. Combining different processors or implementing them as individual components was obvious and well-known to a POSITA at the time of the alleged invention. These and other combinations all follow Morris' clear teaching on this point, are obvious variations of each other, and are consistent with the '340 patent's examples of the controller that included "a microcontroller unit, at least one electronic circuit, and at least one circuit board … [or] a computer processing system that includes a hardware assembly, a software assembly, and/or a firmware assembly." (Ex. 1001, 4:17-24.)

166. Morris' processor(s) communicated with the user detect sensor because "the user detection inductance coil 214 communicate[d] with the translator board 518. The translator board 518 interpret[ed] the signals from the inductance coil 214 and forward[ed] them to the FIT processor 520. The FIT processor 520 … use[d] this indication to help control a workout program." (Morris, [0036].) Morris' processor also communicated with the treadmill belt (operating unit) because it "communicate[d] a signal to the translator board 518, which in turn communicate[d] signals that cause[d], for example, a treadmill belt drive to slow the treadmill belt or the incline motor to lower the incline." (Morris; *see also id*., Claims 24 and 32.)

1[f] "a communication interface in communication with the controller,

167. The '227 patent broadly describes the communication interface as a way to provide exercise data to another device such as to "an outside storage device such as a flash drive, a disk rewriter or a website storage." (Ex. 1001, 6:19-22.) The communication interface can also be "an Internet interface, such as a Wi-Fi internet module or an internet port" (Ex. 1001, 6:40-43), or can be "programmed or incorporated into the controller 40 such that controller 40 performs the functions associated with the communication interface." (Ex. 1001, 6:50-54.) The communication interface can also be a display device. (Ex. 1001, 6:9-13)

168. Consistent with the above description of the '227 patent, the Morris-Ray combination described a communication interface that provided the exercise use data to a display, to a memory device, to a remote cloud-based server and/or to a remote location via a live feed.

169. More specifically, Morris disclosed a communication interface in the form of (1) a display device 524 and/or (2) a display processor 522 which communicated with the display device 524. (Morris, Figs. 6, 11, 12A-C.) Morris' display processor 522 could be a separate component from its FIT processor or could be combined with it. (Morris, [0035].) The display processor could "command the display 524 to display indications of the presence or absence of a user" (Morris,

[0036]), and could include "a television interface, a display interface, an iPod® or other music, multimedia, or other player interface." (Morris, [0035].) The "display 524 include[d] an LCD screen, an interactive touch screen, a plasma display panel, LEDs, indicator lights, or the like." (Morris; *see also id*., [0023]-[0024], Figs. 11 & 12A-C.)

170. Similarly, Ray disclosed (1) a display (Ray, Figs. 1-3, 12:59-67, 13:50-55), where the display could be integrated into the treadmill (Ray, 9:55-57); (2) a communication interface that allowed the user's motivational image and other exercise data to be transmitted over the Internet, such as to transmit user's motivational image and exercise data as a live feed to a remote location (Ray, 3:46-51, 6:67-7:10, 8:1-10, 13:65-67); and/or (3) a communication interface that allowed exercise data to be sent to a storage device such as cloud-based server (Ray, 3:46-51, 5:65-6:5, 7:4-10). In Figure 3, Ray further illustrated a specific embodiment, in which the treadmill had an "interface 55" for transmitting exercise data to another device. (Ray, 13:31-36.)

171. Ray's controller obviously communicated with Ray's communication interface because it provided the user's image and other exercise data so it could be presented on the display or sent to a remote location, such as to the doctor, wellness trainer, or a remote server, as Ray has described, and I have explained earlier.

172. Any one or combinations of the above interfaces in Ray or Morris could be the communication interface that is recited in claim 1.

1[g] "wherein the controller is configured to generate a non-validated exercise use data in response to movement of the operating unit relative to the base and the sensor does not detect engagement of the user with the operating unit,"

1[h] "wherein the controller is further configured to generate a validated exercise use data in response to movement of the operating unit relative to the base and the sensor does detect engagement of the user with the operating unit, and"

173. Below I first address limitation 1[h], followed by limitation 1[g].

174. *Limitation 1[h] - Validated Exercise Use Data*: Morris and Ray taught limitation [1h]. Specifically, Morris explained that "exercise equipment may present information to a user through a display" (Morris, [0050]), showing exercise use data including "information such as ***pace***, heart rate (when available), incline, ***distance,*** program profile, and/or the like." (Morris, [0051]; *see* **blue annotations** in Fig. 11, below.)

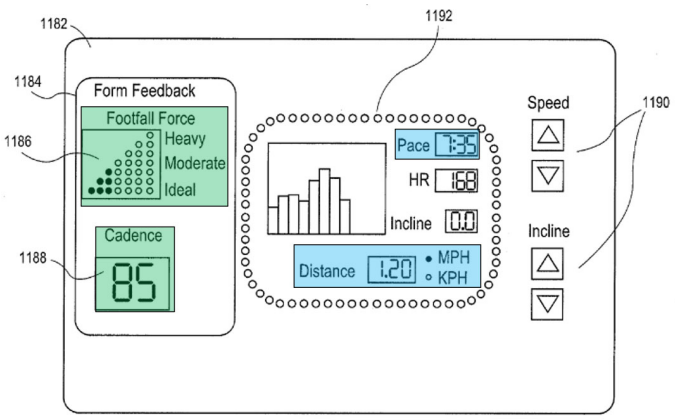


FIG. 11
(Annotated)

175. Morris also described generating and displaying exercise use data such as a ***footfall force*** represented on a "force graph 1186 [that] include[d] one or more indications of force, such as increased bar length of the graph, color changes, and the like for heavier footfall forces …[and] ***a user's cadence—generally expressed as steps per minute***… measured based on the detection of each impact over a period of time." (Morris, [0053]; *see* **green annotations** in Fig. 11, above.)

176. In addition, Morris' invention produced information about the detected force of the footfalls and it explained that "user detection sensor readings [were] evaluated more often ***while the treadmill belt [wa]s moving***." (Morris, [0040].) This makes it obvious, if not explicit, that the exercise use data of Morris was when the belt was moving and the user was walking or running on the treadmill. It is clear that information such as pace, cadence and footfall information were obtained when the user was exercising on the treadmill. Also, it would have been obvious that other information, such as time and distance represented the time spent, or the distance traveled, on a moving treadmill, and therefore, when presented on the same screen as the footfall and pace information (as is shown in Figure 11 of Morris), they also represented exercise use data for the user on the treadmill.

177. Ray explicitly described that validated exercise use data would only be produced and reported while the user was being detected exercising. For example, Ray disclosed generating, transmitting and displaying exercise data 24, such as

calories, heart rate, distance and time. (Ray, 5:46-48, 10:64-67, 13:31-36; *see also* **blue highlights** in annotated Fig. 1, below.) Ray's exercise use data further included a virtual image of the user which was generated and displayed in real time on a screen when the user used the treadmill (Ray, 4:66-5:11), and became "thinner, healthier, and more aesthetically pleasing." (Ray, 5:41-46; *see also* **green highlights** in annotated Fig. 1, below.) The image was thinned based on the intensity, speed or the duration of the user's workout. (Ray, Abstract, 5:44-46, 5:23-29, 10:59-67.)

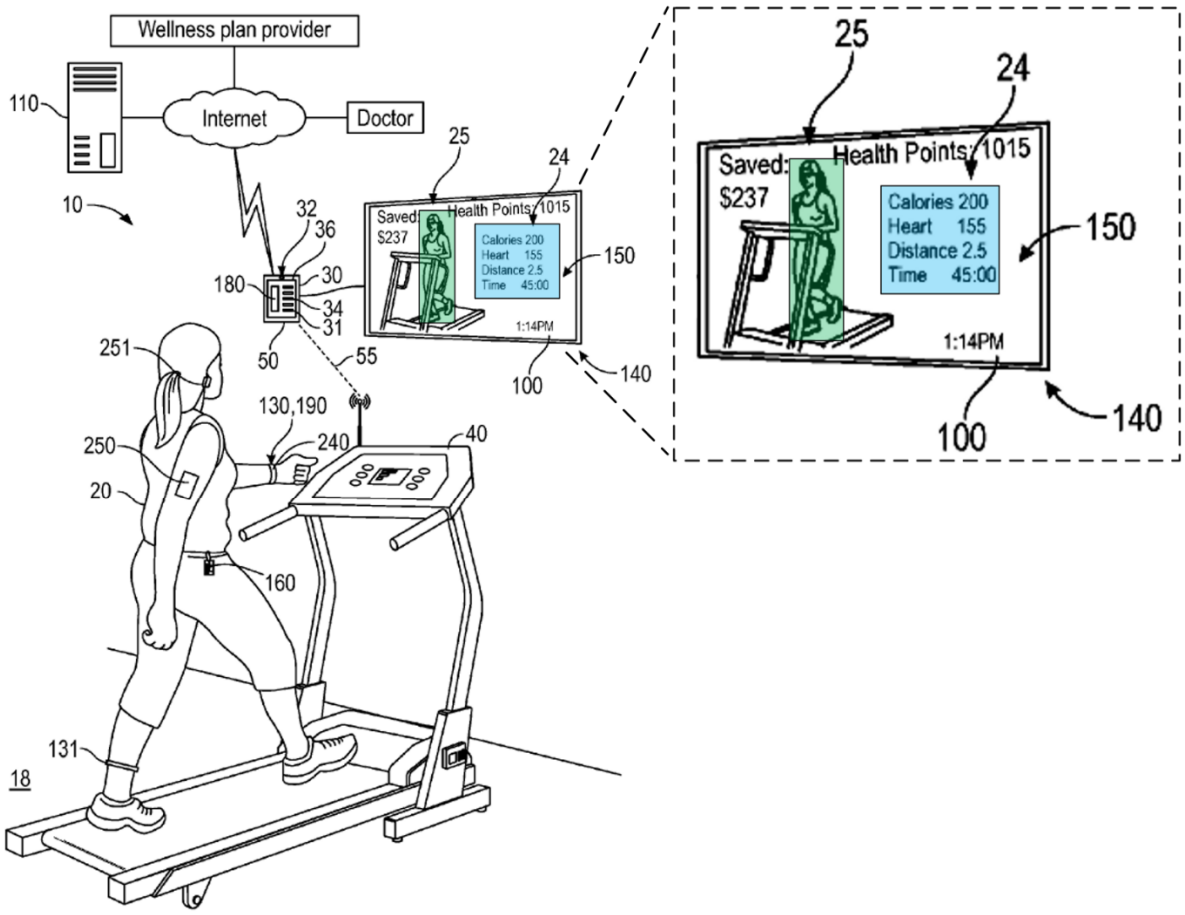


FIG. 1 (Annotated and Display Area Enlarged)

178. The ’227 patent describes that exercise use data can be “a multimedia content, such as an image and/or a sound.” (Ex. 1001, 6:25-29.) Therefore, Ray’s motivational image that morphed according to the user’s exercise intensity/duration on the treadmill fits that description provided by the ’227 patent; it was not only representative of the user’s exercise on the treadmill (intensity, speed and duration), it also in the described format in the ’227 patent.

179. As explained in Ray, the user’s thinner/healthier-looking image was generated in ***real time*** by a computer system, was produced ***via the treadmill interfacing with the computer system*** and was displayed on the screen ***as the user was exercising***. (Ray, 4:67-5:14, 5:23-29, 10:59-67.) For example, Ray explained that the movement of the treadmill could the trigger camera’s operation: “the exercise machine 40 indicates movement thereof at the interface 55 with the electronic device 30, resulting the set of instructions causing the camera 32 to periodically take a photo.” (Ray, 14:7-11.) Therefore, it would have been obvious to a POSITA that the user’s image, which changed in real time based on the intensity/speed of the user’s exercise, would be generated when the treadmill’s belt (operating unit) was moving. In addition, it would have been obvious to a POSITA that Ray’s other types of exercise data (such as time and distance) would be generated while the belt was moving because that information would be computed based on the movement of the belt. (*See, e.g.*, Ray, 13:24-30 (“***the time 140 and***

duration of the exercise performed by the user 20"); *see also id*., 5:45-48 ("In addition to seeing her image, she can also view on the display ***her exercise data such as heart rate, calories burned and distance advanced***.").)

180. In the Morris-Ray combination, the controller would have been configured to detect the user's presence using a camera (sensor) as described in Ray. According to Ray, the camera detected a user on the moving belt (operating unit) when, for example, it sensed a user's shoulders moving up and down (Ray, 14:6-14), and/or by taking real-time images of the user "***as long as the treadmill [wa]s moving***." (*Id*., 6:53-55.) Ray further explained that ***"If the user stop[ped] exercising, the camera w[ould] no longer record images***." (Ray, 6:55-57.) This means the detection of the user would be carried out as long as the treadmill's belt was moving and the camera was detecting the user's movements. Thus, Ray's exercise use data obtained was validated exercise use data.

181. As I explained earlier, Ray provided an additional level of validation or verification that was tied to the identity of the user. In particular, Ray described that the in "***validation process*** of the invention, the patient's identity ***and exercise routine are confirmed*** simultaneously." (Ray, 8:26-28, 13:24-30.) This provided an additional level of confirmation, which meant not only the generated exercise data provided to the doctor or another third party were obtained when the user was actually on the treadmill, and it corresponded to the correct user.

182. Moreover, as explained above, Morris and Ray both described generating exercise use data, including distance, pace, footfall force, cadence, time, and a user's virtual image, any one or any combination of which can be construed as the claimed exercise use data. Therefore, generating and reporting the user's thinning image while the exercising user was being detected and stopping the reporting of the user's virtual image in the absence of the user, as explained above, suffices to render obvious the generation of "validated exercise use data."

183. In addition, it would have been obvious to a POSITA that other exercise use data, such as pace, footfall force, cadence, distance and/or time would also be reported while the exercising user was being detected and would cease to be reported when the user was no longer exercising. For example, pace, footfall force and cadence could only be generated based on detection of user's footsteps, which would no longer be generated in the absence of the user, and the reporting of other information such as time and distance would have been unnecessary (as the user had left the treadmill).

184. *Limitation 1[g] - Non-Validated Exercise Use Data*: Generation of non-validated exercise use data was already known by a POSITA, and was admitted as such in the '227 patent. (*See* my discussion of limitation 1[g] in Section VI.C.1, below.)

185. Regardless, in the Morris-Ray combination, Morris taught or suggested this limitation because it explained that when a user was not detected, and failed to return within a period of time, such as approximately 6-8 seconds, a ***controlled slowdown*** of the treadmill is triggered. (Morris, [0045], Fig. 8, steps 850-860; *see also id*., [0008]: "In an embodiment, these signals can be used to pause or stop a treadmill, for example, ***when a user departs without stopping the belt of the treadmill***. These signals can also be used to ***power down a machine after a user has been gone for a certain period of time***."). During the interim period when the treadmill was running without a user, Morris explained that a user return message was displayed to ask the user to please return to the treadmill. (Morris, [0045].)

186. As explained in Morris, when the user was not detected, Morris' treadmill would still be running for a certain period of time before the controlled slowdown was initiated. It would have been obvious to a POSITA that certain exercise information that did not depend on the user's presence (e.g., the elapsed time) would continue to be generated in the absence of the user until the slowdown occurred. This information would be non-validated exercise use data because it was generated while the user was not being detected and would, therefore, not be reported and would not have been subject to Ray's identity verification. Continuing to generate the non-validated data (e.g., for 6-8 seconds) prior to slowdown of the treadmill would have been obvious to a POSITA because (1) it would have allowed

reporting of the exercise information to be readily resumed without further delay upon the user's return to the treadmill, and (2) it would have informed the user intending to jump back on the treadmill that the treadmill was still running so the user could use caution in getting back onto the treadmill, or to slowdown the treadmill before resuming his/her exercise.

187. Additionally, this would have been one of only two known alternatives—to continue or not to continue generating the data—when the user was not detected, and would have therefore been obvious.

1[i] "wherein the controller transmits the validated exercise use data to the communication interface."

188. Ray described sending the virtual image as a live feed to third parties such as insurance programs, trainers, and physicians. (Ray, 3:46-50, 5:49-51, 7:4-10, 7;15-22, 7:23-36, 13:7-9.)

189. When including the functionalities of Ray in Morris' treadmill, a POSITA would have understood that communication capabilities that are described in Ray could have been readily implemented, e.g., as part of the communication interface, such as the display processor or an additional transceiver, to transmit the data to a third party. By December of 2014, electronic devices (cell phones, laptops, etc.) and exercise equipment were known to have wireless and remote

communication capabilities. A POSITA would not have had any difficulty implementing it, and would have found it obvious.

3. Dependent Claim 2

"The exercise apparatus of claim 1, wherein to generate the validated exercise use data the controller records the non-validated exercise use data as validated exercise use data for a portion of time that the operating unit moves relative to the base and the sensor does detect engagement of the user with the operating unit."

190. As I explained above in connection with claim 1, it would have been obvious that the treadmill in the Morris-Ray combination would generate certain data, i.e., non-user related information such as the elapsed time, even when the user was not being detected, in anticipation of user's return to the treadmill. Therefore, information generated by the exercise machine (e.g., time) or obtained by the camera (e.g., pictures of the stationary user or the user's heartrate (Ray, 15:47-51)) while the user was not exercising would not be reported and would be non-validated exercise data.

191. Ray explained that its camera would be triggered based on the movement of the exercise machine (Ray, 14:6-11), and would continue recording, generating and transmitting the motivational image as long as the user was detected exercising on the treadmill. (Ray, 14:11-14, 14:35-40.) Therefore, a POSITA would have found it obvious that, upon a determination that captured image(s) indicated a user was present and exercising (as also confirmed by Morris' reluctance sensor),

the user's virtual images and associated exercise data would be recorded (e.g., at the cloud-based server or sent in real time to the doctor (Ray, 7:4-10, 8:1-8), and would thus be validated exercise use data.

192. For example, a POSITA would have understood that for the duration of 6-8 seconds (Morris, [0045]), the exercise use data would not be validated data. Once the user returned to the exercise machine (prior to the expiration of the 6-8 seconds) and for the duration of the exercise by the user, the exercise use data would be *validated* exercise use data because it corresponded to the exercise session and would be recorded and/or reported out, as explained in Ray. This process can repeat every time the user left the treadmill and returned within the prescribed period of time.

4. Dependent Claim 3

"The exercise apparatus of claim 1, wherein the validated exercise use data includes a distance traveled by the user while the sensor detects engagement of the user with the operating unit."

193. Ray disclosed that when a user was exercising on a treadmill, the user can "view on the display her exercise data such as heart rate, calories burned, and **distance advanced**." (Ray, 5:46-48, 10:64-67, 13:31-36, Fig. 1 (annotated below); *see* my discussion of limitation 1[h], above.) Morris also disclosed exercise data (including distance) that would be presented to the user. (Morris, [0051], Fig. 11.) It would have been obvious to a POSITA that the distance traveled would be validated

exercise use data because such information would be captured during the time the user was being detected exercising.

194. In addition, Ray described that distance was one of several exercise data that was displayed on the screen when the user was exercising (along with time, heart rate and calories), and further described that "time" was generated and reported as a "validated exercise use data" to a third party. (*See* my discussion of claim 4, *infra*.) It thus would have been obvious to a POSITA that "distance," listed alongside "time" (*see* annotated Fig. 1, below), would also be exercise data that was collected during the user's exercise and reported to a third party (e.g., a doctor).

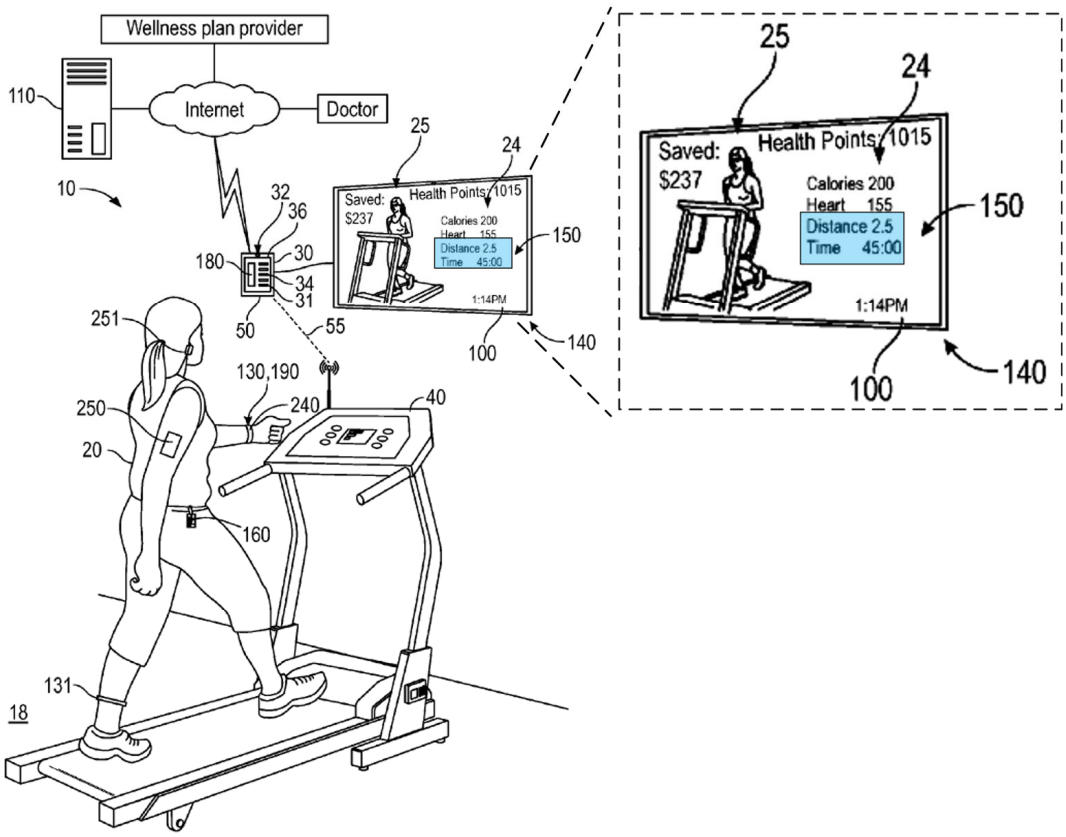


FIG. 1 (Annotated and Display Area Enlarged)

5. Dependent Claim 4

"The exercise apparatus of claim 1, wherein the validated exercise use data includes a time spent exercising while the sensor detects engagement of the user with the operating unit."

195. Ray taught or suggested this claim because Figure 1 of Ray (annotated above) showed time spent exercising as part of the exercise data displayed on the screen while the user was exercising (Ray, 5:46-48) and explicitly stated that, along with the identity of the user, "***the time 140 and duration of the exercise performed by the user 20***" were transmitted to the server and/or reported to the doctor, wellness program, or the like. (Ray, 13:24-30; *see also id*., 13:21-24 ("electronic device 30 is adapted to cause the camera 32 to record a still or video image…***when movement is detected by the camera***"; *see also id*., 10:64-67, 13:20-36, and my discussion of limitation 1[h], above.)

196. Based on the teachings of Ray as described above, it would have been obvious to a POSITA that "the duration of the exercise performed by the user" was part of the validated exercise use data because it was detected while the user was engaged with the treadmill as detected and confirmed via images of the exercising user.

6. Dependent Claim 5

"The exercise apparatus of claim 1, wherein the communication interface is an internet interface for

transmitting the validated exercise use data to a website storage device."

197. This limitation was rendered obvious by Ray. In Figures 1 and 2, Ray illustrated that its electronic device communicated with the Internet and disclosed that its electronic device had "at least periodic access to the Internet or other large area network." (Ray, 12:61-64; Figs. 1 & 2, annotated below.)

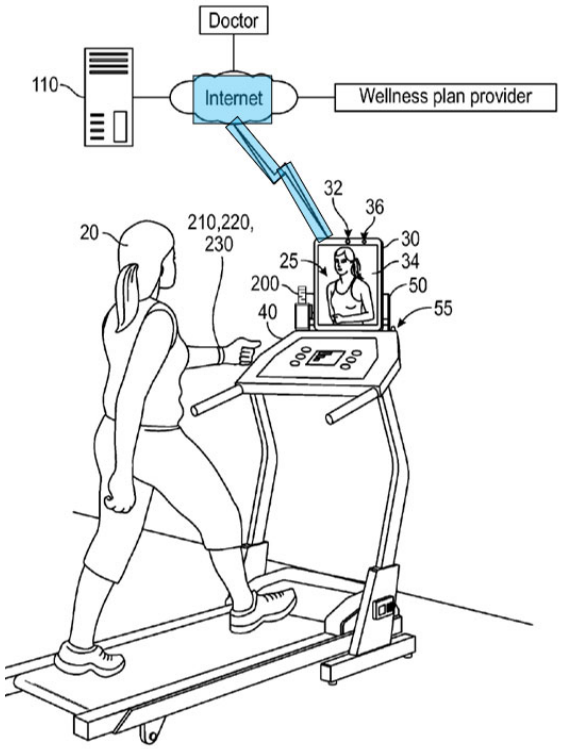


FIG. 2 (Annotated)

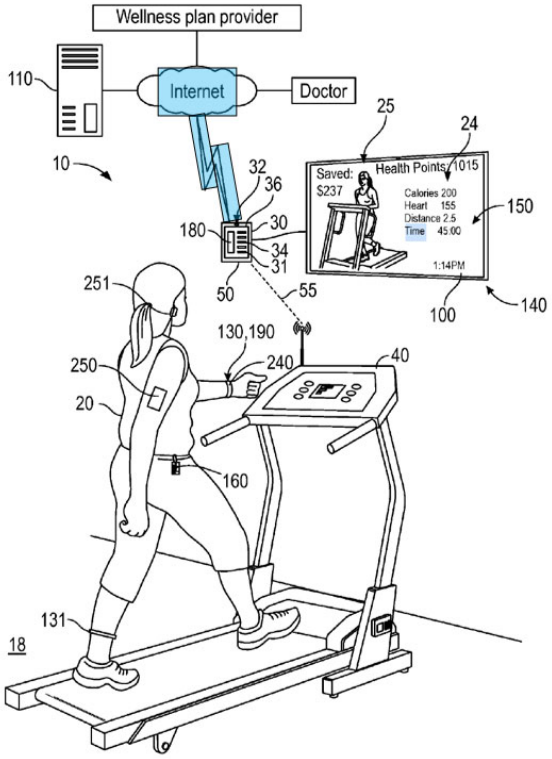


FIG. 1 (Annotated)

198. Additionally, Ray disclosed that its camera could "record a still or video image or produce a ***live feed*** of the patient or exercising user 20 when movement is detected by the camera 32" (Ray, 13:20-24) and provide "the real-time image … [via] a live feed image broadcast ***to a remote location***" (Ray, 13:65-67), such as to

a doctor, wellness manager, or to a cloud-based server etc. (Ray, 5:49-52, 3:47-51; 7:4-10, 8:1-8.) Ray explained that the live feed could be "**through the use of technology similar to Skype**" (Ray, 6:67-7:3), and using the internet. (Ray, 8:1-4.) A POSITA would have found it obvious that in order to produce a live feed via Skype, the device would have an interface that would connect to the Internet.

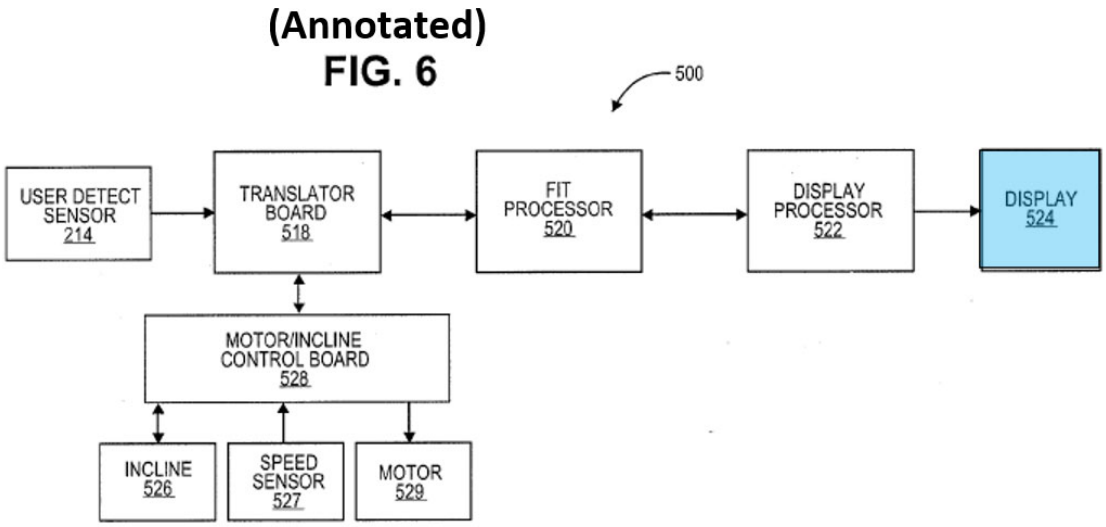
199. Morris described that its treadmill had the capability to "output [data] to a separate computer, or the like" (Morris, [0047], [0050]), and a POSITA at the time of the alleged invention in 2014 would have understood that the communication interface in the Morris-Ray combination could be "easily and affordably" modified to incorporate Internet communication capability that was described in Ray. (Ray, 9:55-57.)

200. *Website storage device*: Ray disclosed that a user's exercise and identity data could easily be stored on a computer or "remote server such as a cloud based server in order to obtain such data at any time or location." (Ray, 7:4-10.) A POSITA would have understood that a remote server or cloud-based server that was accessible via the Internet is a "website storage device," as recited in claim 5.

7. Dependent Claim 6

"The exercise apparatus of claim 1, wherein the communication interface is a display device for directly showing the validated exercise use data to the user."

201. *See* my discussion of limitation 1[f], *supra*. Morris disclosed a display device 524 as the communication interface that received and displayed exercise data, including the user's motivational data in the Morris-Ray combination, as described in connection with limitation 1[e], and Figure 6. Ray also disclosed a display, as shown in Fig 6, below.



8. Dependent Claim 7

"The exercise apparatus of claim 1, wherein the sensor includes a pressure sensor, and wherein the controller is configured to analyze data from the pressure sensor to ascertain whether the user is engaging the operating unit."

202. This claim was obvious based on Morris. Morris described a reluctance sensor that included a magnet and a coil, placed below the treadmill's belt, and which could sense the user's footsteps. More specifically, the output current of the sensor changed as the user shifted his/her weight by running or walking on the belt (Morris,

[0027].) Morris also provided a display of how the user's footfalls changed in a force map of Fig. 11 (Morris, [0055]) shown below.

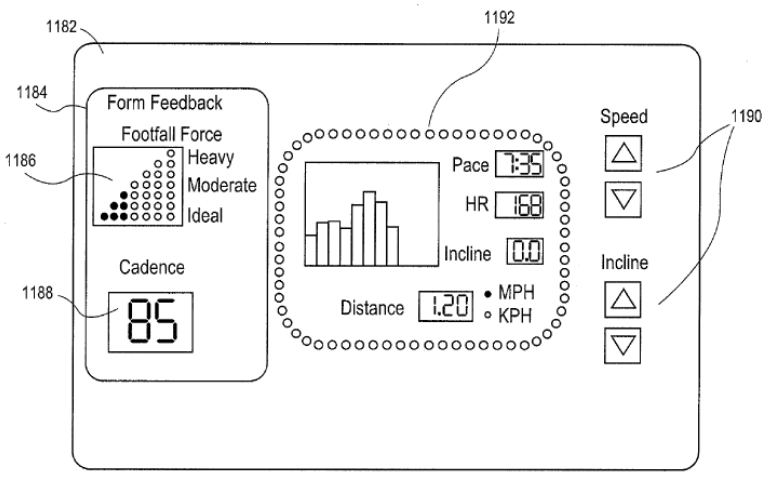
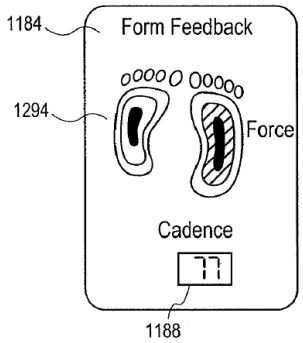


FIG. 11

203. Figure 12B of Morris (below) also showed another diagram of the force exerted by the user's foot and, for example, how it varied between the left and right feet.

FIG. 12B



204. A POSITA would have found it obvious that Morris' reluctance sensor was a force or a pressure sensor that detected the presence of the user by analyzing

the sensor's output signals. Applying general principles of physics, pressure and force are related entities and pressure is defined as force per unit area (P=F/A). The only difference between sensing force and sensing pressure is that one calculation takes into consideration the size of the device doing the sensing the other does not. Therefore, measurement of one entity could have easily produced the other entity, and measurement of force or pressure are simply two ways of describing the same thing.

205. In addition, as I explained in connection with claim 1, above, in the Morris-Ray combination, the user detection mechanism based on the reluctance sensor of Morris would be augmented by Ray's user detection system that used a camera. The two detection techniques complemented each other, while providing their own advantages and unique features. For example, Morris' reluctance sensor produced useful information about the footfall differences and a user's gait (Morris, [0009]), and Ray's video-based detection of the user was able to capture actual images of the user, and then allowed presentation of the user's morphed image that thinned as the user continued to exercise. (Ray, 5:40-46.) For example, the more intensely and the longer the user exercised, the thinner the motivational image would appear. (Ray, 5:40-46.)

206. A POSITA would find it obvious that the two techniques in Morris and Ray, when combined, would improve the detection confidence and provide

additional advantages. First, having two user detection techniques would allow each to provide a backup mechanism for the other. Additionally, Morris' reluctance sensor would have provided more accurate information about the actual force of impact of the user's footfall (Morris, [0051]), i.e., the intensity of exercise, that would be used to change the motivational image more realistically based on the actual intensity of the footfalls measured by the reluctance sensor. (Ray, 5:41-45.)

9. Dependent Claim 8

"The exercise apparatus of claim 7, wherein the operating unit includes an endless belt that defines a user contact surface, and the pressure sensor is configured to detect an amount of pressure on the user contact surface."

207. *See* my discussion of claim limitation 1[b] and claim 7 above, explaining that Morris explained that the operating unit of the treadmill included an endless belt, defining the surface on which the user walked. Figures 3A, 3B and 4 show Morris' reluctance sensor, which was positioned below the deck 206 to sense the user's footfalls. (Morris, [0028]-[0029].) The deck 206 was a stationary component, except in the vertical direction, and the belt was able to move over the deck. As the user walked on the endless belt, his or her feet impacted the belt above the deck 206, causing the deck 206 to move slightly up and down and to induce changes in the output current of the sensor. (Morris, [0027] ("As the deck moves slightly from a user's footfalls or shifts in weight, the magnet's 212 corresponding movements induce a current in the induction coil 214.").

208. Figure 3A is annotated below to show the deck 206, the sensor (magnet 212 and coil 214) and the belt that formed the user contact surface.

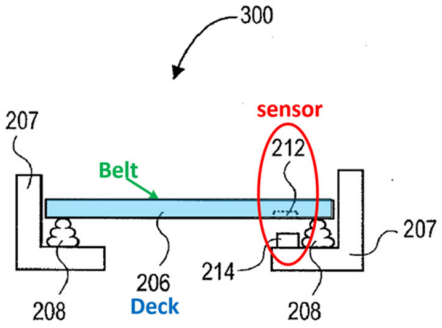


FIG. 3A
(Annotated)

10. Dependent Claim 9

"The exercise apparatus of claim 8, wherein pressure sensor includes a plurality of sub pressure sensors."

209. Morris described using multiple reluctance sensors on the treadmill to, for example, detect differences between the force (or equivalently pressure) exerted by the left and the right footsteps (Morris, [0055]) and/or to indicate if the user is likely bouncing from side to side (or the like). (Morris, [0056].) As I explained above, pressure and force are related entities and pressure is defined as force per unit area ($P=F/in^2$). Therefore, measurement of one entity could have easily produced the other entity.

11. Independent Claim 12

12[pre] "A motorized treadmill comprising:

210. Both Morris and Ray described an exercise machine such as a treadmill. *See* my discussion of claim limitation 1[pre], above).

12[a] "a base;"

211. *See* my discussion of claim limitation 1[a], above.

12[b] "an endless belt movable relative to the base;"

212. *See* my discussion of claim limitation 1[b], above.

12[c] "a motor operably coupled to the endless belt;"

213. *See* my discussion of claim limitation 1[c], above.

12[d] "a sensor configured to detect engagement of the endless belt by a user; and"

214. *See* my discussion of claim limitation 1[d], above.

12[e] "a controller configured to record validated exercise use data in response to the sensor detecting of engagement of the endless belt by the user,"

215. *See* my discussion of claim limitation 1[h], above. Ray rendered this limitation obvious because it described transmitting and storing (recording) the validated exercise use data to a remote location, such as a cloud-based server. (Ray, 7:4-10, 8:1-8, 13:7-30.)

12[f] "the validated exercise data including an amount of user exercise time, the amount of user exercise time being generated by an amount of time that the sensor detects engagement of the endless belt by the user,"

216. *See* my discussion of claim 4, above.

12[g] "wherein the sensor includes a pressure sensor configured to detect an amount of pressure on a portion of the endless belt and generate a pressure data, and the controller is configured to analyze the pressure data to detect engagement of the endless belt by the user."

217. *See* my discussion of claims 7 and 8, above.

12. Independent Claim 14

14[pre] "An exercise apparatus comprising:

218. *See* my discussion of claim limitation 1[pre], above.

14[a] "a base;"

219. *See* my discussion of claim limitation 1[a], above.

14[b] "an operating unit movable relative to the base;"

220. *See* my discussion of claim limitation 1[b], above.

14[c] "a motor coupled to the operating unit;"

221. *See* my discussion of claim limitation 1[c], above.

14[d] "a sensor operable to detect engagement of a user with the operating unit;"

222. *See* my discussion of claim limitation 1[d], above.

14[e] "a controller in communication with the operating unit and the sensor; and"

223. *See* my discussion of claim limitation 1[e], above.

14[f] "a communication interface in communication with the controller,"

224. *See* my discussion of claim limitation 1[f], above.

14[g] "wherein the controller is configured to generate a validated exercise use data in response to the operating unit moving relative to the base and the sensor detecting engagement of the user with the operating unit, and wherein the controller transmits the validated exercise use data to the communication interface."

225. *See* my discussion of claim limitations 1[h] and 1[i], above.

13. Dependent Claim 15

"The exercise apparatus of claim 14, wherein to generate the validated exercise use data the controller records a non-validated exercise use data as validated exercise use data for a portion of time that the operating unit moves relative to the base and the sensor detects engagement of the user with the operating unit."

226. *See* my discussion of claim 2, above.

14. Dependent Claim 16

"The exercise apparatus of claim 14, wherein the validated exercise use data includes a distance traveled by the user while the sensor detects engagement of the user with the operating unit."

227. *See* my discussion of claim 3, above.

15. Dependent Claim 17

"The exercise apparatus of claim 14, wherein the validated exercise use data includes a time spent exercising while the sensor detects engagement of the user with the operating unit."

228. *See* my discussion of claim 4, above.

16. Dependent Claim 18

"The exercise apparatus of claim 14, wherein the communication interface is an internet interface for transmitting the validated exercise use data to a website storage device."

229. *See* my discussion of claim 5, above.

17. Dependent Claim 19

"The exercise apparatus of claim 14, wherein the communication interface is a display device for directly showing the validated exercise use data to the user."

230. *See* my discussion of claim 6, above.

18. Dependent Claim 20

"The exercise apparatus of claim 14, wherein the sensor is one of a current sensor, an optical sensor, a pressure sensor, and a thermal sensor."

231. Ray described using an optical sensor in the form of a camera. *See* my discussion of claim limitation 1[d], above.

B. Ground 2: Claims 10-11, 13, and 20 are Obvious over Morris, Ray, and Cox.

1. Motivation to Combine

232. I have explained a good deal about the motivation to combine Morris and Ray previously. A further combination with Cox would have been obvious because all three references describe features and functionalities of treadmills. Incorporating the features of Cox into the treadmill of Morris-Ray would have amounted to combining known treadmill features and would have improved one of

the previously described goals of both Morris and Ray—user detection—yielding predictable results. The combination would have the added benefit of providing additional data for analysis of the user's performance.

233. Cox discloses a treadmill that included sensors that gathered data related to the user's fitness and therapy, and described processing the detected information to provide feedback on the user's gait, flexibility, mobility, strength, and balance. (Cox, Abstract, 2:65-3:9.) Cox analyzed variations in the current of the treadmill's motor (Cox, 5:33-38) obtained when the user was on the treadmill, provided feedback to the user, and reported the exercise data to insurance companies. (Cox, 2:56-3:9, 3:30-37; Ray, 9:27-47.) Morris and Ray similarly provided feedback to a user to improve their exercise regimen and provided exercise information to third parties such as insurance companies. Therefore, a POSITA would have understood that the Morris-Ray treadmill could be augmented to include the complementary data analysis features of Cox.

234. A POSITA would also find it obvious to add Cox's current sensor into the treadmill. As I have explained in the state of the prior art, Section III.B, many exercise machines and treadmills used multiple and varied sensors to detect whether the user was on the treadmill (*see, e.g.*, Watterson and Rooks). Ray also disclosed the benefits of other sensors, such as a stretch resistance foot band sensor, to gather data, which is then analyzed by electronic device 30 so that feedback can be provided

to a user. (Ray, 10:24-35, 11:21-55, 16:1-43.) Morris' treadmill could also have multiple user detection sensors (Morris, [0009]), including "induction sensors, optical sensors, potentiometers, and the like." (Morris, [0033].) Therefore, a POSITA would have found it obvious and routine to incorporate multiple sensors in the treadmill.

235. Inclusion of Cox's current sensor specifically would have also been obvious and at the same time advantageous. Cox itself explained that its current sensor could be fully integrated into a standard treadmill (Cox, 4:32-39), did not require restrictive or sophisticated instrumentation, and posed no risks to users of a treadmill. (Cox, 1:54-61.) Therefore, a POSITA would have had no difficulty successfully adding Cox's current sensor and analysis associated software to the Morris-Ray treadmill.

236. Cox additionally provided a further benefit by enabling improved gait analysis in the combination. Cox first explained the importance of gait analysis: "[g]ait analysis is essential in physical medicine and is a fundamental tool of the orthopedist, physical therapist, and orthotist/prosthetist. The ability to assess and correct inefficient or dysfunctional gait patterns is fundamental to sound clinical practice." (Cox, 3:9-13.). It then explained that its gait analysis techniques give "clinicians a new analysis tool ***that can be used independently or with other gait analysis techniques*** to increase accuracy and objectivity of gait analysis." (Cox,

3:19-21.) Morris similarly explained that its user detection techniques can be used to evaluate the user's gait, albeit without as much detail and analysis options as Cox did. (Morris, [0009] ("Information that can be derived from the multiple sensors … may be used to determine if a user is favoring one leg or the other, differences in stride or gait, and the like. In turn this information can be evaluated to provide technique suggestions, training tips, and so on.").) Accordingly, a POSITA would have found it obvious that Cox would have provided an improved feature.

237. Additionally, using the current sensor of Cox would have provided an inexpensive and redundant option that allowed detection of the exercising user on the treadmill, which would have augmented Ray's video-based analysis. For example, input from the current sensor would have provided an assessment of how fast or how long the user was exercising on the belt in order to modify Ray's motivational image more accurately. While Morris also described obtaining user's footfall force from its reluctance sensors, it required multiple sensors positioned on multiple locations. Therefore, Cox's single current sensor that measured the treadmill motor's current variations would have provided a cheaper option that did not rely on proper positioning of the reluctance sensors beneath the belt.

238. It is my opinion that the use of a current sensor for detecting the user's presence on the treadmill was well-known and obvious to a POSITA (see, for example, Ashby, described earlier in my Declaration). Morris also mentioned the

use of current sensors in treadmills, but explained that some prior systems that evaluated "changes in load of the electric motor driving the belt of a treadmill," could not detect a "load change" as the incline of the treadmill increased (Morris, [0005]). Morris did not specify the particular prior system and did not provide further details as to what type of "load" was being considered, or the specifics of the load analysis carried out in the prior systems. It is my opinion that this cursory and conclusory statement would not have dissuaded a POSITA from trying the combination of Cox with Morris and Ray. More specifically, Cox explained very clearly that "walking on the treadmill produced ***very little impact on the magnitude of the voltage signals, but produced dramatic variations in the magnitude of the electric current***." (Cox, 5:33-37.) This suggests that the prior system that was mentioned in Morris was perhaps approaching the task in a less effective way than that described by Cox.

239. Additionally, Cox explicitly described testing ***current*** signals for inclination angles of 5 and 10 degrees, (Cox, Table 1), and explained that its ESA tool performed comprehensive time and frequency analysis to match even small perturbations to their source. (Cox, 3:51-56.) Therefore, a POSITA would have understood that the detailed testing and evaluation of Cox that relied on sensing "current" variations done via its ESA tool sufficiently corroborated the viability and success of using a current sensor for detecting the user on a treadmill.

240. Furthermore, in the Morris-Ray-Cox combination, user detection could be done collaboratively using the three techniques of Ray, Morris and Cox, which would have alleviated any concerns about not being able to detect the user when the treadmill was inclined.

241. In the combination, the current sensor of Cox would be positioned between the power source to the motor and the treadmill motor to sense the current (*Id.*, Fig. 1), and the analysis software would be incorporated into the processors and electronic boards of Morris. (*See also* Section VI.A.2. for additional explanations of how Morris' signal processing system would accommodate additional software functionality.)

2. Dependent Claim 10

"The exercise apparatus of claim 1, wherein the sensor includes a current sensor operably connected to the motor, the current sensor is configured to detect an input current into the motor during operation of the operating unit, and wherein the controller is operable to analyze the input current to detect engagement of the user with the operating unit."

242. Figure 1 of Cox (annotated below), similar to Figure 3 of the '227 patent (also annotated below), illustrated that its current sensor was positioned between the electric motor and the electrical power source to sense the electrical current utilized by the motor of treadmill 30. (Cox, 2:16-17, 3:49-56, Figure 1.)

Accordingly, Cox's current sensor was positioned to measure the input current to the electric motor.

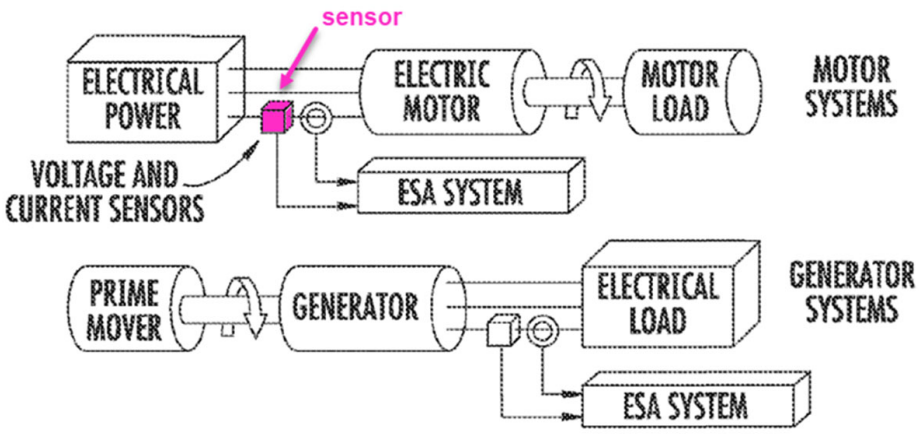
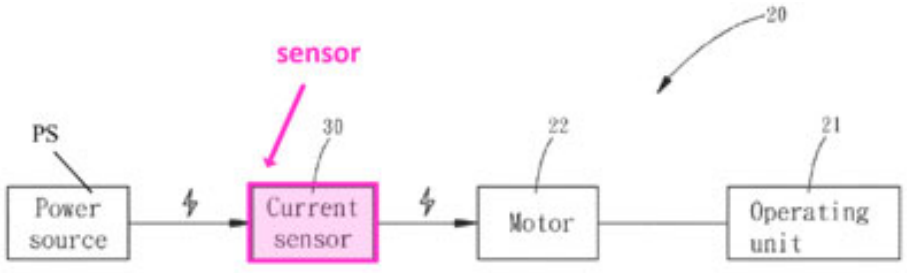


FIG. 1
(Annotated)



'227 Patent - Fig. 3 (Annotated)

243. While Cox clearly stated that its sensing and analysis devices could be fully integrated into the treadmill (Cox, 4:32-39), it used the test set up of Figure 5 (below) to illustrate the concepts of its invention. (Cox, 2:26, 4:40-43.)

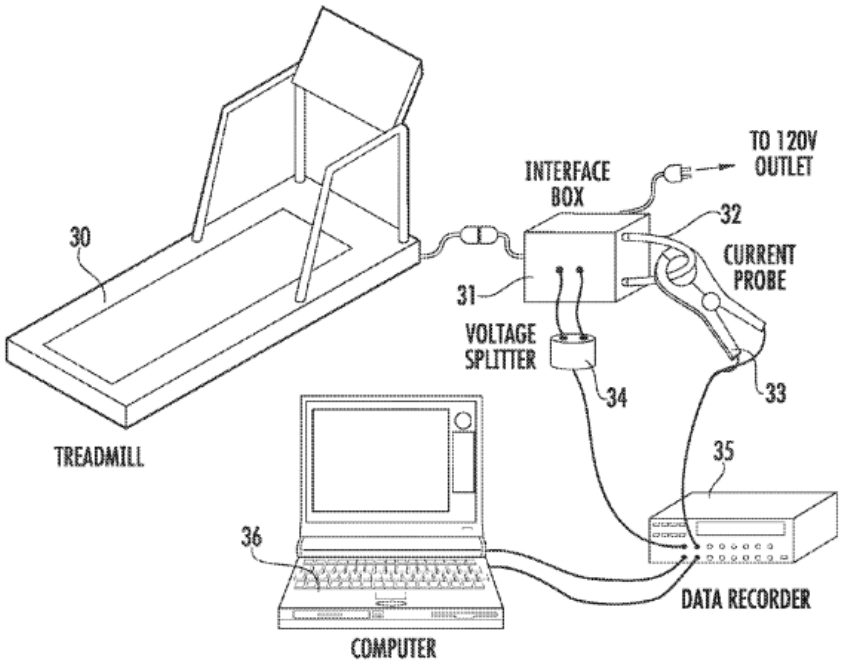
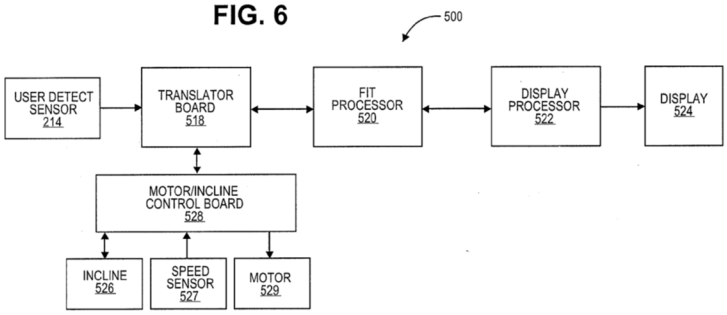


FIG. 5

244. In Figure 5, data recorder 35 and/or computer 36 were connected to interface box 31 (with a current sensor), which allowed the computer to receive and analyze data signals associated with the current sensor. (Cox, 4:40-50.) Through this configuration, Cox taught that the current sensor can indicate the physical condition and abilities of the user, including whether the user was walking on treadmill 30. (Cox, 1:45-52, 2:1-8, 4:14-26, 4:40-54.) Cox, therefore, taught a current sensor operably connected to the electric motor of treadmill 30, where it was configured to detect input current into the motor and where computer 36 was operable to analyze input current to detect engagement of a user.



245. As discussed above, a POSITA would have been motivated to include a current sensor in the Morris-Ray treadmill and would have used Morris' processors and circuit boards (controller) to receive and analyze the current signals, and to provide back-up on additional methods for accurately detecting a user.

3. Dependent Claim 11

"The exercise apparatus of claim 10, wherein the controller is configured to analyze a fluctuation in the input current."

246. While the '227 patent teaches that detecting electrical current is well-known (Ex. 1001, 3:45-50), Cox disclosed a current sensor connected to treadmill 30's electric motor and configured to detect engagement of the user. (*See* my discussion of claim 8, above.) Cox further explained that its "ESA analyze[d] these ***small perturbations [in current and voltage]*** and matche[d] them to their source." (Cox, 3:51-53.)

247. Cox also noted that walking on the treadmill produced very little impact on the magnitude of the voltage signals, but ***produced dramatic variations in the magnitude of the electric current. For this reason, all additional analysis efforts***

focused on the current signals." (Cox, 5:33-38.) To detect user engagement, Cox's software identified "methods to … ***extract useful details (signatures) from the electric current data***." (Cox, 5:41-44.) For example, raw electrical current data could be rectified and analyzed to build a stride profile to calculate exercise metrics, such as stride frequency, as shown in the bottom panel of Figure 8 (below). (Cox, 5:56-67.)

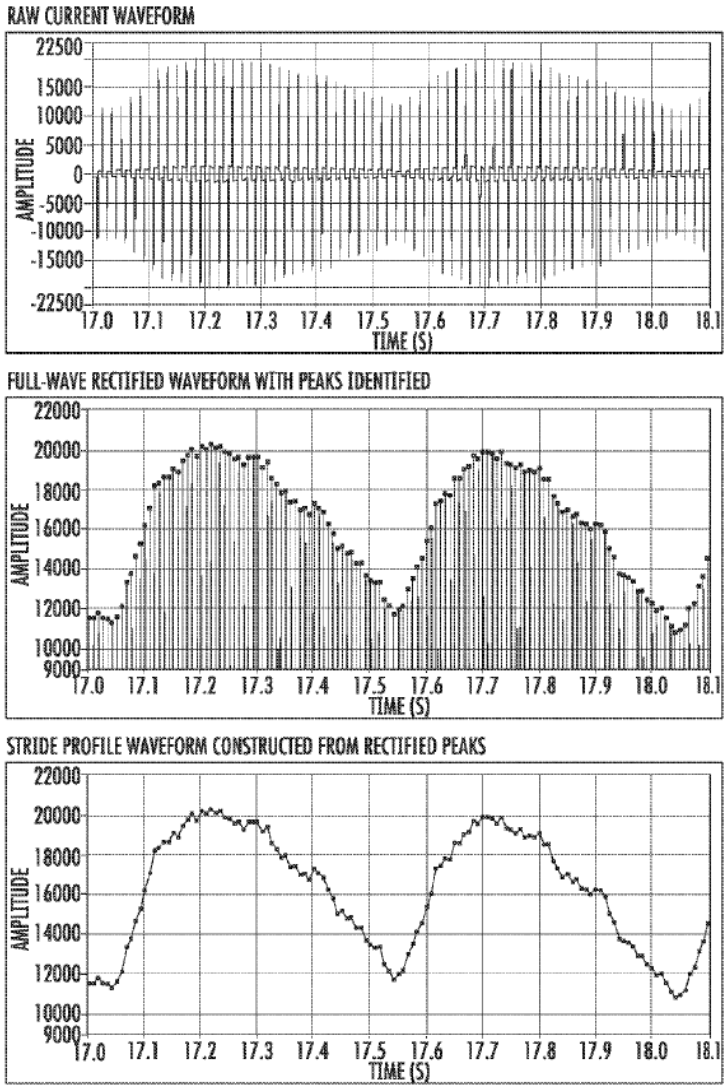


FIG. 8

248. A POSITA, considering the disclosure of Cox, would understand that Cox's fluctuations in the sensed current data indicated whether a user is engaged with treadmill 30, such as whether the user was walking or running, or was walking with an impaired leg, based on variations in the sensed electrical current. (Cox, 2:1-8, 5:39-45, Table 2.)

4. Dependent Claim 13

"The motorized treadmill of claim 12, wherein the sensor includes a current sensor operably connected to the motor, the current sensor is configured to detect an input current of the motor during operation of the endless belt, and the controller is configured to detect engagement of the endless belt by the user in response to a fluctuation in the input current."

249. *See* my discussion of claim 10, above.

5. Dependent Claim 20

"The exercise apparatus of claim 14, wherein the sensor is one of a current sensor, an optical sensor, a pressure sensor, and a thermal sensor."

250. This limitation is rendered obvious by Morris, Cox and Ray. Morris taught or suggested a pressure sensor (as I explained above in connection with claim 12) and an optical sensor. (Morris, [0033].) Cox described a current sensor (*see* my discussion of claim 10, above), and Ray disclosed using various types of sensors to determine a user's engagement with the operating member, such as a camera (*see* my discussion of claim limitation 1[d], above), a temperature sensor and a blood

pressure sensor. (Ray, 16:1-10.) Using multiple sensors that interfaced with a treadmill to detect various parameters of the exercising user was well-known and obvious to a POSITA. (*See also* my discussion of the "Motivation to Combine" in Section VI.B, above.)

C. Ground 3: Claims 1-6 and 14-20 are Obvious over Ray in View of AAPA.

251. As discussed above, Ray disclosed a treadmill that validated exercise data when a user was exercising on a treadmill and reported that exercise data to the user or to a third party. When explaining its invention, Ray did not explicitly call out the known components of a treadmill such as a base, motor, belt, and a controller. These components were essential parts of a motor-driven treadmill and were known to a POSITA and essentially any person who had used or seen a treadmill. Nonetheless, Ray's Figures 1-3 clearly depicted a treadmill, showing at least some of those components.

252. The '227 patent itself explains and admits that these basic components and features of a treadmill were known when it described the prior art in its Background section. For example, it cites to U.S. Patent No. 6,638,198 (Ex. 1008) as prior art disclosing "***a conventional exercise apparatus*** that can provide exercise use data." (Ex. 1001, 1:36-37; Ex. 1008, 7:7-14). The '227 patent further

acknowledges that conventional exercise equipment included an operating member and a controller that collected exercise use data and reported it to the user:

> The conventional exercise apparatus comprises ***an operating member and a controller*** associated with the operating member. When the user drives the operating member to operate the exercise apparatus, the ***controller associated with the operating member creates exercise use data***. Thereafter, the controller ***records the exercise use data and reports the exercise use data*** to the user.

(Ex. 1001, 1:40-47; Ex. 1008, 4:57-64, 6:31-62.)

253. The ’227 patent further explains: “[c]urrently, if the controller is set to record exercise use data on an exercise apparatus ***with motor-driven operating member, such as a treadmill operating member (a motor driven running belt)*** … it would be easy to falsify exercise use data on the exercise apparatus.” (Ex. 1001, 1:58-63; *see also id*., 2:6-14.)

254. In addition, during the prosecution of the related ’375 patent, the claims of that patent application were rejected based on the Yi reference in an Office Action dated January 10, 2020. In response, Applicant made the following statement, admitting that Yi prior art teaches “that distance, time and speed may be displayed on a display unit 42 while a user is on the belt 44 and exercising.” (Ex. 1009, 39.) This corroborates what a POSITA and Applicant already knew, i.e., treadmills by 2014 could generate and display exercise data while the user was exercising.

255. Applicant Admitted Prior Art (AAPA), the general knowledge of a POSITA, and common sense supply the missing treadmill components in Ray. The following components constitute AAPA and would have been known and obvious to a POSITA: (1) motors and motor driven belts on treadmills, (2) controllers that generate exercise data such as time and distance, and (3) reporting exercise data while the user was exercising.

256. Ray described embodiments where its "validation" and "motivation" software (instructions and code) and a camera were implemented on a portable device (e.g., a tablet) that directly communicated with the treadmill's controller to receive exercise data and other information. (Ray, 12:59-67, 13:20-36, 14:31-40, Fig. 1-3.) Ray further explained that its invention can be "easily and affordably" merged into the treadmill itself. (Ray, 9:55-57.)

1. Independent Claim 1

1[pre] "An exercise apparatus comprising:"

1[a] "a base;"

1[b] "an operating unit movable relative to the base;"

1[c] "a motor coupled to the operating unit;"

257. As explained above, these limitations were known to a POSITA per AAPA. Ray's Figures 1-3 showed a treadmill with its basic features, and Ray described its invention implemented "with a treadmill" (an exercise apparatus).

(Ray, 5:23-26.) Ray's Figures 1-3 clearly depicted user 20 exercising on exercise machine 40—a treadmill. (Ray, 5:23-29; Figs. 1-3.) Treadmills had a belt (operating unit) so the user could walk or run on it, as shown in Ray's annotated Figure 1 (below). The belt in a treadmill moved with respect to a stationary base as also illustrated below.

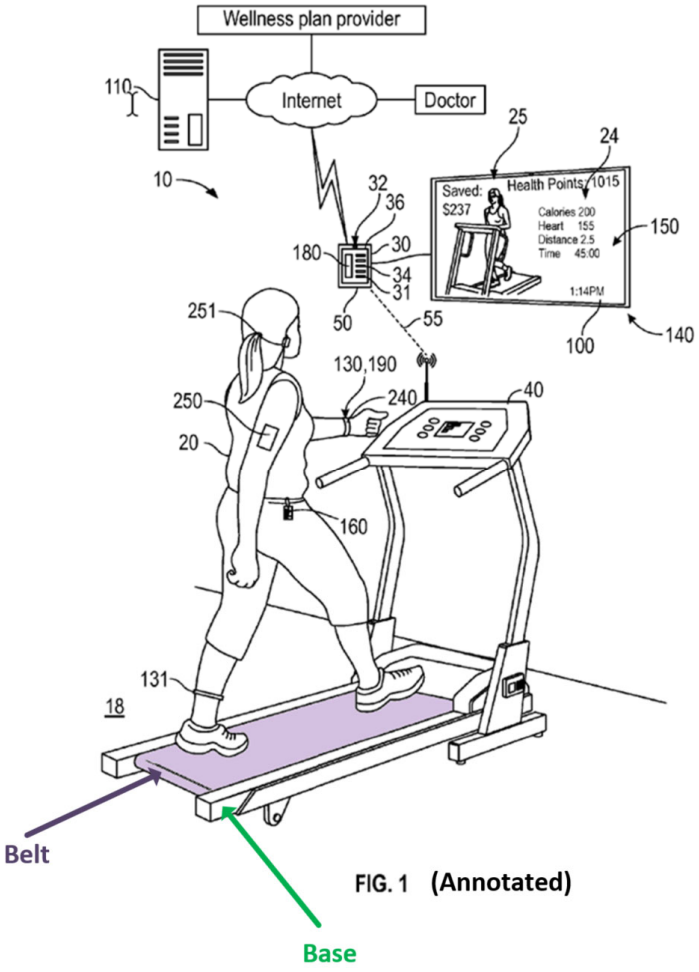


FIG. 1 (Annotated)

258. Ray's Background section discusses a "motor-driven … exercise apparatus"—including treadmills having controllers. (Ex. 1001, 1:38-2:23.)

1[d] "a sensor operable to detect engagement of a user with the operating unit;"

259. *See* Section VI.A.1, limitation 1[d], *supra*. Ray disclosed a camera (sensor) that "record[ed] [] still or video image[s] or produce[d] a live feed of the . . . exercising user 20 ***when movement is detected by the camera***." (Ray, 13:20-24.) A POSITA would have understood that Ray's camera is an optical sensor. (Ex. 1001, 5:38-46; 7:7-11.)

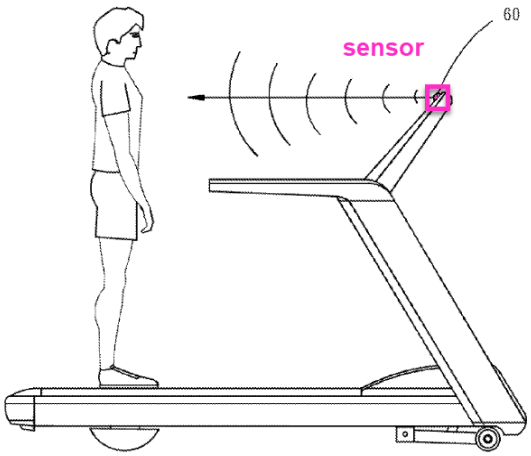
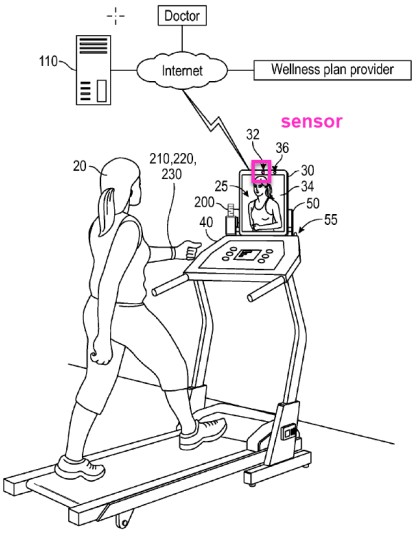
260. Ray further explained:

> [A]s long as the exercise data 24 is being produced by the exercise machine 40, the camera 32 can be instructed to capture the user's image every 10 minutes. Therefore, ***as long as the user 20 continues exercising, the camera 32 will continue to capture the user's image***.

(Ray, 14:34-40, 10:59-64, 14:6-11; *see also id.*, claim 1 reciting "a camera structured to capture live video image of a user while the user is exercising".) Ray's camera also detected when a user was present (or not present) on the moving belt and disclosed that "as long as the treadmill is moving the camera will operate to take their real time image while exercising . . . [i]f the user stops exercising, the camera will no longer record images." (Ray, 6:53-55.) Ray described that the camera determined a user's presence when "movement . . . (such as the user's shoulders moving up and down)" was detected, thus making clear that Ray's camera is operable to detect engagement of a user with the operating unit. (Ray, 14:6-14.)

Ray's camera could also sense small changes in the user's facial color based on blood flow obtain heart and respiratory rates of the user. (Ray, 16:47-50.)

261. Figure 2 of Ray (annotated below) illustrated the camera as part of a tablet, which could be connected to the exercise machine "directly by USB port or another form of hardwire" (Ray, 10:39-42), allowing "[t]he exercise data from the user's workout routine on the exercise machine such as speed, duration and calories burned [to be] automatically entered into the computer device from the exercise machine." (Ray, 10:47-50.) Therefore, the tablet was effectively integrated into the treadmill. Also, as noted above, Ray explained that its invention could be "easily and affordably merged" into the exercise machine (Ray's "integrated embodiment"), which would have guided a POSITA to understand that all of the described functionalities of the electronic device could be incorporated as part of the treadmill.

'227 Patent - Figure 4 (annotated)	Ray - Figure 2 (annotated)
	 FIG. 2

1[e] "a controller in communication with the operating unit and the sensor; and"

262. *See* Section VI.C, *supra*, explaining how the '227 patent admitted, and why a POSITA would have understood that a motorized treadmill, like the one in Ray, included a controller that communicated with the drive motor in order to run the belt, and that a conventional treadmill generated and reported exercise data.

263. It was known to a POSITA and admitted by the applicant that treadmills had a controller, as I explained above. Ray's treadmill had a controller to drive its motor and to generate the exercise data and images. As I explained earlier, by the 2014 timeframe, a POSITA would have known that treadmills included processors or controllers, and these could be multiple processors, each dedicated to performing a particular set of tasks, or a combined controller.

264. The controller was in communication with the belt (operating unit) per AAPA, and with the camera (sensor) to capture images of the user exercising (Ray, 4:66-5:3, 11:1-7; 14:6-14) and "computer-implemented instructions resident on the non-volatile storage medium …cause[d] the camera 32 to record a still or video image or to produce a live feed of the patient or exercising user." (Ray, 13:20-24.)

1[f] "a communication interface in communication with the controller,"

265. Ray disclosed the claimed communication interface because it included (1) a display that showed motivational image on its screen/display (Ray, Figs. 1-3,

12:59-67, 13:50-55), where the display could be integrated into the treadmill (Ray, 9:55-57), (2) a communication interface that allowed the user's motivational image and other exercise data and to be transmitted over the Internet, such as to transmit user's motivational image and exercise data as a live feed to a remote location (Ray, 3:46-51, 6:67-7:10, 8:1-10, 13:65-67) and/or (3) a communication interface that allowed exercise data to be sent to a storage device such as cloud-based server. (Ray, 3:46-51, 5:65-6:5, 7:4-10.) In Figure 3 (annotated below), Ray further illustrated a specific embodiment, in which the treadmill had an "interface 55" for transmitting exercise data to another device. (Ray, 13:31-36.)

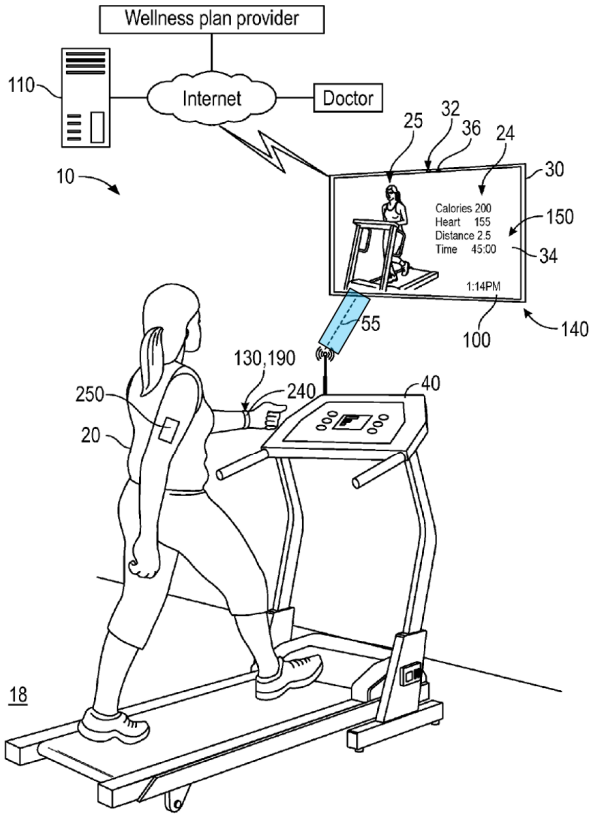


FIG. 3
(Annotated)

1[g] "wherein the controller is configured to generate a non-validated exercise use data in response to movement of the operating unit relative to the base and the sensor does not detect engagement of the user with the operating unit,"

266. As I explained above, it was well-known to a POSITA, and the applicant admitted, that the treadmill's controller generated exercise use data when the treadmill was running, and could continue generating certain types of data even if the user was not on the treadmill. A POSITA would have found it obvious that Ray's treadmill—which was a conventional treadmill with the added "motivational" image feature—would generate data that related to the treadmill functions, such as elapsed time, when the treadmill was turned on initially, or left unattended after the user finished exercising. This type of data (non-validated exercise use data), however, would not be reported out in Ray's invention because it was generated without a user being detected, and would also not be subject to user identity verification of Ray.

267. In my opinion, a POSITA would have also found this obvious for the simple reason that there were only two options when the treadmill was running unattended: continue generating data that did not require the user's presence such as time, or stop generating that information. Selecting one alternative over the other would not have been inventive, and would have been obvious. For example, one reason for continuing to generate the information would have been to alert the user

that the treadmill is still running to allow the user to slow down the belt, or use caution when getting back on the treadmill, to continue his/her exercise.

1[h] "wherein the controller is further configured to generate a validated exercise use data in response to movement of the operating unit relative to the base and the sensor does detect engagement of the user with the operating unit, and"

268. As explained in Section VI.A.2, limitation 1[h], Ray's controller was configured to create exercise use data when the treadmill's belt was moving; the exercise use data included information such as calories, heart rate, distance and time (**blue highlights** in annotated Figure 1), as well as user's image on the treadmill that changed in real time based on the intensity/speed of user's exercise (**green highlights** in annotated Figure 1.) Therefore, Ray described generating exercise use data, including distance, time, and a user's virtual image, any one or any combination of which can be construed as the claimed exercise data.

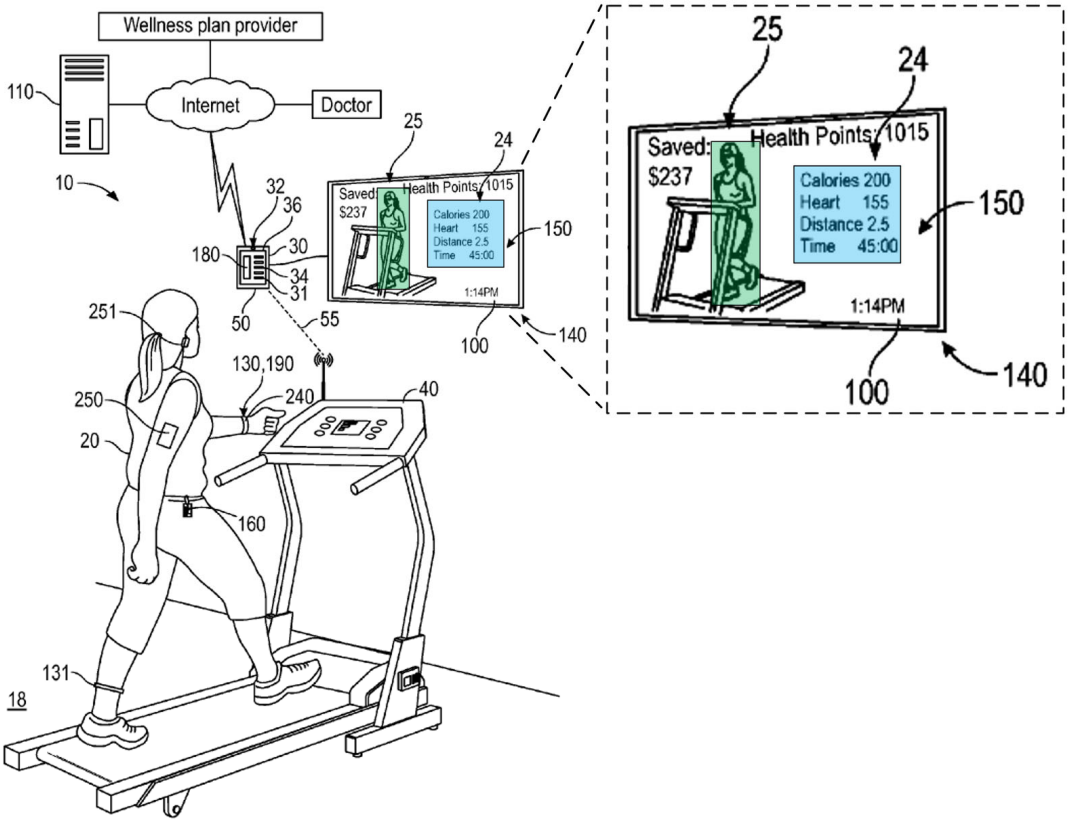


FIG. 1 (Annotated and Display Area Enlarged)

269. Ray described that the user's thinner/healthier-looking image was generated in ***real time*** by a computer system, was produced ***via the treadmill interfacing with the computer system*** and was displayed on the screen ***as the user was exercising***. (Ray, 4:67-5:14, 5:23-29, 10:59-67.) For example, Ray explained that the movement of the treadmill could trigger the camera's operation: "the exercise machine 40 indicates movement thereof at the interface 55 with the electronic device 30, resulting the set of instructions causing the camera 32 to periodically take a photo" (Ray, 14:7-11), and the movement of the exercising user could be detected by the up-and-down movements of the user's shoulders. (Ray,

14:7-14.) Therefore, it would have been obvious to a POSITA that the user's image on a treadmill, which changed in real time based on the intensity/speed of user's exercise, would be generated when the treadmill's belt (operating unit) was moving, and when the user was detected exercising on the treadmill.

270. In addition, it would have been obvious to a POSITA that Ray's other types of exercise information such as time and distance were also generated while the exercising user was being detected on the moving belt (operating unit). (*See, e.g.,* Ray, 13:24-30 ("***the time 140 and duration of the exercise performed by the user 20***"); *see also id*., 5:46-48 ("In addition to seeing her image, she can also view on the display ***her exercise data such as heart rate, calories burned and distance advanced***.").)

271. The camera, according to Ray, detected a user on the moving belt (operating unit*)* when, for example, it sensed a user's shoulders moving up and down (Ray, 14:6-14), and/or by taking real-time images of the user "***as long as the treadmill [wa]s moving***." (Ray, 6:53-55; 14:35-40.) Ray further explained ***"[i]f the user stop[ped] exercising, the camera w[ould] no longer record images***." (Ray, 6:55-57.)

272. It would have been clear to a POSITA that Ray's camera was taking pictures and determining whether the user was exercising and present as long as

treadmill's belt was moving (in response to the movement of the belt). Accordingly, Ray's exercise use data was validated exercise use data.

273. Ray also explained that the exercise data associated with the exercising user was sent out via a live feed to, for example, a doctor (Ray, 5:49-51, 7:4-10, Figs. 1-3) or stored in a remote server (Ray, 3:47-51, 7:4-10, 8:1-8, Figs. 1-3), and that "[u]sing the ***validation process*** of the invention, the patient's identity ***and exercise routine [were] confirmed*** simultaneously." (Ray, 8:26-28; *see also*, *id*., 13:24:30.) Therefore, Ray also described additional levels of validation of the exercise use data based on transmission of exercise data to remote locations/parties and based on validation of the identity of the user that occurred simultaneously.

1[i] "wherein the controller transmits the validated exercise use data to the communication interface."

274. *See* my discussion of limitation 1[i], above, explaining how Ray taught or suggested this limitation.

2. Dependent Claim 2

"The exercise apparatus of claim 1, wherein to generate the validated exercise use data the controller records the non-validated exercise use data as validated exercise use data for a portion of time that the operating unit moves relative to the base and the sensor does detect engagement of the user with the operating unit."

275. As I explained in limitation 1[g], it was obvious to generate treadmill data, such as the elapsed time, when the user was not being detected, such as when

the user was taking a break. In this scenario, the generated information (e.g., time), or the information captured by the camera (e.g., pictures showing a stationary user or a user's heartrate) while user is not moving (Ray, 15:47-51) would not be reported and would not be validated exercise data.

276. Ray's camera was triggered based on the movement of the exercise machine (Ray, 14:6-11), and continued recording, generating and transmitting the motivational image as long as the user was detected exercising on the treadmill. (Ray, 14:11-14, 14:35-40.) A POSITA would have found it obvious that, when the image(s) were captured, analyzed and indicated that a user was present and exercising, the user's virtual images and associated exercise data would be recorded (e.g., at the cloud-based server or sent in real time to the doctor (Ray, 7:4-10, 8:1-8), and would thus be validated exercise use data.

3. Dependent Claim 3

"The exercise apparatus of claim 1, wherein the validated exercise use data includes a distance traveled by the user while the sensor detects engagement of the user with the operating unit."

277. *See* my discussion in Section VI.A.4, above.

4. Dependent Claim 4

"The exercise apparatus of claim 1, wherein the validated exercise use data includes a time spent exercising while the sensor detects engagement of the user with the operating unit."

278. *See* my discussion in Section VI.A.5, above.

5. Dependent Claim 5

"The exercise apparatus of claim 1, wherein the communication interface is an internet interface for transmitting the validated exercise use data to a website storage device."

279. *See* my discussion in Section VI.A.6, above.

6. Dependent Claim 6

"The exercise apparatus of claim 1, wherein the communication interface is a display device for directly showing the validated exercise use data to the user."

280. Ray described that the user's thinner/healthier-looking image was generated in ***real time*** by a computer system, was produced ***via the treadmill interfacing with the computer system*** and was ***displayed on the screen as the user was exercising***. (Ray, 4:67-5:14, 5:23-29, 10:59-67; Fig. 1.)

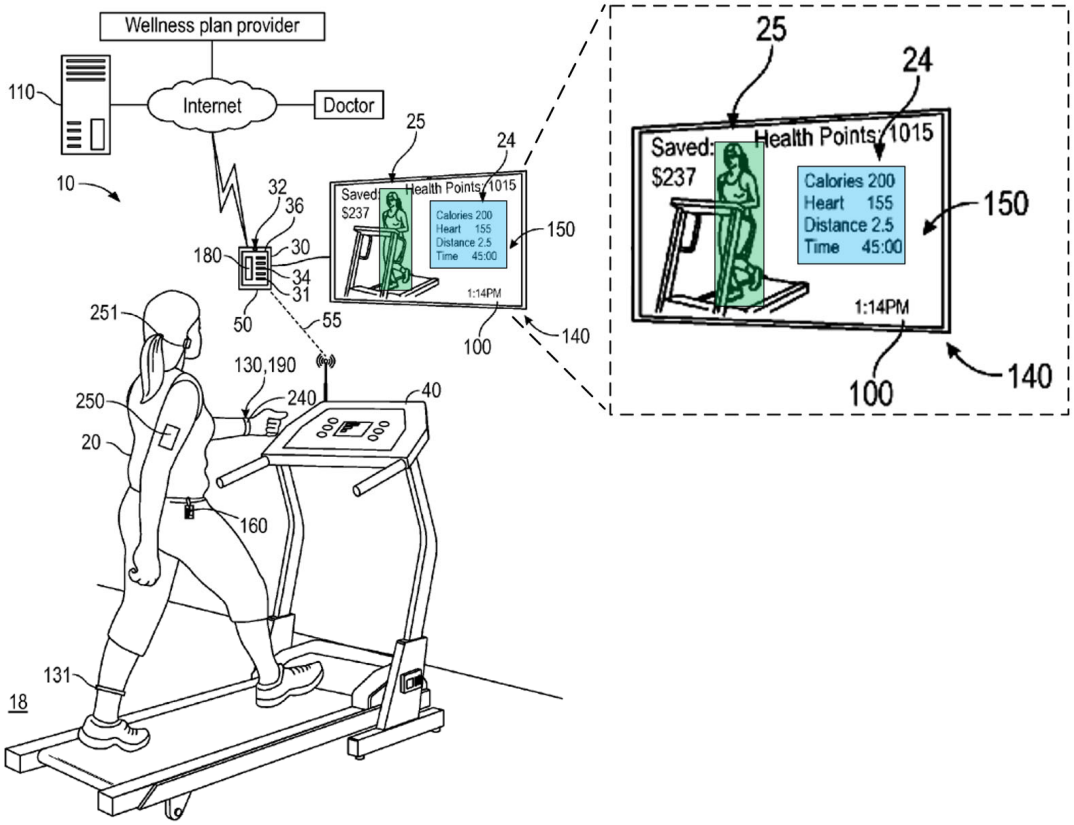


FIG. 1 (Annotated and Display Area Enlarged)

7. Independent Claim 14

14[pre] "An exercise apparatus comprising:

14[a] "a base;"

14[b] "an operating unit movable relative to the base;"

14[c] "a motor coupled to the operating unit;"

14[d] "a sensor operable to detect engagement of a user with the operating unit;"

281. Ray in view of AAPA taught or suggested these limitations. *See* my discussion of claim limitations 1[pre]-1[d], above.

14[e] "a controller in communication with the operating unit and the sensor; and"

282. *See* my discussion of claim limitation 1[e], above. A POSITA would have understood that a motorized treadmill, like the one in Ray, included a controller that communicated with the drive motor in order to run the belt, and that a conventional treadmill generated and reported exercise data.

14[f] "a communication interface in communication with the controller,"

283. *See* my discussion of claim limitation 1[f], above.

14[g] "wherein the controller is configured to generate a validated exercise use data in response to the operating unit moving relative to the base and the sensor detecting engagement of the user with the operating unit, and wherein the controller transmits the validated exercise use data to the communication interface."

284. *See* my discussion of claim limitations 1[h] and 1[i], above.

8. Dependent Claim 15

"The exercise apparatus of claim 14, wherein to generate the validated exercise use data the controller records a non-validated exercise use data as validated exercise use data for a portion of time that the operating unit moves relative to the base and the sensor detects engagement of the user with the operating unit."

285. *See* my discussion of claim 2, above.

9. Dependent Claim 16

"The exercise apparatus of claim 14, wherein the validated exercise use data includes a distance traveled by the user

while the sensor detects engagement of the user with the operating unit."

286. *See* my discussion of claim 3, above.

10. Dependent Claim 17

"The exercise apparatus of claim 14, wherein the validated exercise use data includes a time spent exercising while the sensor detects engagement of the user with the operating unit."

287. *See* my discussion of claim 4, above.

11. Dependent Claim 18

"The exercise apparatus of claim 14, wherein the communication interface is an internet interface for transmitting the validated exercise use data to a website storage device."

288. *See* my discussion of claim 5, above.

12. Dependent Claim 19

"The exercise apparatus of claim 14, wherein the communication interface is a display device for directly showing the validated exercise use data to the user."

289. *See* my discussion of claim 6, above.

13. Dependent Claim 20

"The exercise apparatus of claim 14, wherein the sensor is one of a current sensor, an optical sensor, a pressure sensor, and a thermal sensor."

290. *See* my discussion of claim 20 in Section VI.A.18, above.

D. Ground 4: Claims 10-11 and 20 are Obvious over Ray in View of AAPA and Cox.

1. Motivation to Combine

291. *See* my discussion in Section VI.B, above. Ray and Cox both described detecting a user on a treadmill; Ray used a camera, while Cox analyzed variations in the electric current drawn by the tread motor (Cox, 5:33-38). Cox, like Ray, reported data to insurance companies. (Cox, 2:56-3:9, 3:30-37; Ray, 9:27-47.) Therefore, a POSITA would have been motivated by the shared goals and similar functionalities of the two references, and would have found it obvious to combine them.

292. Additionally, Cox's current sensor would have provided redundancy and accuracy of user detection, similar to what I explained earlier regarding combining Cox with Ray and Morris. The use of Cox's current sensor in Ray's treadmill would have also provided certain benefits and advantages. Specifically, using the sensed variations in the electric current could have provided a more accurate measure of how intensely the user was exercising, and would have been provided feedback to more accurately change the user's motivational image. Using Cox's additional features would have also provided information that can help correct and improve a user's exercise form.

293. Ray disclosed the benefits of having additional sensors, such as a stretch resistance foot band sensor, that could be incorporated into Ray's system.

(Ray, 10:24-35, 11:21-55, 16:1-43.) As I also explained earlier, including multiple sensors in treadmills was already well known. Therefore, a POSITA would have been able to successfully modify Ray's treadmill to include Cox's current sensor, as confirmed by Cox itself which stated that its current sensor could be integrated into the treadmill. (Cox, 1:54-61, 4:32-39.)

294. In addition, Cox described gait analysis techniques that gave "clinicians a new analysis tool ***that can be used independently or with other gait analysis techniques*** to increase accuracy and objectivity of gait analysis." (Cox, 3:19-21.) Cox explained, "[g]ait analysis is essential in physical medicine and is a fundamental tool of the orthopedist, physical therapist, and orthotist/prosthetist. The ability to assess and correct inefficient or dysfunctional gait patterns is fundamental to sound clinical practice." (Cox, 3:9-13.) Therefore, the addition of Cox's sensor, which enabled gait analysis of the user, would have enhanced the treadmill's compatibilities, thus providing an additional motivation to combine.

295. In the combination, the current sensor of Cox would be positioned between the power source and the treadmill motor to sense the current (Cox, Fig. 1), and the analysis software would be incorporated into the controller(s) of Ray. (*See* Section VI.C.1, limitation 1[d]'s explanation of Ray's controller in its integrated embodiment.)

2. Dependent Claims 10-11

296. These claims are rendered obvious based on the same rationale discussed in Sections VI.B.2-4, when the current sensor of Cox is implemented into Ray's treadmill.

3. Dependent Claim 20

297. Cox described a current sensor (*see* my discussion of claim 20 in Section VI.A.18, above), and Ray disclosed using various types of sensors to determine a user's engagement with the operating member, such as camera (*see* my discussion of limitation 1[d], above), a temperature sensor and a blood pressure sensor. (Ray, 16:1-10.) Using multiple sensors that interfaced with a treadmill to detect various parameters of the exercising user was well-known and obvious to a POSITA.

E. Ground 5: Claims 7-9 and 12 are Obvious over Ray and Daly.

1. Motivation to Combine

298. In Section VI.D, above, I explained why and how a POSITA would add the current sensor that is described in Cox to Ray's treadmill, namely to provide a backup detection mechanism and to improve Ray's detection and virtual image presentation.

299. Similar incentives as above motivate a POSITA to include Daly's pressure sensor into Ray's treadmill. Daly describes a user detection technique that

is based on analyzing the signals that are produced by it pressure sensors, and similar to Ray, it detected whether the user was on the treadmill and provided feedback and exercise data such as the user's cadence, number of steps, stride, heartrate, etc. (Daly, 4:11-32, 5:61-67.) (Ray, 4:65-5:7, 5:40-55, 7:39-54, 13:20-30, 13:50-67; Daly, 2:65-3:12, 3:40-51, 4:11-32, 7:39-54.) More specifically, Daly described an array of piezoelectric sensors positioned under the treadmill's deck as an illustrative example, but also stated that the sensors could be pressure sensors. (Daly, 6:37-54) The sensors detected deformations of the deck due to user's feet impacting the deck. Daly explained a control system analyzed the signals from the sensors and calculated exercise metrics for the user, and also determined whether or not a user was engaged with the treadmill; if the user was not detected, the treadmill could enter a standby mode. (Daly, 6:32-54, 7:39-54.)

300. Daly also disclosed that feedback can be provided via display showing an image of a person, such that a user is motivated to continue exercising and improve their exercise form. (Daly, 3:41-44, 3:64-4:10, 18:46-56.) Ray and Daly, therefore, are directed to the same goal of providing feedback to a user concerning their exercise metrics and providing motivation to a user.

301. At least because of the common objectives and related features, a POSITA would have found it obvious to combine the teaching of Daly with Ray. In implementing this combination, a POSITA would have added Daly's

piezoelectric/pressure sensors and associated analysis software to Ray's treadmill. This task would have been obvious and straight forward; as I explained earlier, a POSITA would have known by 2014 that treadmills could include multiple sensors that collaboratively provided enhanced features and functionalities to the user. In the Ray-Daly combination, information indicative of the amount of pressure or force of the user's footsteps would have been provided to Ray's image processing system to enhance the validation feature of Ray and provide a more accurate morphing of the virtual image. This combination would have also provided other advantages such as generating footstep count and stride information for the user to view, which would have served as both motivational and training feedback. (Daly, 3:41-44, 4:11-33.)

2. Dependent Claim 7

302. As I explained above, a POSITA would have had no difficulty incorporating Daly's pressure sensors into Ray's treadmill belt, and import Daly's software analysis code to detect a user and determine the exercising user's cadence, stride, and other exercise metrics, if was not already part of Ray's software.

303. Figure 1 of Daly shows a piezoelectric sensor array that determines the rate of exercise of the user. (Daly, 6:39-61.) Daly control system 206 receives a load detection signal from its piezoelectric sensor array and uses that to control the speed, inclination angle or stiffness of the treadmill. (Daly, 14:4-25.)

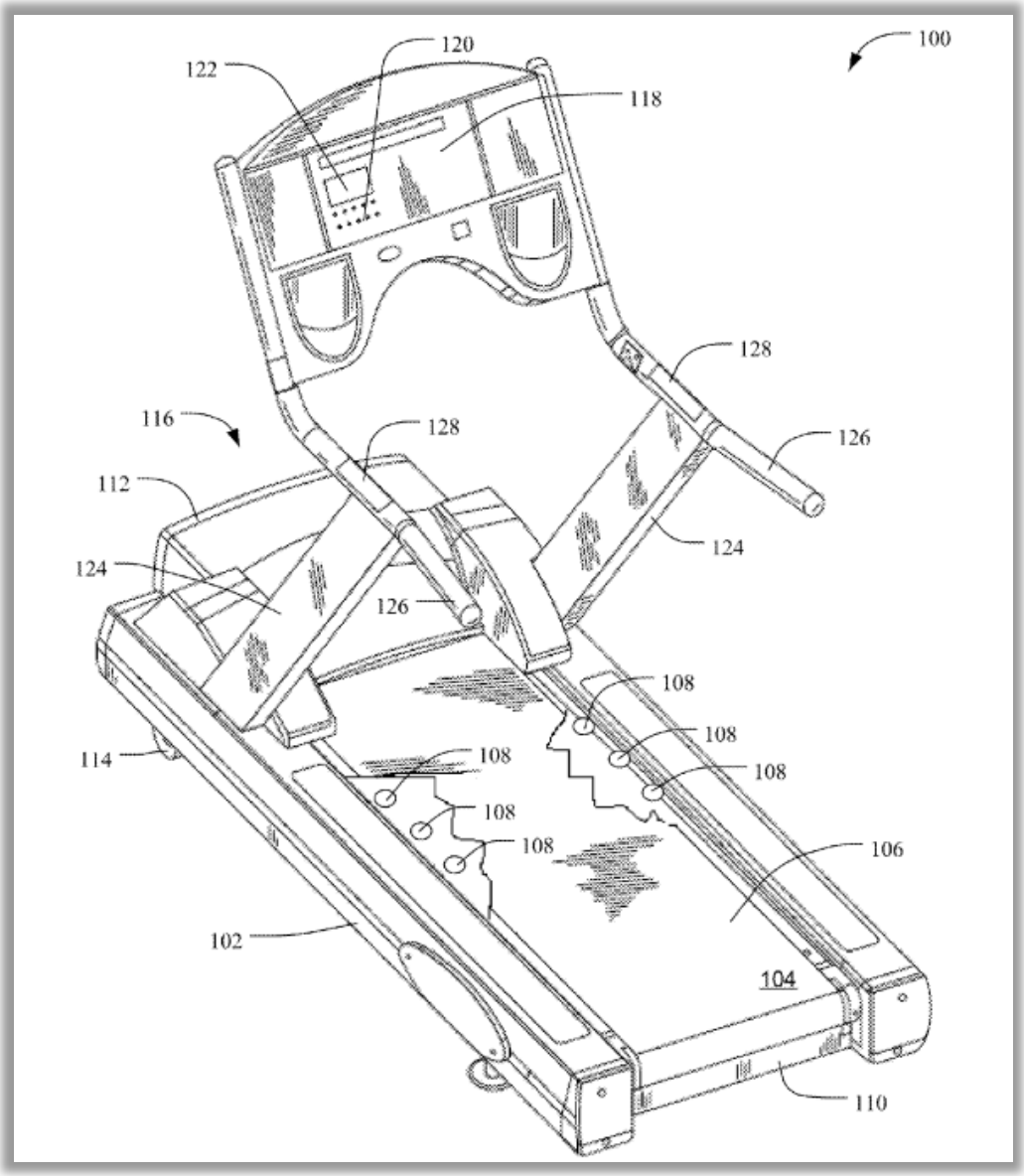


Figure 1 - Daly's Array of Piezoelectric Sensors under Treadmill Belt

304. Daly's piezoelectric sensor array detects when a user interacts with belt 104. Specifically, as shown in Figure 12 below, Daly's control system 206 receives a signal from the deflection sensor interface 224 (step 1202), which correlates to the force that the user imparts on the deck 104. (Daly, 21:32-40.) Control system 206 next determines whether the output signal is greater than an "inactivity threshold value" (step 1204). If the force is greater than the inactivity threshold, then control system 206 continues to determine whether the output signal is active for a predetermined period (step 1206), i.e., continues to validate that a user is engaged with the treadmill to activate the treadmill from standby status (step 1208). (Daly, 21:40-55.) If the force is less than the inactivity threshold (step 1210), then the control system 206 directs the device controller 226 to inactivate the treadmill (step 1212) while it awaits engagement of the user (step 1214). (Daly, 21:40-22:11.)

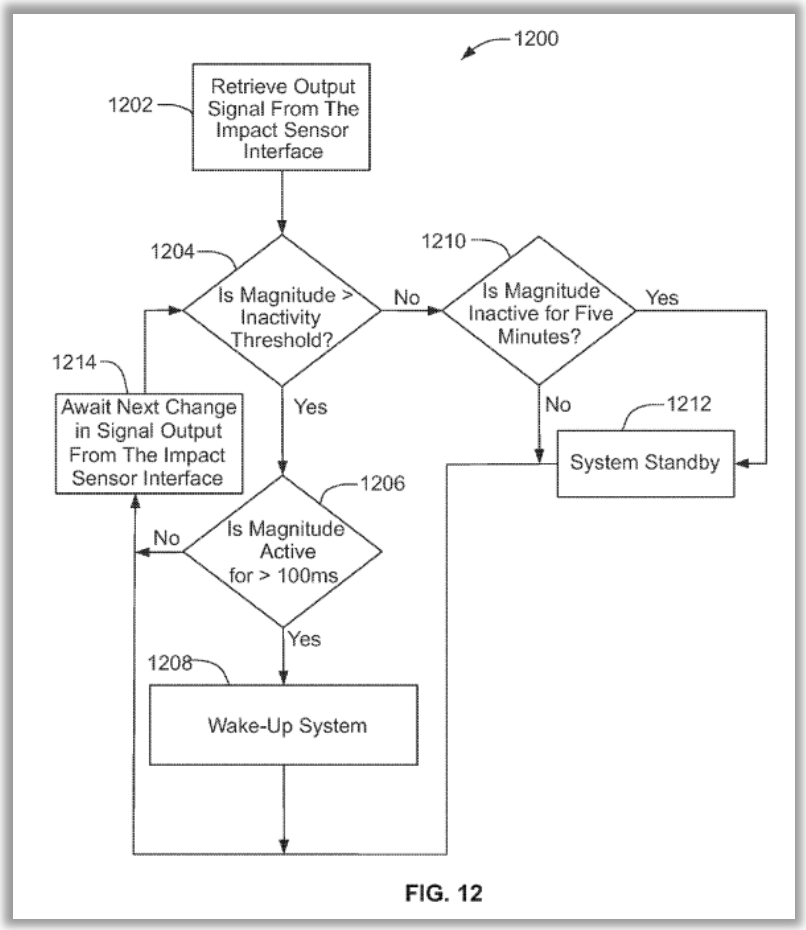
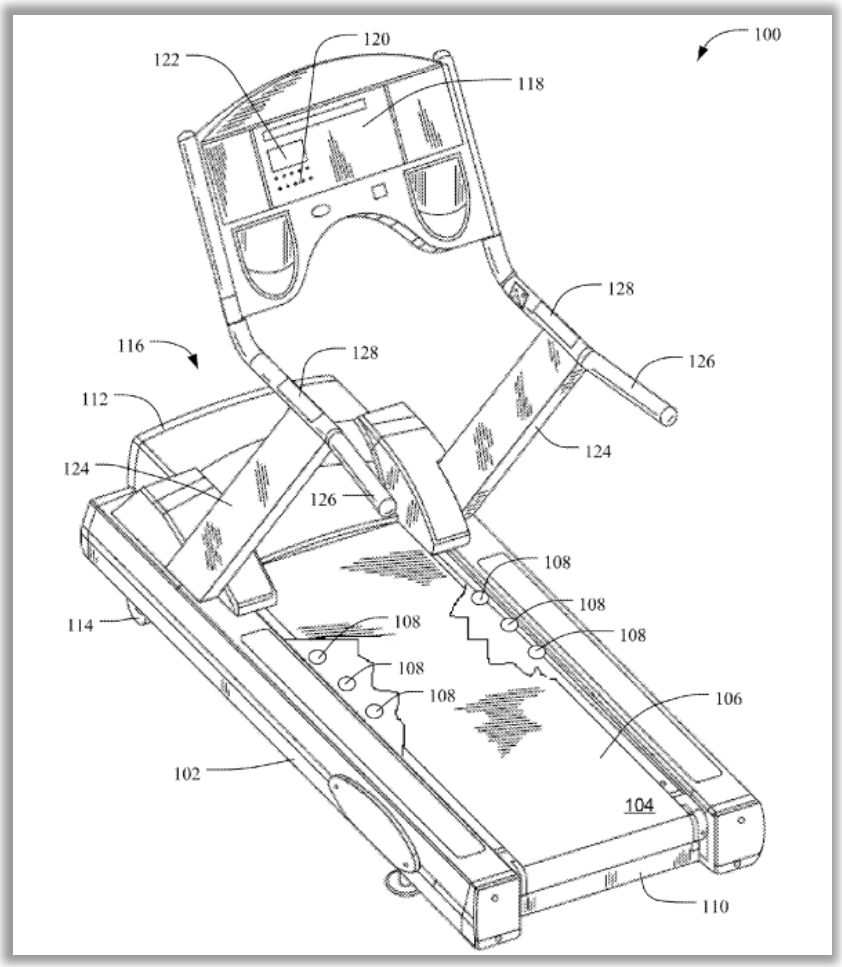


FIG. 12

305. Daly's pressure/piezoelectric sensor array detects the force exerted by an exerciser on belt 104, and uses it to make adjustments to the speed of the belt; it also used that information to adjust the metabolic cost equation to accurately reflect the user's exercise metrics. (Daly, 15:6-13.) If no output signal indicating the presence of a user has been received by control system 206 for a period of time, an inactivity flag is set. (Daly, 16:6-30.) This indicates "if a user is present on the treadmill." (Daly, 5:62-67.) In summary, Daly's system used a pressure sensor and controller that analyzed data from the pressure sensor to determine if a user was on the belt based on the user's foot impacts. As I explained earlier, it would have been obvious to a POSITA that this information obtained via detecting user's foot impact would be used to complement Ray's user detection, and it would have provided redundancy and accuracy by producing the morphed virtual images based on the actual footstep data from Daly's pressure sensors.

3. Dependent Claim 8

306. As shown in Figure 1 (below), Daly includes "[a] belt 106, on which a user may walk, jog, and/or run" that moves over deck 104 of treadmill 100. (Daly, 6:44-46.)



4. Dependent Claim 9

307. Daly discloses that sensor 108 could be a "pressure sensor" (Daly, 8:56-62), and is "for example, a plurality of sensors" as shown in Figure 1 above. (Daly, 6:46-48.)

5. Independent Claim 12

12[pre] "A motorized treadmill comprising:"

12[a] "a base;"

12[b] "an endless belt movable relative to the base"

12[c] "a motor operably coupled to the endless belt"

308. *See* my discussion of claim 1, above.

12[d] "a sensor configured to detect engagement of the endless belt by a user; and"

309. *See* my discussion of claim limitation 1[d], above, for Ray's camera sensor. In the combination, Daly's pressure sensor output would be used to help morph Ray's images more accurately based on footstep detections on the treadmill. Daly's pressure sensors would have also provided a backup and redundant user detection scheme.

12[e] "a controller configured to record validated exercise use data in response to the sensor detecting of engagement of the endless belt by the user,

310. *See* my discussion of claim limitation 1[h], above, for an explanation of how Ray produced validated exercise use data. In the combination, Daly's pressure sensor would have provided input for morphing the images and also provided a backup/redundant detection scheme.

12[f] "the validated exercise data including an amount of user exercise time, the amount of user exercise time being generated by an amount of time that the sensor detects engagement of the endless belt by the user,"

311. *See* my discussion of claim 4, above.

12[g] "wherein the sensor includes a pressure sensor configured to detect an amount of pressure on a portion of the endless belt and generate a pressure data, and the controller is configured to analyze the pressure data to detect engagement of the endless belt by the user."

312. *See* my discussion of claims 7 and 8, above.

F. Ground 6: Claim 13 is Obvious over Ray, AAPA, Daly and Cox.

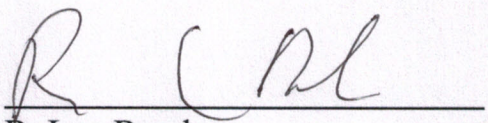
1. Dependent Claim 13

313. As discussed in Section VI.B.4, above, the limitations of claim 13 were rendered obvious by this combination. Daly's treadmill included "a current sensor or current measuring device and configured to obtain the electrical current draw values of, for example, the drive member 208 or motor." (Daly, 9:31-35.) In the combination, Cox's analysis of the current drawn by the motor to detect the user's presence would have augmented the Ray-Daly user detection technique to improve the detection of the user and provide backup and redundancy. The combination would not have required any hardware changes and the software code of Cox could have been readily implemented into the Ray-Daly treadmill, to produce predictable results with a reasonable expectation of success.

VII. CONCLUSION

I hereby declare that all the statements made in this declaration are based on my own true knowledge, that all statements made on information and belief are believed to be true, and that all statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001. I declare under the penalty of perjury under the laws of the United States that all statements made in this declaration are true and correct.

Dated this 1st day of August, 2023



R. Lee Rawls

APPENDIX A

R. Lee Rawls

14019 - 165th Avenue NE
Woodinville, WA 98072-9074
Phone: (425) 481-1104
Email: lee@jump-design.net

ENGINEERING EXPERIENCE

Partner: Jump Design Innovations, LLC **1999 – Present**

Engineering Contractor/Inventor

As a Partner in Jump Design I regularly develop ideas into products. My primary focus is the mechanical side of the process, but I regularly integrate electromechanical and software controls into the products I design.

Partial list of Clients Includes:

Innovalarm	(Smoke detectors)
IDD Aerospace	(Cockpit pilot interface modules)
Microvision	(Heads up display)
M9 Defense	(Military protective gear)
MIDITRONX	(Musical instruments)
64seconds	(Pipeline leak detection devices)
GHKN	(Continuous Detonation Rocket Engine)
Bayliner	(Boat components)
MagnaDrive	(Magnetic power transmission couplings)
Marine Hardware Inc.	(Marine deck, engine, propulsion components)
Sea-Lect Plastics	(Injection Molding)
SRAM	(Bicycle components)
Sea-Dog	(Marine Components)
Westover Scientific	(Microscopes)
Digital Control DCI	(Drill head tracking)
IRSG	(Moveable, modular shelving and storage)

StairMaster Sports/Medical Products, Inc. **1991 – 1999**
Vice President – Product Development and Engineering **Kirkland, WA**

- At StairMaster I managed a team of over 20 engineers & support staff. As head of that engineering staff was directly Responsible for all R&D including new product concepts, new product specifications, new product hardware development, electronics development & testing, and software & firmware development & testing.
- I was also responsible for maintenance of existing products including all Hardware, electronics & software, value engineering and intellectual property issues.

- During my tenure at StairMaster I developed and brought to market more than 20 commercial fitness products. Those products typically involved complex mechanisms, electronic resistance devices including software electronics and a user interface for selecting an controlling the exercise.
- Most of the StairMaster products that I developed and maintained included complex operating systems and communication interfaces. Some of those products could communicate with other exercise devices or with a communication hub.
- I personally hired, directed and managed the entire engineering staff.

Loredan Biomedical Inc. **1986 – 1991**
Director of Manufacturing **Davis, CA**

- Loredan Biomedical developed and sold complex computer controlled joint strength evaluation and testing equipment that was targeted to the physical rehabilitation and testing market.
- As Director of Manufacturing I was responsible for all aspects of producing and testing these products.
- I was also directly involved in developing the specifications for new products or changes to existing products. In this roll I regularly developed mechanical, electrical & software specifications and evaluated the development of any changes or new products.

PATENT EXPERIENCE

- **DEPOSITIONS** Recent:
  - Nautilus, Inc. v. ICON Health & Fitness, Inc. Case: IPR2017-01408
  - VR Optics, LLC v. Peloton Interactive, Inc. Case: 1:16-cv-6392 (JPO)
  - Mad Dogg Athletics v. Peloton Interactive, Inc. Case: 2:20-cv-00382

- **PATENT PROSECUTION:**
  Inventor (Rawls; R. Lee) of the following patented products:

Resistance Training Machine	5,308,303	May 3, 1994
Device To Prevent Binding …	5,312,313	May 17, 1994
Exercise and Diagnostic Apparatus …	5,348,519	Sept. 20, 1994
Resistance Training Machine	5,387,170	Feb. 7, 1995
Exercise Apparatus	5,354,248	Oct. 11, 1994
Exercise Machine	D355,684	Feb. 21, 1995
Upper Body Exercise Apparatus	5,499,959	Mar. 19, 1996
Exercise System	5,547,439	Aug. 20, 1996
Exercise Apparatus	D373,805	Sept. 17, 1996
Exercise Apparatus	5,565,002	Oct. 15, 1996
Handle for an Exercise Apparatus	D381,717	July 29, 1997
Exercise Apparatus	5,910,072	June 6, 1999
In-Line Skating Simulator	6,514,180	Feb. 4, 2003
Kayak Foot Brace	7,168,388	Jan. 30, 2007
Direct Action Window Lock	8,182,001	May 22, 2012
Rudder Assembly	8,210,114	July 3, 2012

o	Hose Valve Apparatus …	8,479,353	July 9, 2013
o	Match Holder	D710,537	Aug. 5, 2014
o	Direct Action Window Lock	8,899,632	Dec. 2, 2014

EDUCATION

University of California at Davis
Master's degree Dept. of Physical Education (Biomechanics), 1986

University of Massachusetts at Amherst
Bachelor's degree STPEC (Political Economics), 1977

APPENDIX B

C. L. HAGEN.

TRAINING MACHINE.

APPLICATION FILED OCT. 20, 1911.

1,064,968.

Patented June 17, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

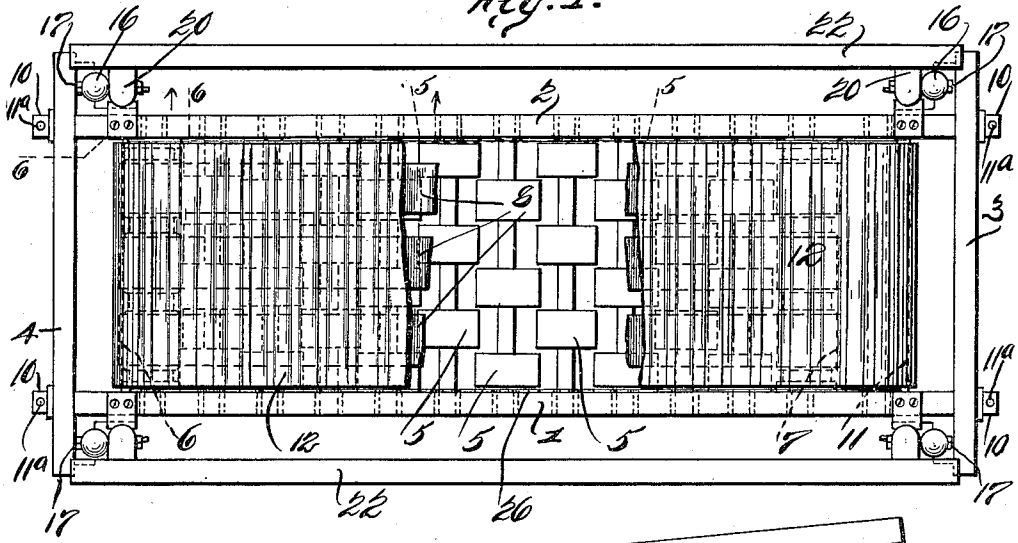


Fig. 2.

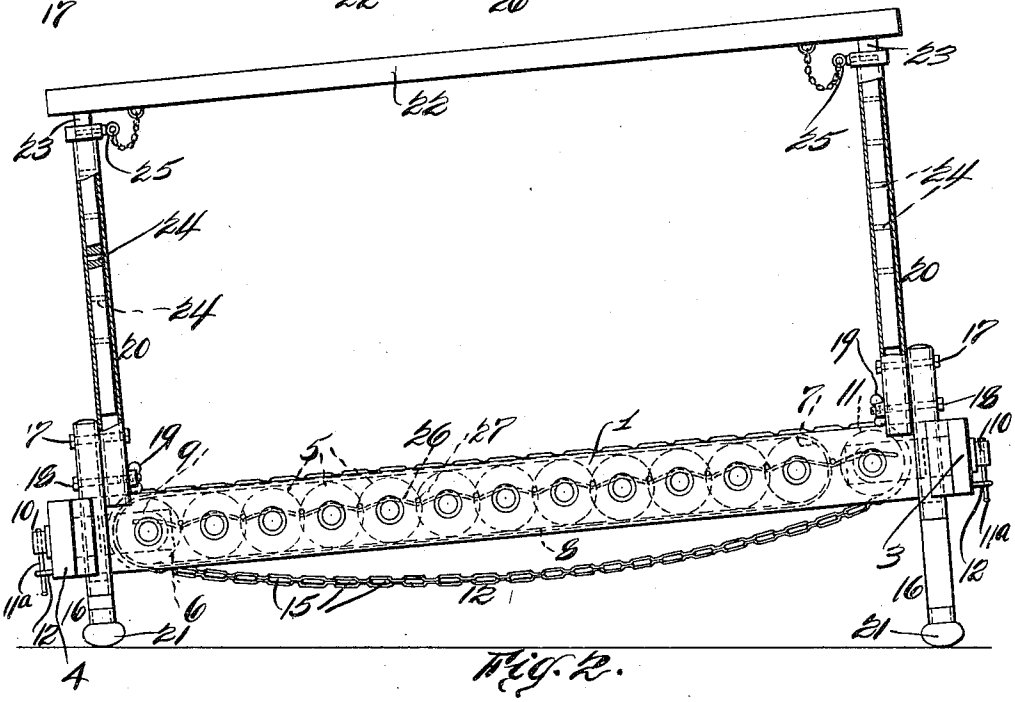
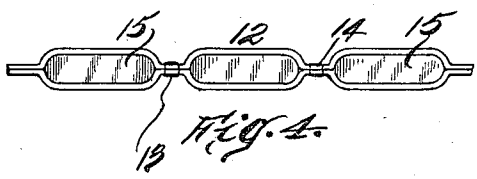


Fig. 4.



Witnesses:
C. A. Davis
Mabel Dittenhofer

Inventor:
Claude L. Hagen
by F. Warren Wright
attorney.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

C. L. HAGEN.

TRAINING MACHINE.

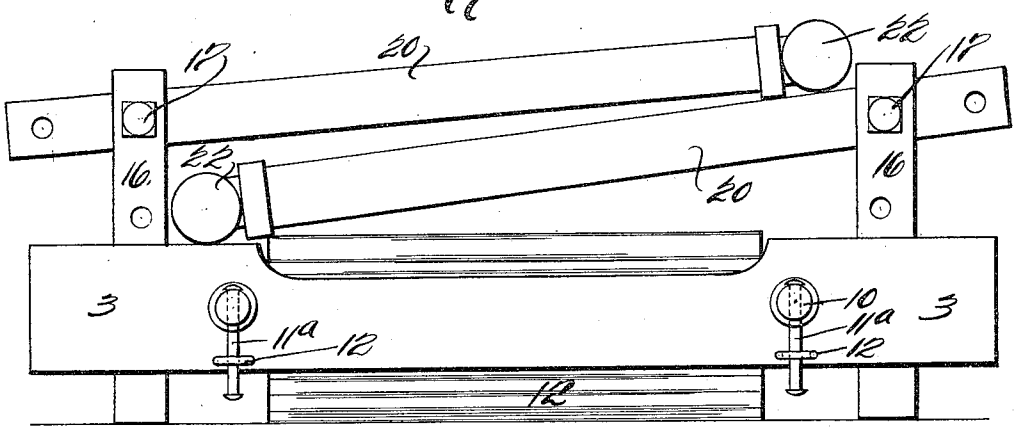
APPLICATION FILED OCT. 20, 1911.

1,064,968.

Patented June 17, 1913.

2 SHEETS—SHEET 2.

Fig. 4a



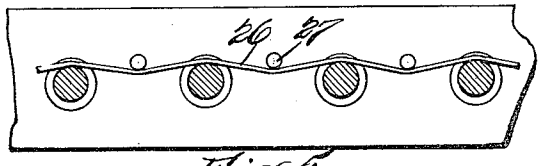


Fig. 5.

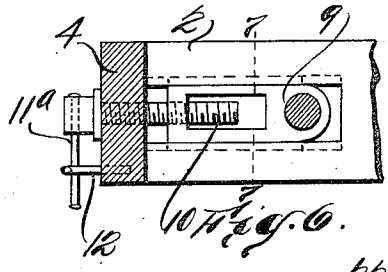


Fig. 6.

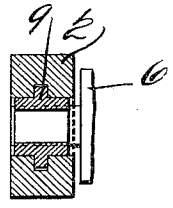


Fig. 7.

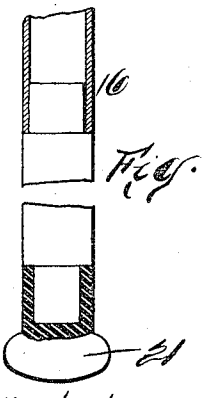


Fig. 8.

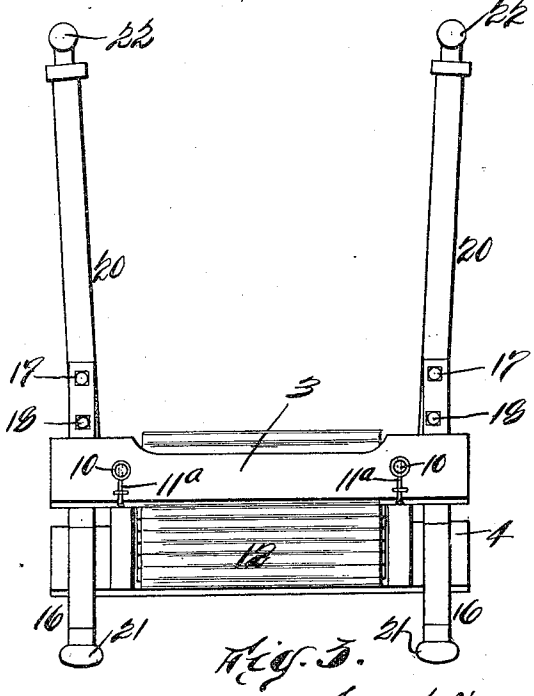


Fig. 9.

Witnesses
E. A. Jans
Mabel Dittenhoefer

Inventor:
Claude L. Hagen
by F. Warren Wright
Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CLAUDE LAURAINE HAGEN, OF NEW YORK, N. Y.

TRAINING-MACHINE.

1,064,968. Specification of Letters Patent. Patented June 17, 1913.

Application filed October 20, 1911. Serial No. 655,827.

To all whom it may concern:

Be it known that I, CLAUDE LAURAINE HAGEN, a citizen of the United States, residing at New York city, in the county and State of New York, have invented certain new and useful Improvements in Training-Machines, of which the following is a clear, full, and exact description.

The object of my invention is to provide a new and improved training machine of the type described in my United States Letters Patent of August 9th 1904, Number 767,221.

Prime objects of the invention are to reduce the noise, make such machine adjustable for all sizes and heights of individuals, improve the toe grip or running tread of the device to make the same more comfortable to the user, and to improve in the construction, wear and durability of the moving parts, particularly the traveling belts.

The scope of my invention will be pointed out in the claims.

In carrying out the invention, I provide a rectangular frame, in the side pieces of which are mounted a series of rollers, such as shown in my aforesaid patent, over which rollers I prefer to mount distributing and wear take-up belts forming additional treads as well, and over such take-up belts I provide a tread or toe gripped belt of a peculiar construction, preferably formed with lateral slats joined by flexible hinged joints. I provide means for independently taking up the slack on the wear tread belts from the means used for taking up the slack in the toe gripped belt. In order to reduce the noise of the apparatus, I mount the rectangular frame on four posts, each terminating in a rubber or other elastic foot step. In order to secure a machine which will be adjustable, and have the narrowest possible tread when used for persons of various size, I provide inclined side posts having sliding therein or thereon supporting rods for side rails which as raised or lowered will also be brought more or less toward the center of the apparatus, whereby a short person with short arms will not have to reach as far out.

In order to make the device readily shipable, I provide such side posts with removable bolts to permit the same to be folded inwardly over the rectangular frame. In order to prevent noise, after considerable amount of wear on the machine, I provide a resilient means for bearing on the rollers tending to hold the same down after wear.

In the accompanying drawings: Figure 1 is a top plan with parts broken away, showing my improved apparatus. Fig. 2 is a side elevation with parts of the adjusting tubes shown broken away. Fig. 3 is an end view of the apparatus looking from the forward end. Fig. 4 is a detailed side elevation enlarged of a portion of the toe gripped belt. Fig. 4ª is an enlarged end view of the apparatus showing the same when collapsed for shipping. Fig. 5 is an enlarged fragmentary detail on the line 5—5 Fig. 1, showing the resilient take-up mechanism. Fig. 6 is a section on line 6—6 Fig. 1. Fig. 7 is a section on line 7—7 Fig. 6. Fig. 8 is a detail, partly in section, showing one of the leg or post members.

As shown in the drawings, my improved training device consists of side members 1, 2, joined at their ends by end members 3 and 4. In suitable bearings in the side members 1 and 2 I mount a series of rollers 5. The rollers consist of enlarged portions with intervening spaces. In the spaces of one portion the enlarged portion of an adjoining roller enters so as to provide a device such as described in my aforementioned United States Letters Patent.

In the frame I mount rollers 6 and 7, one at the extreme end and the other adjacent to a roller 11 to be hereinafter described, and I pass over such rollers 6 and 7 and above the rollers a series of belts, in this instance shown as three separated belts indicated by 8. They may be of fabric, rubber or reinforced fabric. The roller 7 near one end of the machine may be permanently mounted, but the roller 6 at the other end of the machine is mounted in a slide block 9 with which is engaged a screw 10 passing through the end member 4, and provided on the outside with a sliding locking pin 11ª, which, as indicated in Fig. 6, normally engages a staple 12.

In order to take up the tension on the treadmill belts 8 the pin 11ª is lifted from its staple, and the screw rotated to secure the take-up and then the pin is dropped back into position, so that the screw will be locked thereafter against vibration. A roller 11 is provided at the opposite end of the machine from the take-ups for the belts 8. The roller 11 is provided with similar take-up

mechanism to that described, and shown in Fig. 6.

Over and around one side of the roller 11 and over and around one side of the roller 6 I pass a toe gripped belt 12. The toe gripped belt is preferably formed of fabric, crash being an example, and is sewn together as indicated in Fig. 4 at 13 and 14, leaving chambered sections between the sewing, into which I pass slats of wood or other material 15.

To support the frame I provide posts 16, each secured at its upper end to a plate 17 attached to one of the side members 1 and 2. The post 16 projects above the side members, and each post is provided with two bolt holes, through which are passed bolts 17 and 18, bolt 18 being provided with a winged hand nut 19, so that it may be readily movable. The bolts 17 and 18 as well as being secured to the upper ends of the posts 16, also pass through tubular posts extending obliquely to the vertical. The tubular posts are indicated at 20. The bottom of each post 16 I supply with a resilient cushion 21 preferably of rubber. Side rails 22 are also provided, having at each of their ends solid rods 23 pierced by projections 24 at various distances, so that the side rails may be raised, and their solid rods 23 slid in the oblique tubular posts 20 to give a variation of height, and a variation at the same time of space between the side rails. A pin 25 may be used to hold the post 23 in its adjusted position, with regard to the hollow tubular post 20.

In view of the rollers and the wear resisting tread belts 8, there will be no tendency for the user to sink to any extent into the space holes between the rollers. There will be no tendency for the toe gripped belt to sink below a normal and substantially single plane. At the same time the user will get the benefit of all the rolls acting in unison, and all doing very little work at a given time, whereby great quietness and ease of operation may be secured. Any degree of extra stress on the belts desired may be secured by tightening up the belts 8. Both sets of belts in view of their adjustment at the opposite ends of the machine, may be adjusted independently. As the rolls wear their bearings in practice tending to cause a rattle and noise, I provide along the side members 1 and 2 a strong but small wire or flat spring 26 causing it to bear lightly on the top of each roll by means of pins 27 secured to the side frame, and bearing on the wire or flat spring at an intermediate position.

In carrying out this invention, details of construction may be varied from those shown, and yet the essence of the invention be retained; some parts might be employed without others, and new features thereof might be combined with elements old in the art in diverse ways, although the herein described type is regarded as embodying substantial improvements over such modifications.

As many changes could be made in the above construction, and many apparently widely different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted in an illustrative and not in a limiting sense. It is furthermore desired to be understood that the language used in the following claims is intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

I claim as my invention:

1. The herein described training machine, comprising a frame, rollers therein, a treadmill belt passing over said rollers, a toe gripped belt superposed and inclosing the rollers and treadmill belt.

2. The herein described training machine, comprising a frame, rollers therein, a tread mill belt passing over said rollers, a toe gripped belt superposed and inclosing the rollers and treadmill belt, the treadmill belt passing around a roller intermediate of the ends of the apparatus, and take-up means for adjusting the tension on each belt independently of the other.

3. The herein described training machine, comprising a frame, rollers therein, a treadmill belt passing over said rollers, a toe gripped belt superposed and inclosing the rollers and tread mill belt, the treadmill belt passing around a roller intermediate of the ends of the apparatus, and take-up means for adjusting the tension on each belt independently of the other, and take-up mechanism consisting of guide blocks, a screw take-up means, a pin sliding in the head thereof, and a staple adapted to be interlocked by said pin.

4. The herein described training apparatus consisting of a frame, a treadmill apparatus, oblique posts extending upwardly and outwardly from said frame, adjustable side rails carried thereby adapted to be secured in adjustable positions on said oblique posts.

5. The herein described training apparatus consisting of a frame, a treadmill apparatus, and oblique posts extending upwardly and outwardly from said frame, adjustable posts and side rails carried thereby adapted to be secured in adjustable positions on said oblique posts, the bottom ends of said oblique posts having a removable bolt and a pivot bolt, whereby the oblique

posts may be turned inwardly one on the other.

6. The herein described training machine consisting of a frame, rolls therein, a toe gripped belt upon the rolls, consisting of at least two fabrics secured together at different distances, slats inserted between the fabric, between the points at which the fabric is secured together.

7. The herein described training apparatus consisting of a frame, rollers therein, a treadmill belt over said rollers, a resilient wire or flat spring take-up device secured to the frame and bearing upon the rollers.

8. The herein described training apparatus consisting of a frame, rollers therein, a treadmill belt over said rollers, a resilient wire or flat spring take-up device secured to the frame and bearing upon the rollers, said take-up device consisting of a resilient wire or flat spring bearing on the rollers with a pin bearing upon the wire or flat spring intermediate of the rollers.

Signed at New York city, New York.

CLAUDE LAURAINE HAGEN.

Witnesses:

F. WARREN WRIGHT,

FRED FRANCIS WEISS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

APPENDIX C

United States Patent [19]

Taitel

[11] **Patent Number: 4,544,152**

[45] **Date of Patent: Oct. 1, 1985**

[54] **PASSIVE-TYPE TREADMILL**

[76] Inventor: **Charles M. Taitel**, 35 Union Rd., Parsippany, N.J. 07054

[21] Appl. No.: **517,079**

[22] Filed: **Jul. 25, 1983**

[51] **Int. Cl.**[4] **A63B 23/06**

[52] **U.S. Cl.** **272/69**; 188/187; 188/72.7

[58] **Field of Search** ..... 272/69, 73, 96, 131, 272/132; 188/187, 72.7, 72.8, 106 P; 128/25 R, 25 B

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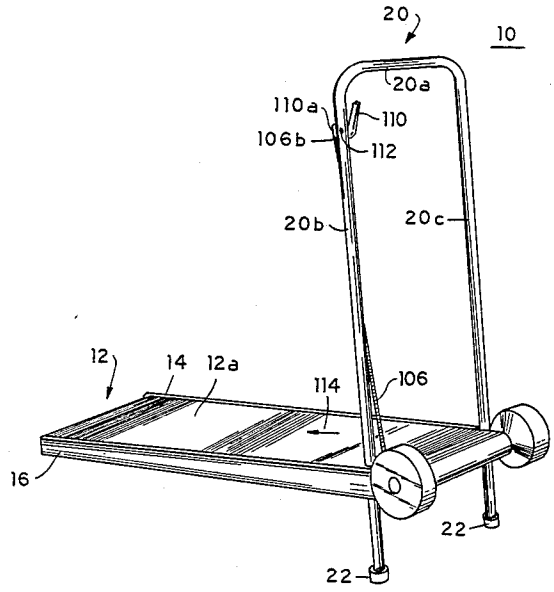
Primary Examiner—Richard J. Apley
Assistant Examiner—S. R. Crow
Attorney, Agent, or Firm—Louis Weinstein

[57] **ABSTRACT**

A passive treadmill having a governor to adjustably limit the rate of speed of the treadmill belt. Resilient flexible rotating blades flex due to the centrifugal force developed during rotation, the magnitude of the centrifugal force being a function of the linear speed of the treadmill belt. Brake pads mounted on the flexible blades move into sliding engagement with an annular stationary surface to limit the linear speed of the treadmill belt. A rotatably mounted cam is manually adjustable to adjust the spacing between the aforesaid slidably engagable surfaces to adjust the governor. The governor assembly is of relatively small size and volume and the moving components of the governor are mounted within a compact casing.

The rollers, which rollingly support the treadmill belt, are rotatably mounted within elongated openings provided in each of a pair of mounting rails. Roller support shafts are inserted into slots arranged at spaced intervals along the support rails and a compressible rope is arranged between the support shafts and the upper interior surface of the support rail elongated openings. A single elongated rod in the elongated opening of each rail supports all of the associated shafts, providing the dual functions of securing said roller shafts in position and rotatably supporting all of the roller shafts at a uniform height. The compressible rope compensates for any tolerances between the parts and prevents the roller shafts, and hence the rollers, from experiencing any undesirable movement and/or vibration.

5 Claims, 17 Drawing Figures



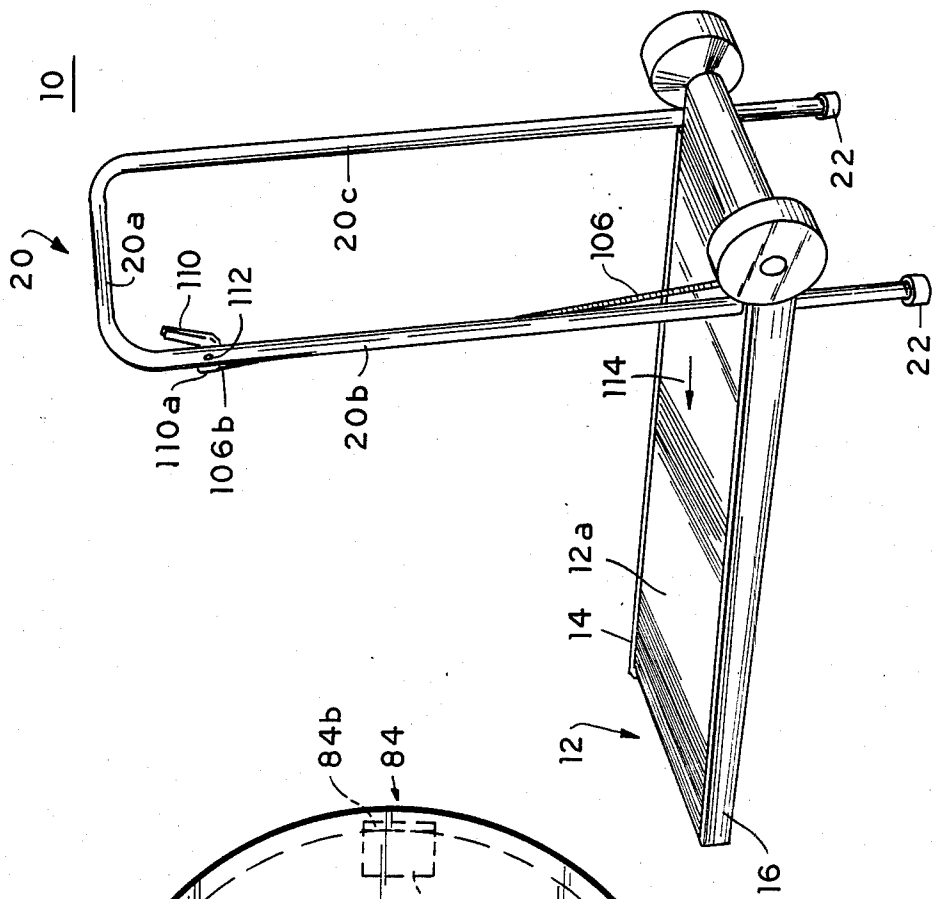


FIG. 1

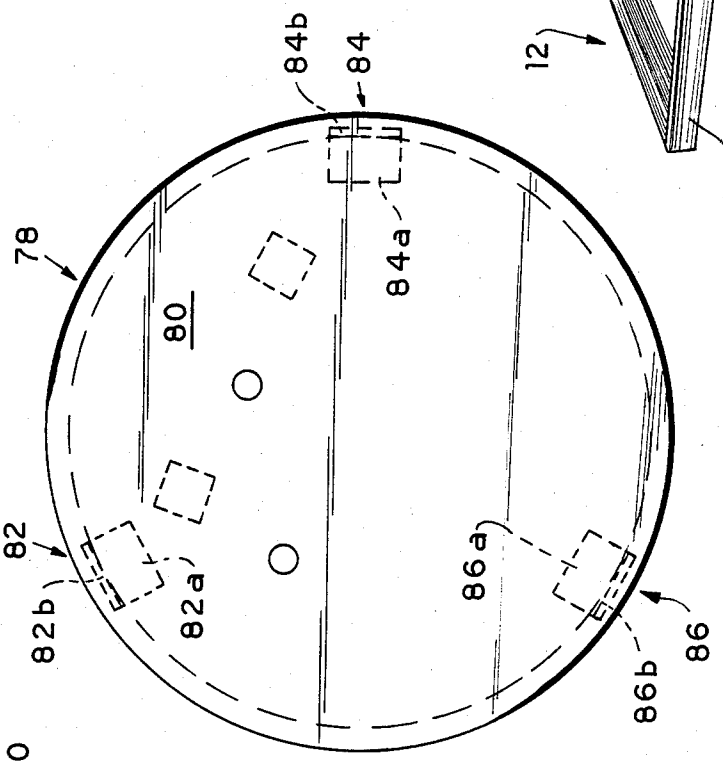


FIG. 3a

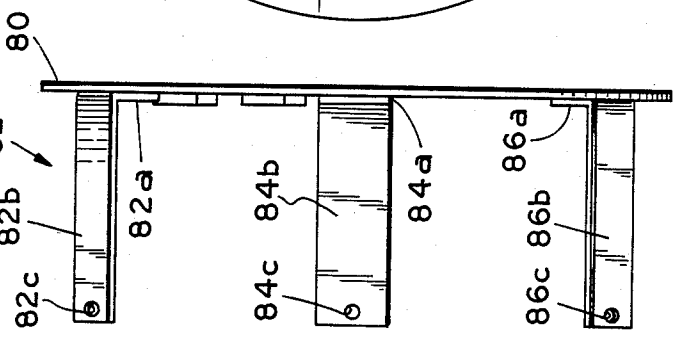
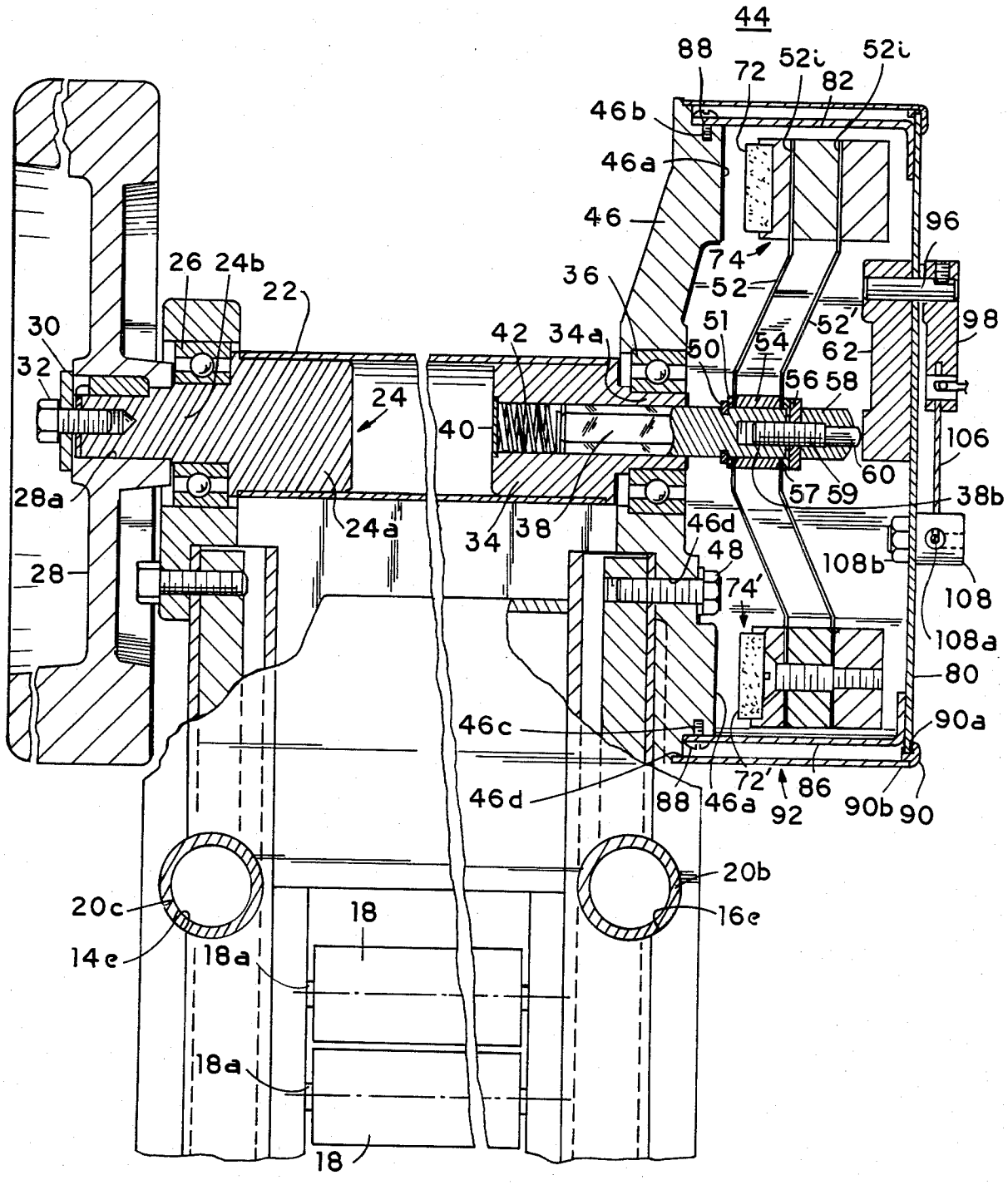


FIG. 3b

FIG. 2


44
88
72
52i
52i
82
46b
46a
46
96
74
36
52
26
24b
22
30
42
34a
51
52'
98
32
50
54
62
24
40
56
58
106
28a
57
59
60
38b
24a
34
38
46d
48
108b
28
74'
108
108a
80
46c
90a
72'
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90
20b
20c
18
16e
14e
18a
18a
18

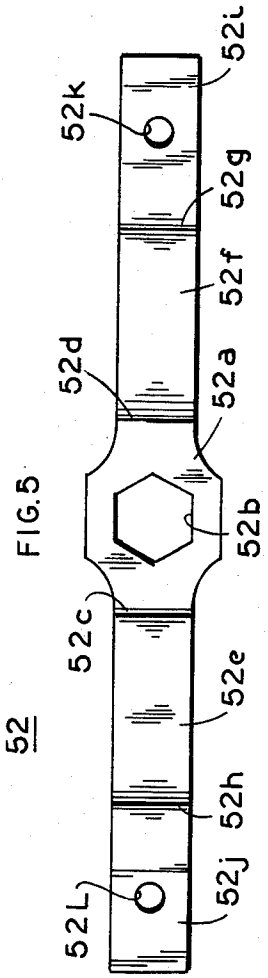


FIG. 5

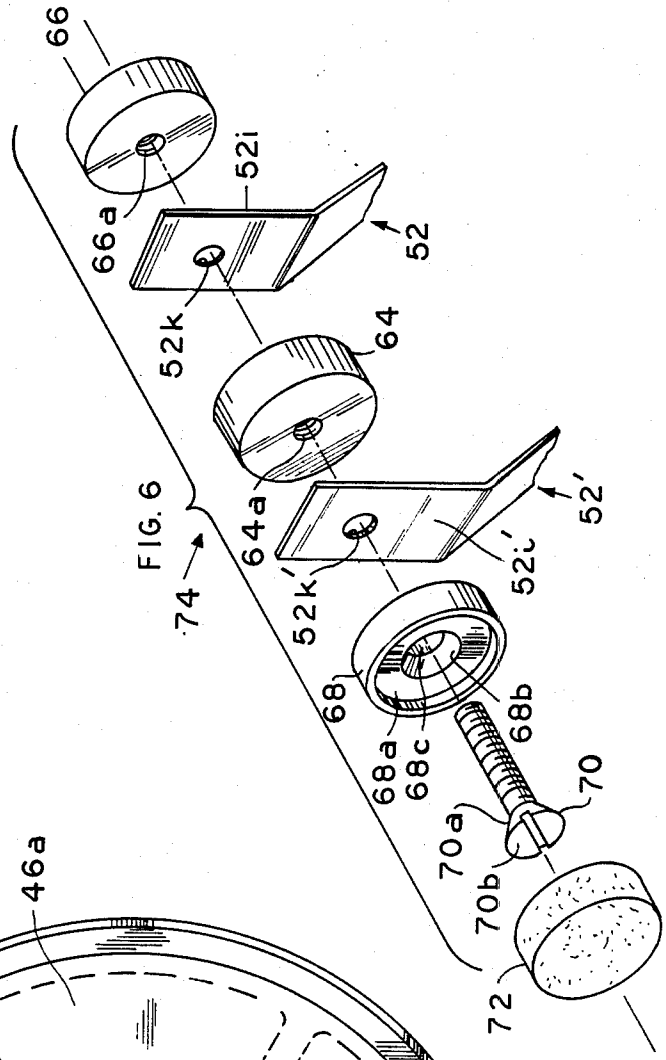


FIG. 6

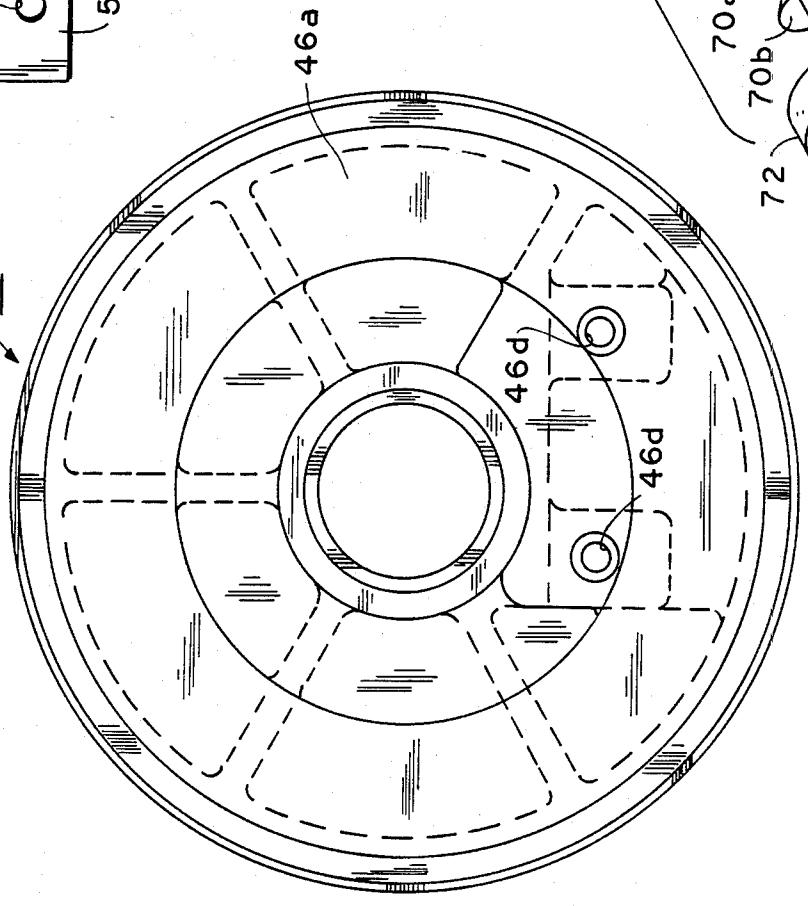
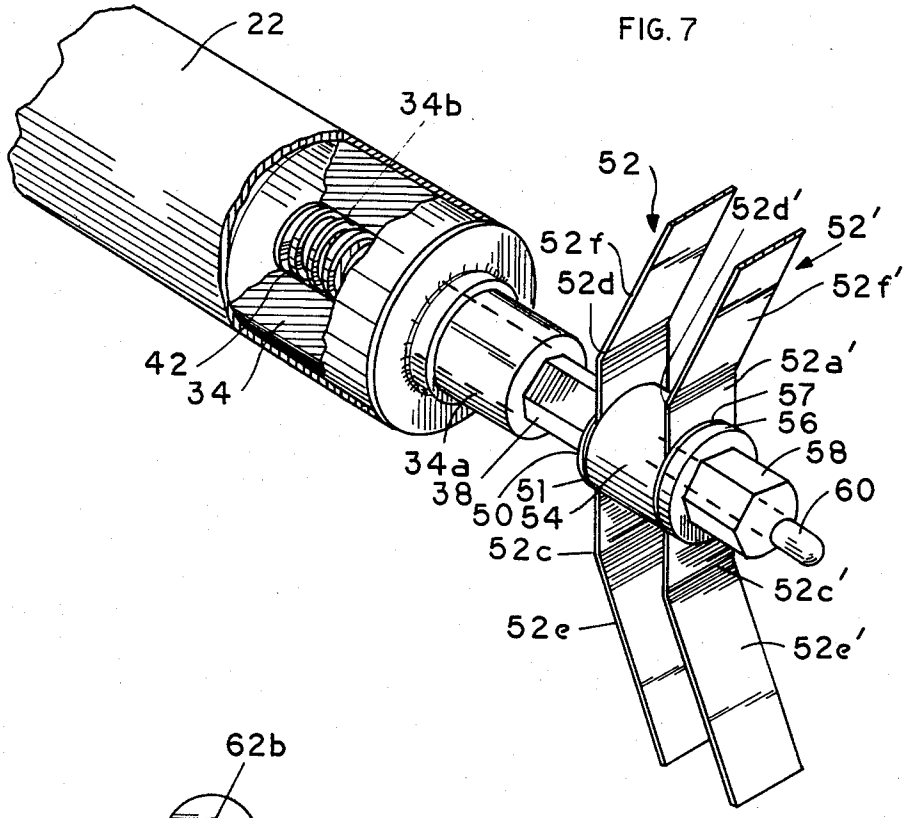


FIG. 4

FIG. 7



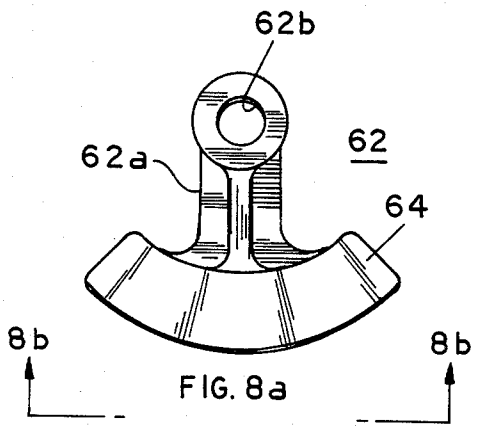


FIG. 8a

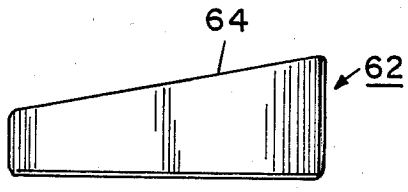
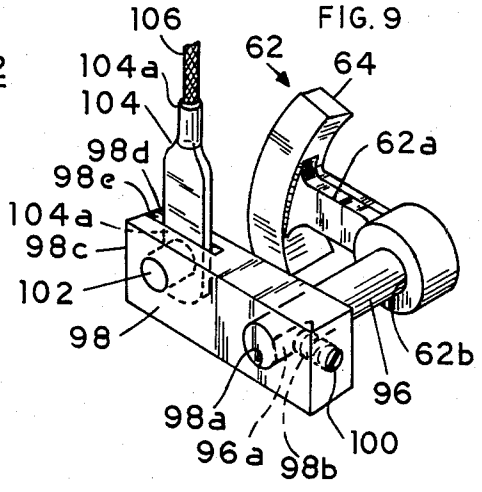


FIG. 8b

FIG. 9



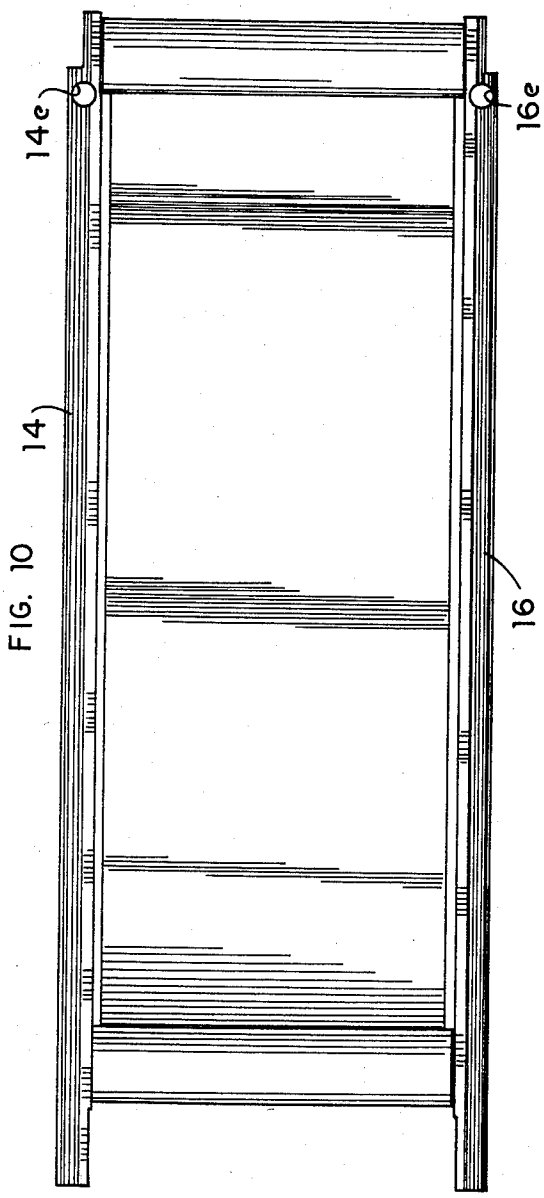


FIG. 10

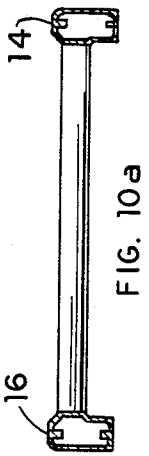


FIG. 10a

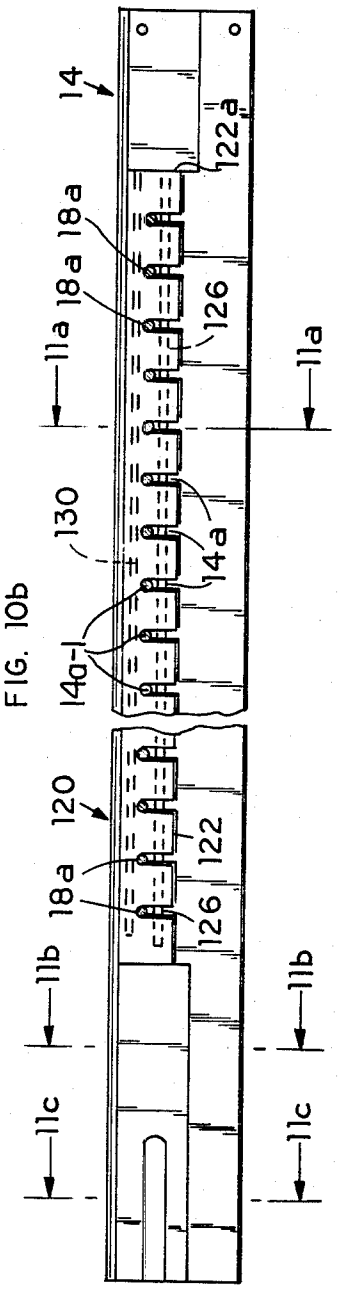


FIG. 10b

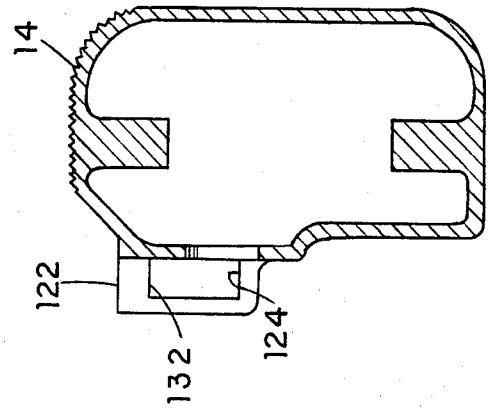


FIG. 11c

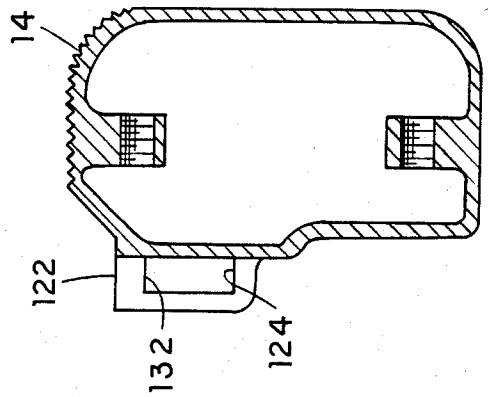


FIG. 11b

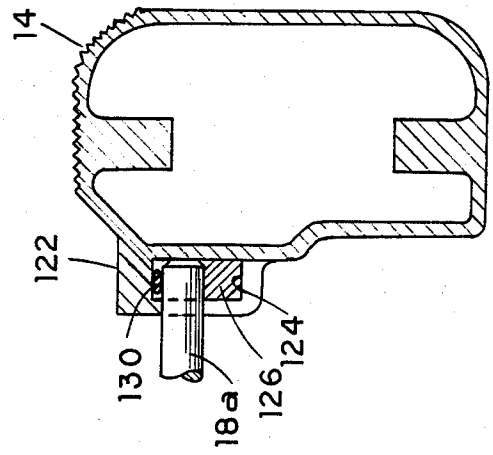


FIG. 11a

PASSIVE-TYPE TREADMILL

FIELD OF THE INVENTION

The present invention relates to treadmills, and more particularly, to treadmills of the passive type, typically employed for exercise purposes and including a flywheel and a governor having axially adjustable, flexible rotating blades axially movable by an adjustment cam and cooperating with a stationary surface for limiting the linear velocity of the treadmill belt which engages the roller coupled to the flexible blades of the governor, and further including method and apparatus for assembling the treadmill rollers along support rails in a simiplified manner, said method assuring precise horizontal and vertical alignment of the roller shafts.

BACKGROUND OF THE INVENTION

Treadmills are presently utilized as advantageous means for performing vigorous exercise indoors and at a stationary position. Such treadmills are typically comprised of an elongated closed-loop belt supported by a plurality of rotatable rollers arranged at closely-spaced parallel intervals and being mounted in a freewheeling manner. In order to limit the linear speed of the belt, it is typical to provide a flywheel. The user holds on to the treadmill rail to control speed. Only one known treadmill employs a governor which is both complicated and expensive. It is, therefore, desirable to provide a governor for treadmills and the like which is simple to use and having a simplified and yet rugged and reliable design to enable rapid adjustment of the treadmill linear speed.

DESCRIPTION OF THE INVENTION

The present invention provides a treadmill assembly which is characterized by a novel governor having rotatable flexible blades adjustably moveable in the axial direction about the center of rotation and having brake pads at the free end of the blades for slidable engagement with a cooperating stationary annular surface. The blades are mounted upon a shaft normally urging the blades away from the stationary annular surface. Cam means is provided to adjust the axial position of said flexible blades relative to said stationary surface. The centrifugal force developed by the rotating blades cause the blade ends to deflect toward the stationary surface, the amount of deflection being a function of the magnitude of the centrifugal force. The cam means thus serves as a means for limiting the linear speed of the treadmill in a simple and straightforward manner.

The treadmill belt is supported by a plurality of rollers arranged at closely-spaced, parallel intervals, said rollers being supported by a pair of rails each provided with a roller supporting section having an elongated opening communicating with a plurality of slots open ended at their bottom ends for receiving the roller shafts. The roller shafts are maintained at the proper height and are retained within said slots by means of an elongated rod inserted into said elongated opening and arranged beneath said roller shafts. An elongated resilient member is arranged in each of said elongated openings to compensate for any dimension deviations due to normal tolerances, and thereby prevent the roller shafts from experiencing any linear movement.

OBJECTS OF THE INVENTION AND BRIEF DESCRIPTION OF THE FIGURES

It is, therefore, one object of the present invention to provide a novel governor for use in treadmill assemblies and the like, said governor employing axially positionable flexible rotating blades adapted to experience substantially linear movement in a direction parallel to the rotational axis of the blades and further including adjustable cam means for controlling the position of said blades along their longitudinal axis to adjust the position of the brake pads carried by the blades relative to a cooperating stationary annular surface, and thereby control and limit the linear speed of the treadmill.

Still another object of the present invention is to provide a governor for treadmill assemblies and the like, which is of simple, compact design thereby providing a compact governor assembly capable of being arranged within a small housing.

Still another object of the present invention is to provide a treadmill assembly incorporating a plurality of closely-spaced rollers supported by the roller support sections of a pair of rails, each rail support section having an elongated opening and a plurality of slots communicating with said opening each receiving one of the roller shafts and including an elongated rod extending through each of said elongated openings for supporting the shafts of said rollers extending into said opening, and for retaining said shafts in said rail.

Still another object of the present invention is to provide a treadmill assembly of the character described in which rope-like resilient compressible means is arranged in each of said elongated openings above said roller shafts to restrain the roller shafts from experiencing any undesirable linear displacement.

The above as well as other objects of the present invention will become apparent when reading the accompanying description and drawings in which:

FIG. **1** shows a perspective view of a treadmill assembly designed in accordance with the principles of the present invention.

FIG. **2** shows a broken top plan view of the treadmill assembly of FIG. **1**, in which portions thereof are sectionalized for facilitating the understanding of the present invention.

FIGS. **3***a* and **3***b* show plan and side elevations respectively, of a spider employed in the governor assembly of FIG. **2**.

FIG. **4** is an end view of a brake disc employed in the governor of FIG. **2**.

FIG. **5** is a plan view of one of the flexible resilient springs of the governor shown in FIG. **2**.

FIG. **6** is an exploded perspective view showing the brake pad and spacer assembly of FIG. **2** in greater detail.

FIG. **7** is a partially exploded perspective view showing the shaft sub-assembly of the governor assembly of FIG. **2** in greater detail.

FIGS. **8***a* and **8***b* show plan and end views respectively, of the cam assembly employed in the governor assembly of FIG. **2**.

FIG. **9** shows a perspective view of the cam and lever assembly employed in the governor assembly of FIG. **2**.

FIG. **10** shows a top plan view of the frame assembly employed in the treadmill assembly of FIG. **2**.

FIGS. **10***a* and **10***b* show end and side views of the frame as shown in FIG. **10**.

FIGS. 11*a*, 11*b* and 11*c* show sectional views taken along the lines 11*a*—11*a*, 11*b*—11*b* and 11*c*—11*c* of FIG. 10*b*.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a treadmill 10 embodying the principles of the present invention and comprised of a treadmill belt 12 arranged between a pair of rails 14 and 16, shown best in FIGS. 10–10*b*. The left-hand ends of rails 14 and 16 are designed to rest upon a floor or other suitable supporting surface.

A plurality of rollers 18 (see FIG. 2) are arranged between rails 14 and 16, and have their shafts 18*a*, as shown in FIGS. 2, 10*b* and 11*a*, extending into openings 14*a*, 16*a* provided at spaced intervals along each of the confronting inner surfaces of the roller supporting sections of rails 14 and 16. FIG. 10*b* shows one set of openings 14*a* arranged at spaced intervals along the roller supporting section 122 of rail 14.

U-shaped bar or handle assembly 20 of treadmill 10 is comprised of a yoke portion 20*a* for gripping by a treadmill user, if desired. Downwardly depending arms 20*b* and 20*c* terminate in feet covered with rubber-like supporting cups 22, 22. The arms 20*b* and 20*c* extend through openings 14*e*, 16*e* in rails 14 and 16, and are secured thereto by suitable fastening means (see FIGS. 1 and 10).

As shown in FIG. 2, continuous closed loop treadmill belt 12, in addition to encircling rollers 18, encircles a forward-most roller comprised of hollow cylindrical member 22, whose left-hand end receives the right-hand end 24*a* of a support member 24, the end 24*a* being force-fitted into the left-hand end of hollow cylinder 22. Intermediate portion 24*b* of member 24 is journaled within bearing assembly 26, while the left-hand end 24*c* of member 24 extends through the central opening 28*a* in flywheel 28. Washer 30 and fastener 32 secure flywheel 28 to member 24, and hence to roller 22. The bearing 26 is mounted within an opening 27*a* in support member 27, joined to rail 14 by fastener 29.

The right-hand end of hollow cylindrical member 22 force-fittingly receives the left-hand end of hollow shaft supporting member 34, whose right-hand end 34*a* is journaled within bearing assembly 36, which is arranged within opening 46*e* in governor base plate 46 (see FIGS. 2 and 4). Member 34 (note FIG. 7) has a hexagonal-shaped bore of a cross-sectional configuration adapted to conform to and slidably receive elongated hexagonal shaft 38. A closure cap 40 closes and seals the left-hand end of the hexagonal-shaped opening in member 34. Helical spring 42 is positioned between cap 40 and the left-hand end of hexagonal shaft 38. Shaft 38 is slidable within member 34, and is normally urged to the right by spring 42. The right-hand end of shaft 38 extends into governor assembly 44 comprised of generally circular-shaped base plate 46, which is joined to rail 16 by fasteners 48, 48 extending through openings 46*d* in base plate 46 (see FIG. 4).

A retaining ring 50 is secured within an annular groove 38*c* in shaft 38 intermediate its ends and is engaged by ring-shaped member 51, which engages a first flexible blade 52, having a central portion 52*a* provided with a hexagonal-shaped central opening 52*b* (see FIG. 5). Flexible blade 52 is bent along bend lines 52*c* and 52*d* to form the diagonally-aligned portions 52*e* and 52*f*, and is further bent along bend lines 52*g* and 52*h* forming radially aligned free end portions 52*i* and 52*j*, each having an opening 52*k* and 52*l*, respectively. A spacer 54 having a generally cylindrical outer surface and a hexagonal-shaped hollow interior, is placed over shaft 38 and provides the desired spacing between flexible blade 52 and flexible blade 52', which is substantially identical to blade 52. A circular-shaped disk 57 having a hexagonal-shaped recess 57*a* is placed against and receives the right-hand end of shaft 38. The marginal portion of disk 57 rests against blade 52' and is positioned between the right-hand surface of the central portion 52*a*' of blade 52' and ring-shaped washer 56, and is retained in place by hexagonal-shaped nut 58, having a threaded portion 58*a*, which threadedly engages a threaded member 59 which also engages the tapped interior portion 38*b* of shaft 38. An elongated button-like cylindrical-shaped member 60 having a low friction bearing surface is force-fitted into the opening in the right-hand end of nut 58 and its rounded tip is arranged to slidably engage the diagonally-aligned cam surface 64 of a pivotally mounted cam member 62 shown in FIGS. 2, 8*a*, 8*b* and 9. The diagonally-aligned cam surface 64 adjustably controls the position occupied by button 62, which in turn determines the position of shaft 38, which is moved either toward the left or toward the right, relative to the position occupied by cam member 62, thereby movably positioning flexible blades 52, 52'.

The free ends 52*i*, 52*i*' of blades 52, 52', shown best in FIGS. 2, 5 and 6, receive and support a brake assembly comprised of a cylindrical disk 64 serving as a spacer arranged between blade portions 52*i*, 52*i*', a second circular disk 66 arranged against the right-hand surface of blade portion 52*i* and a third circular disk 68 arranged against the left-hand surface of blade portion 52*i*'.

Circular disk 68 is provided with a recess 68*a* having a central opening 68*b*, which tapers to a narrower clearance opening 68*c*, which extends through the right-hand side of disk 68. Disks 64 and 66 each have threaded central openings 64*a*, 66*a* for receiving and threadedly engaging threaded fastener 70 to secure the brake assembly comprised of blade ends 52*i*, 52*i*' and disks 64, 66 and 68. The threaded fastening member 70 has a head portion with a tapered configuration 70*a*, which is received within the tapered portion provided in disk 68 between openings 68*b* and 68*c*. Thus the top surface 70*b* of fastener 70 is substantially flush with the recessed surface 68*a* of disk 68.

A brake pad in the form of a circular disk 72 is positioned within recess 68*a* and is preferably adhesively secured therein. It should be noted in FIG. 2 that a pair of brake pad assemblies 74, 74' are provided at each end of the pair of flexible blades. The brake pads 72, 72' are positioned to selectively engage an annular surface 46*a* provided inwardly of the periphery of governor base plate 46. The brake pads are preferably formed of felt.

The governor assembly 44 is covered by a spider 78, shown best in FIGS. 2, 3*a* and 3*b*, which spider is comprised of a cylindrical disk 80 having three L-shaped legs 82, 84, 86, the short leg portions 82*a*, 84*a* and 86*a* being joined to the interior surface of the disk 80, for example, by welding, and the long leg portions 82*b*, 84*b* and 86*b* extending away from disk 80 and toward governor base plate 46. Each of the legs 82–86 is provided with an opening 82*c*, 84*c*, 86*c* at its free end, each of said openings receiving a fastening member 88, which threadedly engages tapped openings, such as for example, tapped openings 46*b*, 46*c* in base plate 46, for securing spider 80 to base plate 46. Opening 80*a* in disk 80 receives shaft 96, which supports cam member 62 (see

FIG. 9), and opening 80*b* supports guide member 108 (see FIG. 2).

A gasket 90 encircles the periphery of disk 80 and is provided with a continuous groove 90*a* for embracing the peripheral edge of disk 80 (see FIG. 2). An elongated flexible sheet is arranged to rest upon a first shoulder 90*b* provided in gasket 90, and a second shoulder 46*d* arranged about the periphery of base plate 46. Sheet 92 encircles and encloses the governor assembly 44.

The adjustable cam 62 is provided with a mounting opening 62*b* at the end of arm 62*a*, shown best in FIGS. 2, 8*a* and 9. Shaft 96 is force-fitted into opening 62*b* in cam member 62 and has its opposite end extending into opening 98*a* in lever arm 98. The left end of shaft 96 is provided with a flat 96*a* for engagement by a set screw 100, which threadedly engages tapped opening 98*b* in lever arm 98, which tapped opening communicates with opening 98*a* in order to secure shaft 96 to lever arm 98. As was mentioned above, shaft 96 extends through opening 80*a* in disk 80 (see FIG. 3*a*).

The left-hand end of lever arm 98 is provided with a pair of bifurcated arms 98*c*, 98*d* defined by a slot 98*e* arranged therebetween. An opening is provided in each of the arms 98*c*, 98*d* for receiving pin 102, which extends through these openings, as well as an opening 104*a* in a cable anchor 104, whose upper end 104*a* is secured to one end of a cable 106. Cable 106 extends through an opening 108*a* in post 108 secured to spider disk 80 by fastening member 108*b*. The cable extends upwardly along arm 20*b* of U-shaped handle assembly 20, shown in FIG. 1, and has its upper end 106*b* secured to the anchoring end 110*a* of handle 110, which is pivotally mounted to arm 20*b* by pin 112. By swinging handle 110, cable 106 is moved respectively up or down, causing the movement of lever arm 98, which extends through opening 80*a* in spider cylindrical disk 80, as shown best in FIG. 2, in order to rotate lever arm 98 and cam 62.

The position of rotatable cam 62 controls the positioning of button 60 and hence flexible arms 52, 52′ and brake shoes 72, 72′ relative to the cooperating stationary surface 46*a*.

The governor 44 assembly operates as follows:

A person standing upon the treadmill belt 12 may either walk or run in the "uphill" direction, i.e., in a direction from the left toward the right, relative to FIG. 1, causing the upper run 12*a* of treadmill belt 12 to move in the direction shown by arrow 114. The treadmill belt engages hollow cylindrical roller 22, causing it to rotate. Member 34 and hexagonal shaft 38 rotate together with hollow cylindrical roller 22, causing the rotation of flexible blades 52, 52′. The flexible blades 52, 52′ develop a centrifugal force, the magnitude of which controls the deflection of the diagonal portions 52*e*, 52*e*′, 52*f*, 52*f*′ of the flexible blades 52*e*, 52*e*′ towards the left, the greater the angular velocity, the greater the deflection. As the angular velocity and hence the amount of deflection increases, the brake pads 72, 72′, mounted to the ends of blades 52, 52′ engage stationary annular surface 46*a* to limit the angular velocity of roller 22 and hence treadmill belt 12. By adjusting cam member 62 to move shaft 38 further toward the right, the drag imposed upon treadmill belt 12 by the governor assembly 44 is reduced or even removed, allowing the treadmill to move at a faster rate. Conversely, by moving cam member 62 to move shaft 38 further toward the left and against the force of spring 42, the maximum speed of treadmill belt 12 is decreased.

Due to the unique shape of the flexible blades 52, 52′, the outward radial movement of the brake assemblies 74, 74′ is minimal, providing a governor assembly of small, compact size, most of the movement of the brake assembly 74, 74′ occurring in a direction substantially parallel to the axis of rotation of the blades.

The housing of the governor assembly is arranged to be easily and readily removed and replaced to simplify the periodic removal and replacement of the brake pads 72, 72′.

As was mentioned hereinabove, treadmill belt 12 is supported by a plurality of closely-spaced rollers 18. Each roller 18 is mounted upon a shaft 18*a*, the free ends of which extend outwardly from the free ends of the roller 18. The rails 14 and 16 are provided with an intermediate portion 120, shown best in FIGS. 10*b* and 11*a*–11*c*, said intermediate portion having an elongated hollow rectangular-shaped roller shaft supporting section 122, extending inwardly from each rail, such as for example, the rail 14 shown in FIGS. 11*a*–11*c*. The hollow-shaped shaft supporting section 122 is provided with an elongated substantially rectangular-shaped hollow interior 124. In order to mount the shafts 18*a* of rollers 18, slots 14*a* are machined into the inwardly extending projection 122 at regular intervals, as shown in FIG. 10*b*. The slots 14*a* are open at their bottom ends.

At least one end of the hollow interior 124 provided in hollow shaft supporting section projection 122 is open.

Once the slots 14*a* are machined or otherwise formed in shaft supporting section 122, one end of the shafts 18*a* are each inserted upwardly into one of the slots 14*a* to be arranged in the manner shown in FIGS. 10*b* and 11*a*. The shafts 18*a* are lifted upwardly to rest against the upper end 14*a*–1 of each slot 14*a* and an elongated rod 126, preferably having a rectangular-shaped cross-section, is inserted through the open right-hand end of section 122 and into hollow elongated interior 124. The rollers 18 and shafts 18*a* are lifted, in order to pass rod 124 beneath each of the shafts 18*a*, so that the rod 126 supports all of the shafts 18*a* at a uniform height.

An elongated resilient compressible rope-like member 130 is preferably initially inserted into hollow elongated opening 124, in order to be positioned between rollers 18*a* and the interior top surface 132 of elongated opening 134. The diameter of rope-like member 130 is preferably greater than the distance between top interior wall 132 and engaging portion of roller shaft 18*a* to provide a tight fit of shaft 18*a* within slot 14*a*, and to prevent any "play" between shafts 18*a*, rod 126 and shaft supporting section 122.

Rod 124 supports all of the rollers 18*a* at a proper uniform height, while rope-like member 130 compensates for any play between the shaft 18*a*, the upper end of each slot 14*b* and elongated rod 126. Elongated rod 126 serves the dual function of supporting all of the roller shafts at the proper uniform height and of retaining all of the shafts 18*a* in their operating position without the need for any fastening means whatsoever. It should be understood that the mounting arrangement provided in rail 16 is identical to that described in connection with rail 14. Preferably rope-like member 130 is placed within hollow interior 124 prior to insertion of the shafts 18*a* into slots 14*a*.

The rails 14 and 16 are preferably formed through an extrusion process, thus further significantly reducing the cost of components as well as reducing the fabrication and assembly costs.

A latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances, some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A governor assembly for use in treadmills and the like, comprising a rotatable member having an opening in one end thereof of a predetermined cross-section;

a second member having a cross-sectional configuration conforming to the shape of the opening in said first member slidably extending at least partially into the opening of said first member;

bias means engaging one end of said second member for normally biasing said second member in a first direction;

a pivotally-mounted cam member having a diagonally-aligned cam surface engageable with the opposite end of said second member and limiting movement of said second member in said first direction in accordance with the angular orientation of said cam member;

at least one flexible blade member having a portion secured to said second member at a location beyond the one end of said first member;

said blade member having at least one blade arm portion extending diagonally outwardly from said second member;

a brake pad secured to the free end of said blade member;

said diagonally-aligned blade arm portion forming an angle with the imaginary rotational axis of said blade arm of less than 90°, when said blade member is stationary, said blade arm portion being urged in a direction to increase said angle as a function of increasing rotational speed of said blade arm, the free end of said blade member generally defining a circular path;

a stationary member having an annular surface surrounding the imaginary axis of rotation of said blade member and positioned a spaced distance from the brake pad on said blade member when said blade member is stationary and adapted to be engaged by said brake pad when said blade member is rotated at a predetermined angular velocity, the value of said angular velocity being a function of the spacing between the brake pad and the stationary surface when the blade member is stationary, being adjusted by said cam member.

2. The apparatus of claim 1, wherein said flexible blade member comprises a pair of thin flexible metallic blades having their inner ends joined to said second member and a spacer member arranged between the free ends of said blade arms;

said brake pad being joined to the blade positioned closer to said stationary surface.

3. The apparatus of claim 1 further comprising an operating handle arranged at a position remote from said cam member;

a cable joined between one end of said pivotally-mounted operating handle and said pivotally-mounted cam member for adjustably pivoting said cam member.

4. The apparatus of claim 1 further comprising a removable cover assembly enclosing said blade member;

said cam member being pivotally mounted upon one surface of said cover assembly.

5. The apparatus of claim 1 further comprising a flywheel member joined to the end of said first member opposite said second member;

said first member being rotatably mounted in a free-wheeling fashion.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,544,152

DATED : October 1, 1985

INVENTOR(S) : Charles M. Taitel and Janice B. Taitel

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the title page
after "Charles M. Taitel," insert --and Janice B. Taitel, both of--.

Signed and Sealed this

Twelfth Day of *August 1986*

[SEAL]

Attest:

Attesting Officer

DONALD J. QUIGG

Commissioner of Patents and Trademarks

APPENDIX D

US006783482B2

(12) **United States Patent**
Oglesby et al.

(10) **Patent No.: US 6,783,482 B2**
(45) **Date of Patent: Aug. 31, 2004**

(54) **TREADMILL CONTROL SYSTEM**

(75) Inventors: **Gary E. Oglesby**, Manhattan, IL (US); **Emil S. Golen, Jr.**, Barrington, IL (US); **James B. Fox**, Elk Grove Village, IL (US); **John Danile**, Algonquin, IL (US); **Robert D. Kohan**, Naperville, IL (US); **Christopher E. Clawson**, Palatine, IL (US); **Kenneth F. Lantz**, Poquoson, VA (US); **Daniel R. Wille**, St. Louis Park, MN (US); **Timothy J. Porth**, Bloomington, MN (US)

(73) Assignee: **Brunswick Corporation**, Lake Forest, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 310 days.

(21) Appl. No.: **09/944,142**

(22) Filed: **Sep. 4, 2001**

(65) **Prior Publication Data**

US 2002/0045517 A1 Apr. 18, 2002

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/651,249, filed on Aug. 30, 2000, now Pat. No. 6,626,803.
(60) Provisional application No. 60/230,733, filed on Sep. 7, 2000.

(51) **Int. Cl.**[7] **A63B 22/00**
(52) **U.S. Cl.** **482/54**; 482/51
(58) **Field of Search** 482/51, 54

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Primary Examiner—Glenn E. Richman
(74) *Attorney, Agent, or Firm*—Michael B. McMurry

(57) **ABSTRACT**

A microprocessor based exercise treadmill control system is disclosed which includes various features to enhance user operation. These features include programs operative to: permit a set of user controls to cause the treadmill to initially operate at predetermined speeds; permit the user to design custom workouts; permit the user to switch between workout programs while the treadmill is in operation; and perform an automatic cooldown program where the duration of the cooldown is a function of the duration of the workout or the user's heart rate. The features also include a stop program responsive to a detector for automatically stopping the treadmill when a user is no longer on the treadmill and a frame tag module attached to the treadmill frame having a non-volatile memory for storing treadmill configuration, and operational and maintenance data. Another included feature is the ability to display the amount of time a user spends in a heart rate zone.

10 Claims, 16 Drawing Sheets

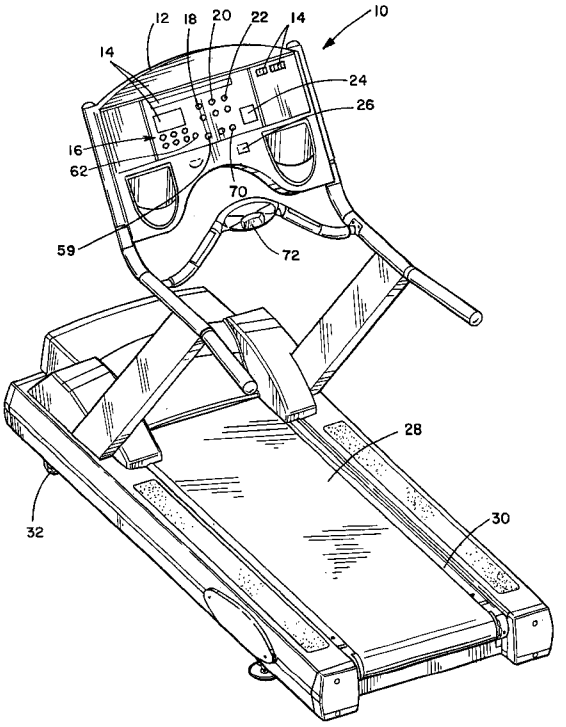
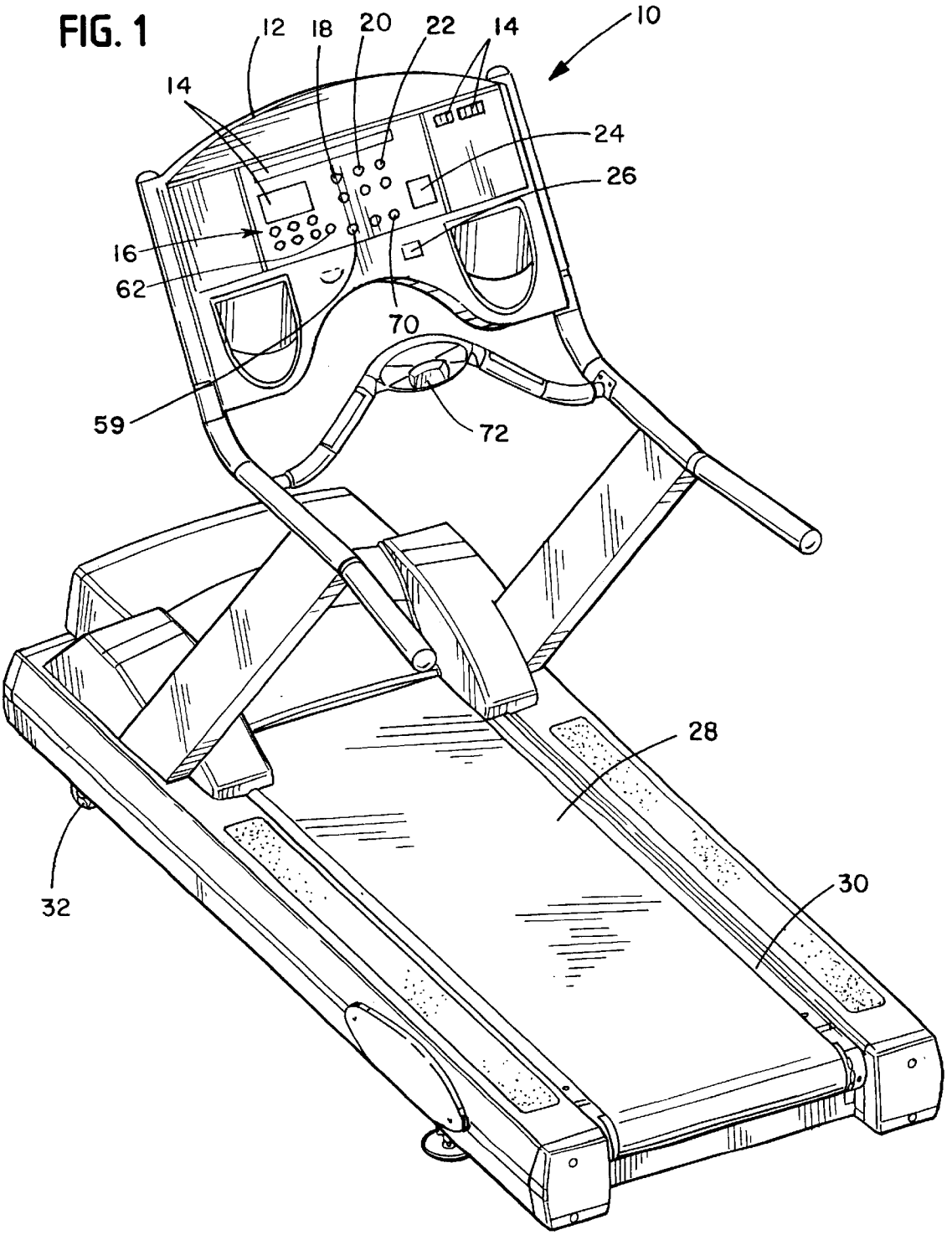


FIG. 1



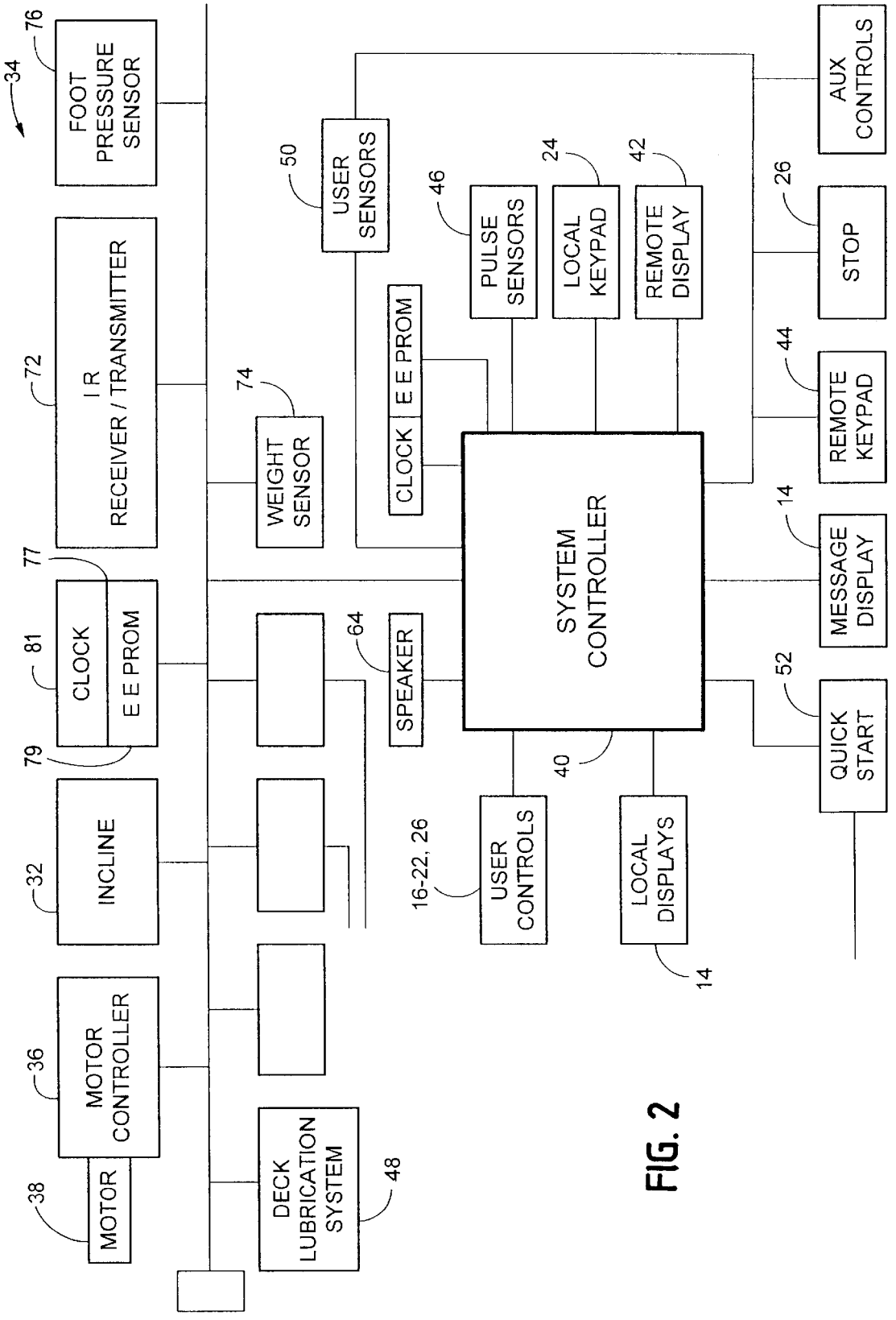

34
76
FOOT PRESSURE SENSOR
72
I R RECEIVER / TRANSMITTER
77
CLOCK
E E PROM
81
79
32
INCLINE
36
MOTOR CONTROLLER
38
MOTOR
48
DECK LUBRICATION SYSTEM
74
WEIGHT SENSOR
64
SPEAKER
50
USER SENSORS
CLOCK
E E PROM
46
PULSE SENSORS
24
LOCAL KEYPAD
42
REMOTE DISPLAY
SYSTEM CONTROLLER
40
16-22, 26
USER CONTROLS
LOCAL DISPLAYS
14
AUX CONTROLS
26
STOP
44
REMOTE KEYPAD
14
MESSAGE DISPLAY
52
QUICK START

FIG. 2

FIG. 3

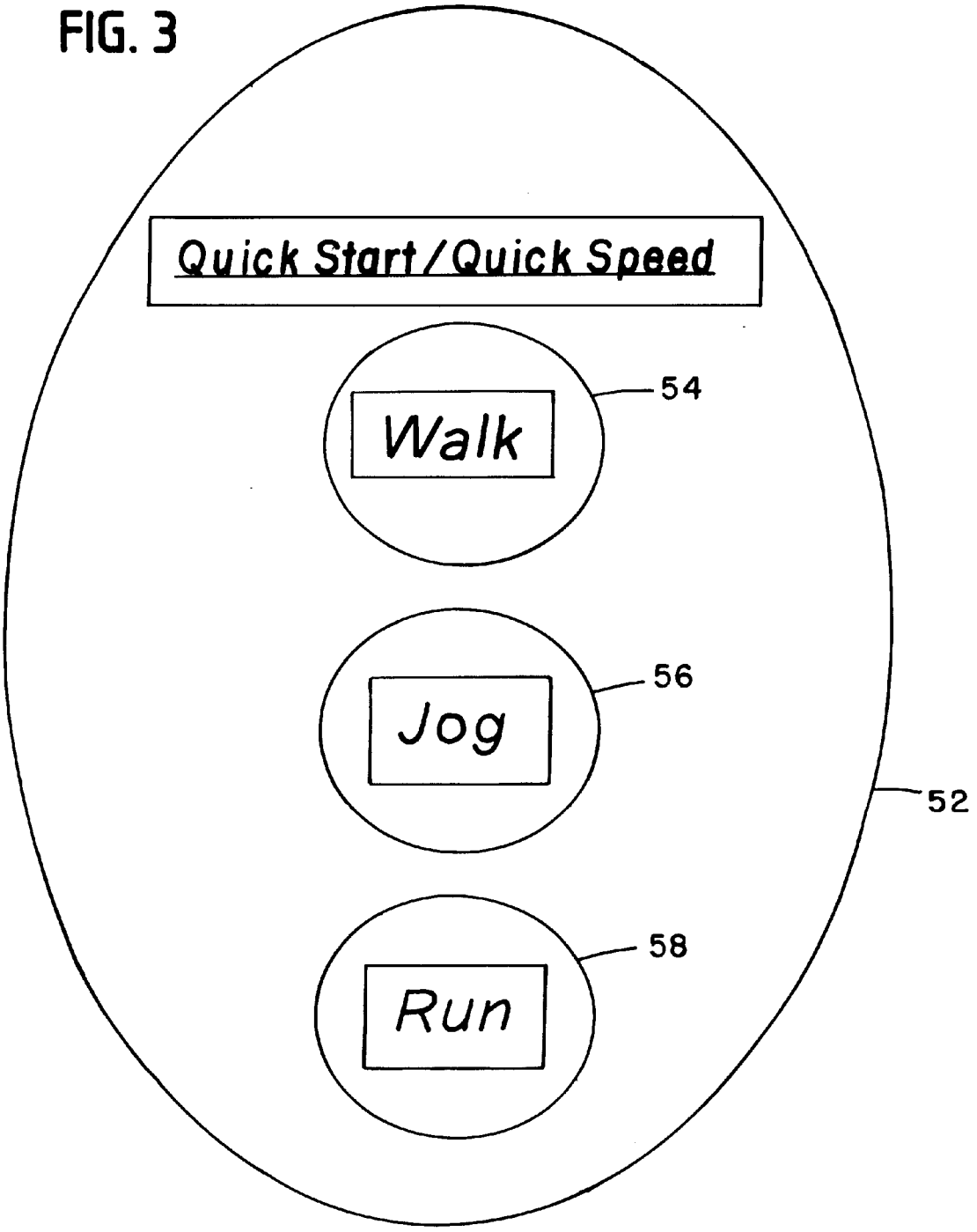
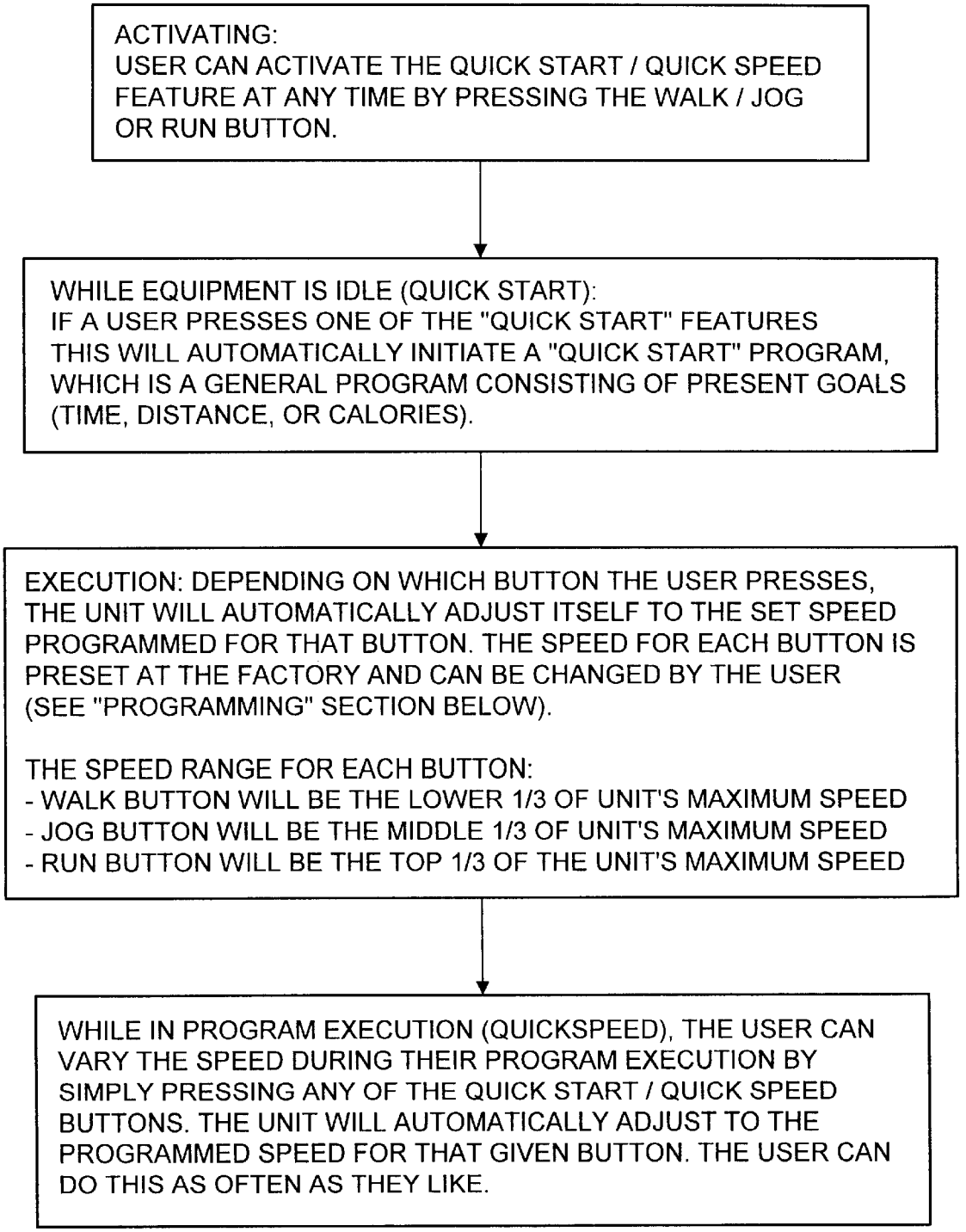


FIG. 4


ACTIVATING:
USER CAN ACTIVATE THE QUICK START / QUICK SPEED FEATURE AT ANY TIME BY PRESSING THE WALK / JOG OR RUN BUTTON.
WHILE EQUIPMENT IS IDLE (QUICK START):
IF A USER PRESSES ONE OF THE "QUICK START" FEATURES THIS WILL AUTOMATICALLY INITIATE A "QUICK START" PROGRAM, WHICH IS A GENERAL PROGRAM CONSISTING OF PRESENT GOALS (TIME, DISTANCE, OR CALORIES).
EXECUTION: DEPENDING ON WHICH BUTTON THE USER PRESSES, THE UNIT WILL AUTOMATICALLY ADJUST ITSELF TO THE SET SPEED PROGRAMMED FOR THAT BUTTON. THE SPEED FOR EACH BUTTON IS PRESET AT THE FACTORY AND CAN BE CHANGED BY THE USER (SEE "PROGRAMMING" SECTION BELOW).
THE SPEED RANGE FOR EACH BUTTON:
- WALK BUTTON WILL BE THE LOWER 1/3 OF UNIT'S MAXIMUM SPEED
- JOG BUTTON WILL BE THE MIDDLE 1/3 OF UNIT'S MAXIMUM SPEED
- RUN BUTTON WILL BE THE TOP 1/3 OF THE UNIT'S MAXIMUM SPEED
WHILE IN PROGRAM EXECUTION (QUICKSPEED), THE USER CAN VARY THE SPEED DURING THEIR PROGRAM EXECUTION BY SIMPLY PRESSING ANY OF THE QUICK START / QUICK SPEED BUTTONS. THE UNIT WILL AUTOMATICALLY ADJUST TO THE PROGRAMMED SPEED FOR THAT GIVEN BUTTON. THE USER CAN DO THIS AS OFTEN AS THEY LIKE.

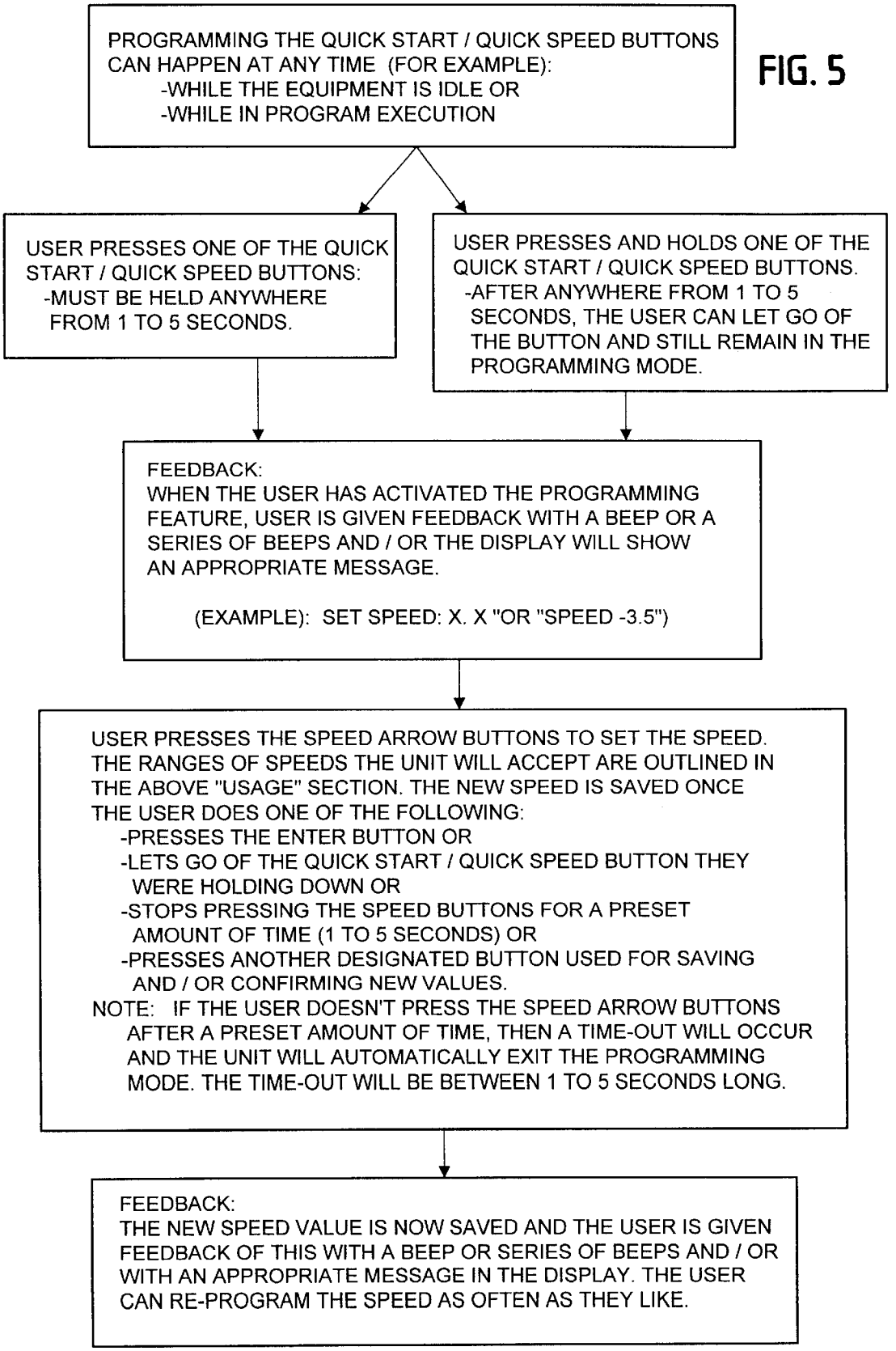

PROGRAMMING THE QUICK START / QUICK SPEED BUTTONS CAN HAPPEN AT ANY TIME (FOR EXAMPLE):
-WHILE THE EQUIPMENT IS IDLE OR
-WHILE IN PROGRAM EXECUTION
USER PRESSES ONE OF THE QUICK START / QUICK SPEED BUTTONS:
-MUST BE HELD ANYWHERE FROM 1 TO 5 SECONDS.
USER PRESSES AND HOLDS ONE OF THE QUICK START / QUICK SPEED BUTTONS.
-AFTER ANYWHERE FROM 1 TO 5 SECONDS, THE USER CAN LET GO OF THE BUTTON AND STILL REMAIN IN THE PROGRAMMING MODE.
FEEDBACK:
WHEN THE USER HAS ACTIVATED THE PROGRAMMING FEATURE, USER IS GIVEN FEEDBACK WITH A BEEP OR A SERIES OF BEEPS AND / OR THE DISPLAY WILL SHOW AN APPROPRIATE MESSAGE.
(EXAMPLE): SET SPEED: X. X "OR "SPEED -3.5")
USER PRESSES THE SPEED ARROW BUTTONS TO SET THE SPEED. THE RANGES OF SPEEDS THE UNIT WILL ACCEPT ARE OUTLINED IN THE ABOVE "USAGE" SECTION. THE NEW SPEED IS SAVED ONCE THE USER DOES ONE OF THE FOLLOWING:
-PRESSES THE ENTER BUTTON OR
-LETS GO OF THE QUICK START / QUICK SPEED BUTTON THEY WERE HOLDING DOWN OR
-STOPS PRESSING THE SPEED BUTTONS FOR A PRESET AMOUNT OF TIME (1 TO 5 SECONDS) OR
-PRESSES ANOTHER DESIGNATED BUTTON USED FOR SAVING AND / OR CONFIRMING NEW VALUES.
NOTE: IF THE USER DOESN'T PRESS THE SPEED ARROW BUTTONS AFTER A PRESET AMOUNT OF TIME, THEN A TIME-OUT WILL OCCUR AND THE UNIT WILL AUTOMATICALLY EXIT THE PROGRAMMING MODE. THE TIME-OUT WILL BE BETWEEN 1 TO 5 SECONDS LONG.
FEEDBACK:
THE NEW SPEED VALUE IS NOW SAVED AND THE USER IS GIVEN FEEDBACK OF THIS WITH A BEEP OR SERIES OF BEEPS AND / OR WITH AN APPROPRIATE MESSAGE IN THE DISPLAY. THE USER CAN RE-PROGRAM THE SPEED AS OFTEN AS THEY LIKE.

FIG. 5

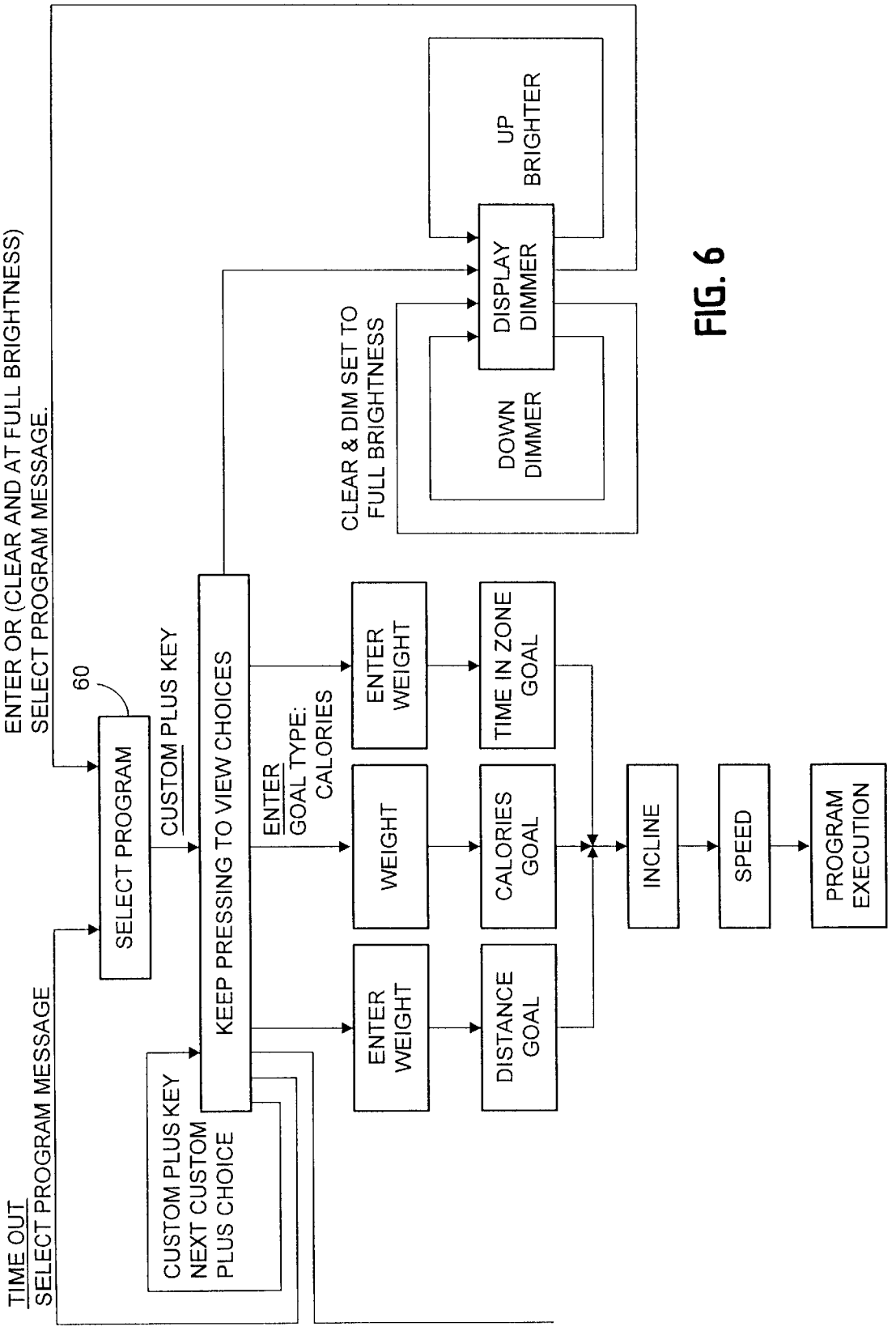

ENTER OR (CLEAR AND AT FULL BRIGHTNESS)
SELECT PROGRAM MESSAGE.
60
SELECT PROGRAM
CUSTOM PLUS KEY
KEEP PRESSING TO VIEW CHOICES
ENTER
GOAL TYPE:
CALORIES
ENTER WEIGHT
WEIGHT
CALORIES GOAL
TIME IN ZONE GOAL
ENTER WEIGHT
DISTANCE GOAL
INCLINE
SPEED
PROGRAM EXECUTION
CLEAR & DIM SET TO FULL BRIGHTNESS
DISPLAY DIMMER
UP BRIGHTER
DOWN DIMMER
CUSTOM PLUS KEY NEXT CUSTOM PLUS CHOICE
TIME OUT
SELECT PROGRAM MESSAGE

FIG. 6

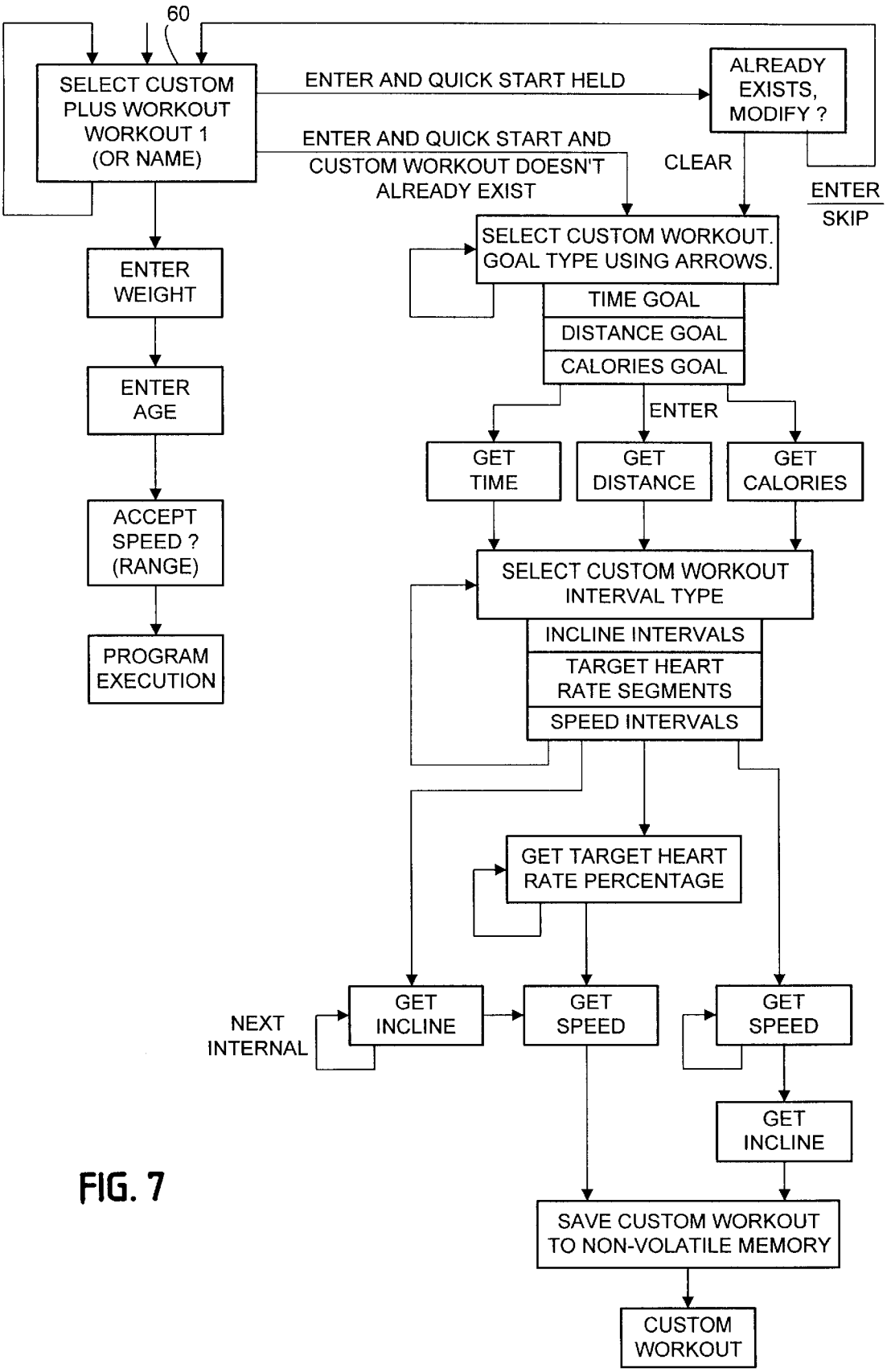
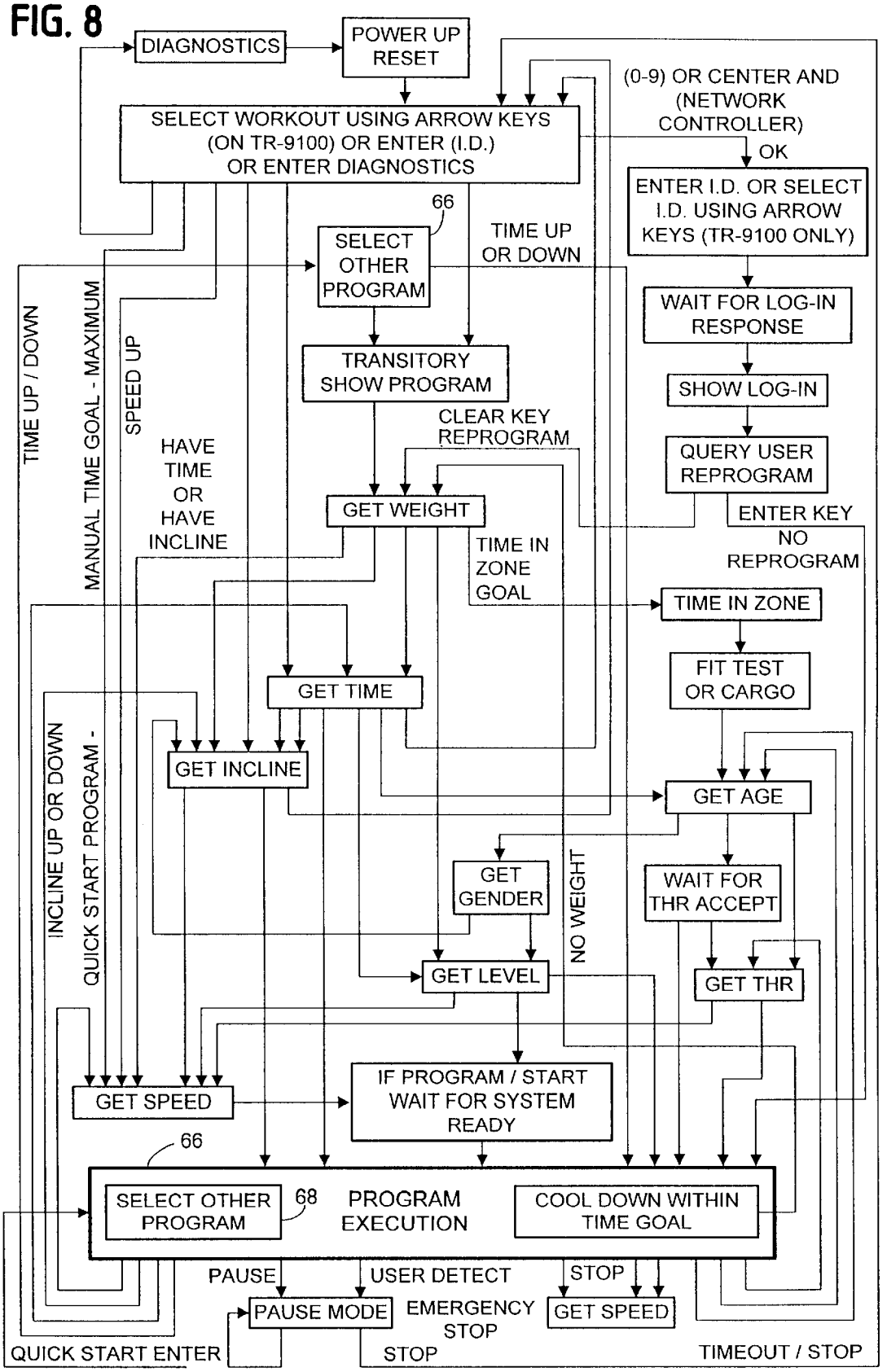

60
SELECT CUSTOM PLUS WORKOUT WORKOUT 1 (OR NAME)
ENTER AND QUICK START HELD
ALREADY EXISTS, MODIFY ?
ENTER AND QUICK START AND CUSTOM WORKOUT DOESN'T ALREADY EXIST
CLEAR
ENTER
SKIP
ENTER WEIGHT
SELECT CUSTOM WORKOUT. GOAL TYPE USING ARROWS.
TIME GOAL
DISTANCE GOAL
CALORIES GOAL
ENTER
ENTER AGE
GET TIME
GET DISTANCE
GET CALORIES
ACCEPT SPEED ? (RANGE)
SELECT CUSTOM WORKOUT INTERVAL TYPE
INCLINE INTERVALS
TARGET HEART RATE SEGMENTS
SPEED INTERVALS
PROGRAM EXECUTION
GET TARGET HEART RATE PERCENTAGE
NEXT INTERNAL
GET INCLINE
GET SPEED
GET SPEED
GET INCLINE
SAVE CUSTOM WORKOUT TO NON-VOLATILE MEMORY
CUSTOM WORKOUT

FIG. 7

FIG. 8


DIAGNOSTICS
POWER UP RESET
SELECT WORKOUT USING ARROW KEYS (ON TR-9100) OR ENTER (I.D.) OR ENTER DIAGNOSTICS
(0-9) OR CENTER AND (NETWORK CONTROLLER) OK
ENTER I.D. OR SELECT I.D. USING ARROW KEYS (TR-9100 ONLY)
66
SELECT OTHER PROGRAM
TIME UP OR DOWN
WAIT FOR LOG-IN RESPONSE
TRANSITORY SHOW PROGRAM
SHOW LOG-IN
CLEAR KEY REPROGRAM
QUERY USER REPROGRAM
TIME UP / DOWN
MANUAL TIME GOAL - MAXIMUM
SPEED UP
HAVE TIME OR HAVE INCLINE
GET WEIGHT
ENTER KEY NO REPROGRAM
TIME IN ZONE GOAL
TIME IN ZONE
FIT TEST OR CARGO
GET TIME
INCLINE UP OR DOWN
QUICK START PROGRAM -
GET INCLINE
GET AGE
GET GENDER
NO WEIGHT
WAIT FOR THR ACCEPT
GET LEVEL
GET THR
GET SPEED
IF PROGRAM / START WAIT FOR SYSTEM READY
66
SELECT OTHER PROGRAM
68
PROGRAM EXECUTION
COOL DOWN WITHIN TIME GOAL
PAUSE
USER DETECT
STOP
PAUSE MODE
EMERGENCY STOP
GET SPEED
QUICK START ENTER
STOP
TIMEOUT / STOP

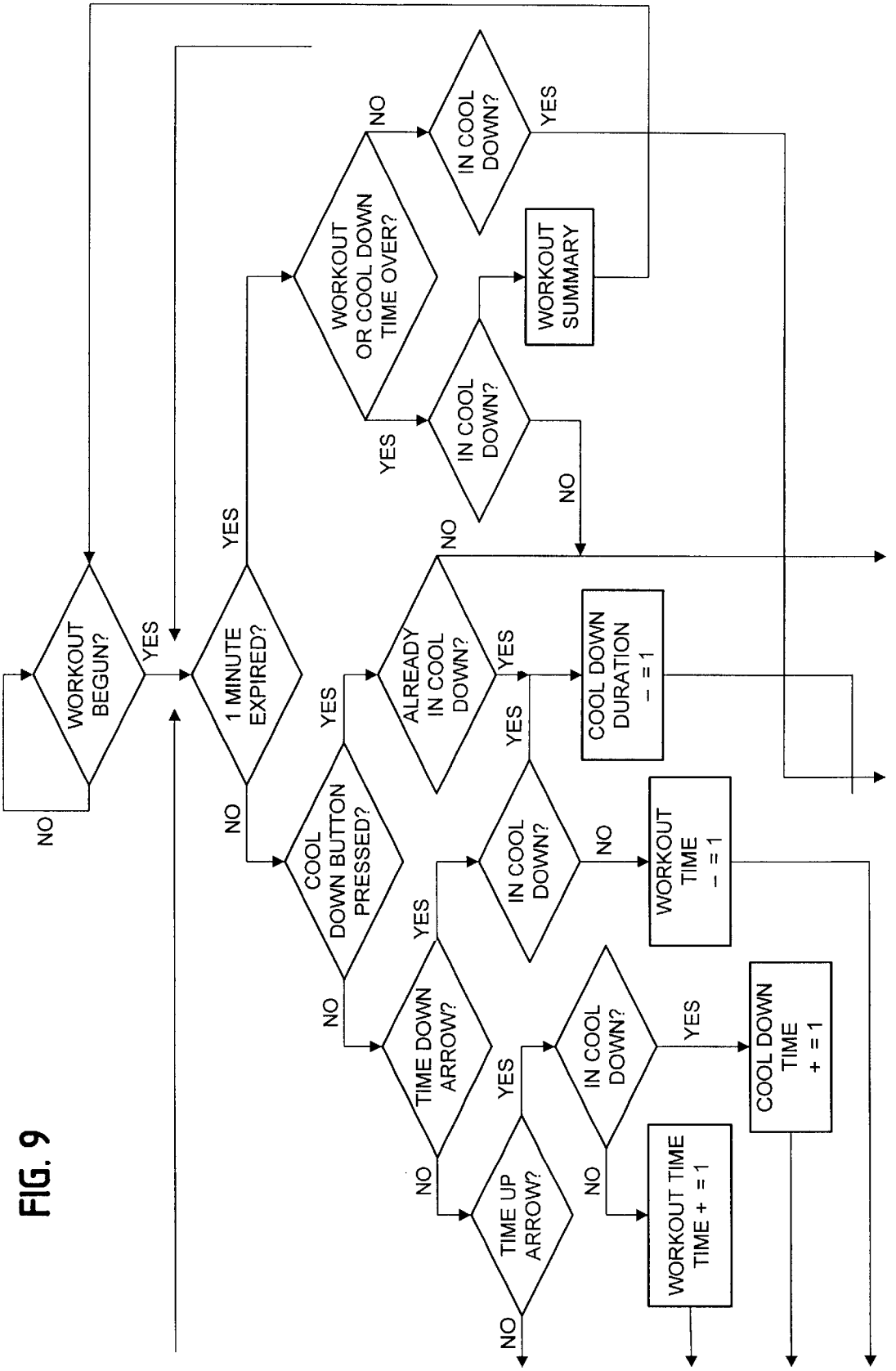

WORKOUT BEGUN?
NO
YES
1 MINUTE EXPIRED?
NO
YES
COOL DOWN BUTTON PRESSED?
NO
YES
TIME DOWN ARROW?
NO
YES
TIME UP ARROW?
NO
YES
ALREADY IN COOL DOWN?
NO
YES
COOL DOWN DURATION - = 1
IN COOL DOWN?
NO
YES
WORKOUT TIME - = 1
IN COOL DOWN?
NO
YES
WORKOUT TIME TIME + = 1
COOL DOWN TIME + = 1
WORKOUT OR COOL DOWN TIME OVER?
NO
YES
IN COOL DOWN?
NO
YES
WORKOUT SUMMARY

FIG. 9

FIG. 10A

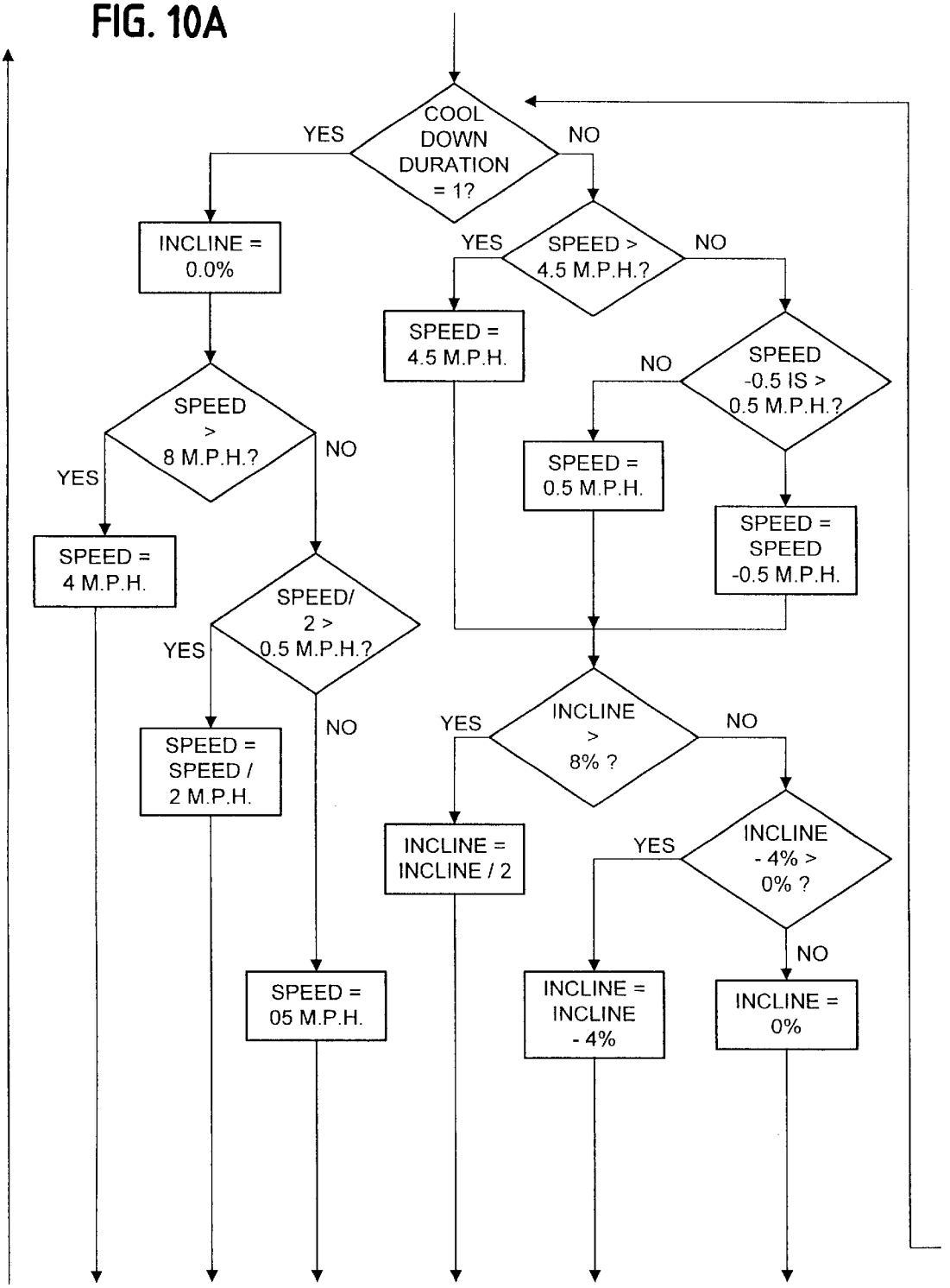

COOL DOWN DURATION = 1?
YES
NO
INCLINE = 0.0%
SPEED > 4.5 M.P.H.?
YES
NO
SPEED = 4.5 M.P.H.
SPEED -0.5 IS > 0.5 M.P.H.?
NO
SPEED = 0.5 M.P.H.
SPEED = SPEED -0.5 M.P.H.
SPEED > 8 M.P.H.?
YES
NO
SPEED = 4 M.P.H.
SPEED/ 2 > 0.5 M.P.H.?
YES
NO
SPEED = SPEED / 2 M.P.H.
SPEED = 05 M.P.H.
INCLINE > 8% ?
YES
NO
INCLINE = INCLINE / 2
INCLINE - 4% > 0% ?
YES
NO
INCLINE = INCLINE - 4%
INCLINE = 0%

FIG. 10B

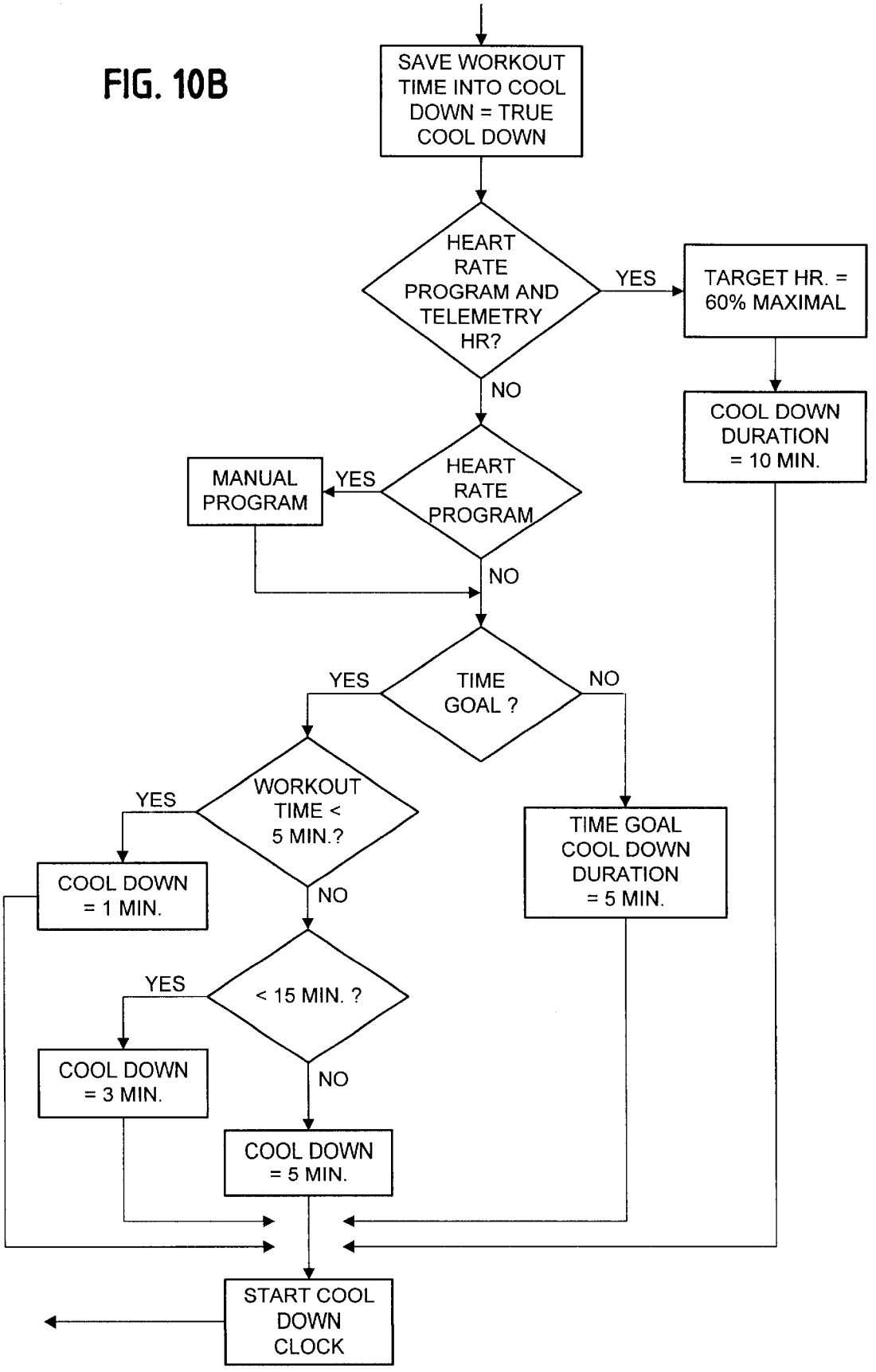

SAVE WORKOUT TIME INTO COOL DOWN = TRUE COOL DOWN
HEART RATE PROGRAM AND TELEMETRY HR?
YES
TARGET HR. = 60% MAXIMAL
NO
COOL DOWN DURATION = 10 MIN.
MANUAL PROGRAM
YES
HEART RATE PROGRAM
NO
YES
TIME GOAL ?
NO
YES
WORKOUT TIME < 5 MIN.?
TIME GOAL COOL DOWN DURATION = 5 MIN.
COOL DOWN = 1 MIN.
NO
YES
< 15 MIN. ?
COOL DOWN = 3 MIN.
NO
COOL DOWN = 5 MIN.
START COOL DOWN CLOCK

FIG. 11

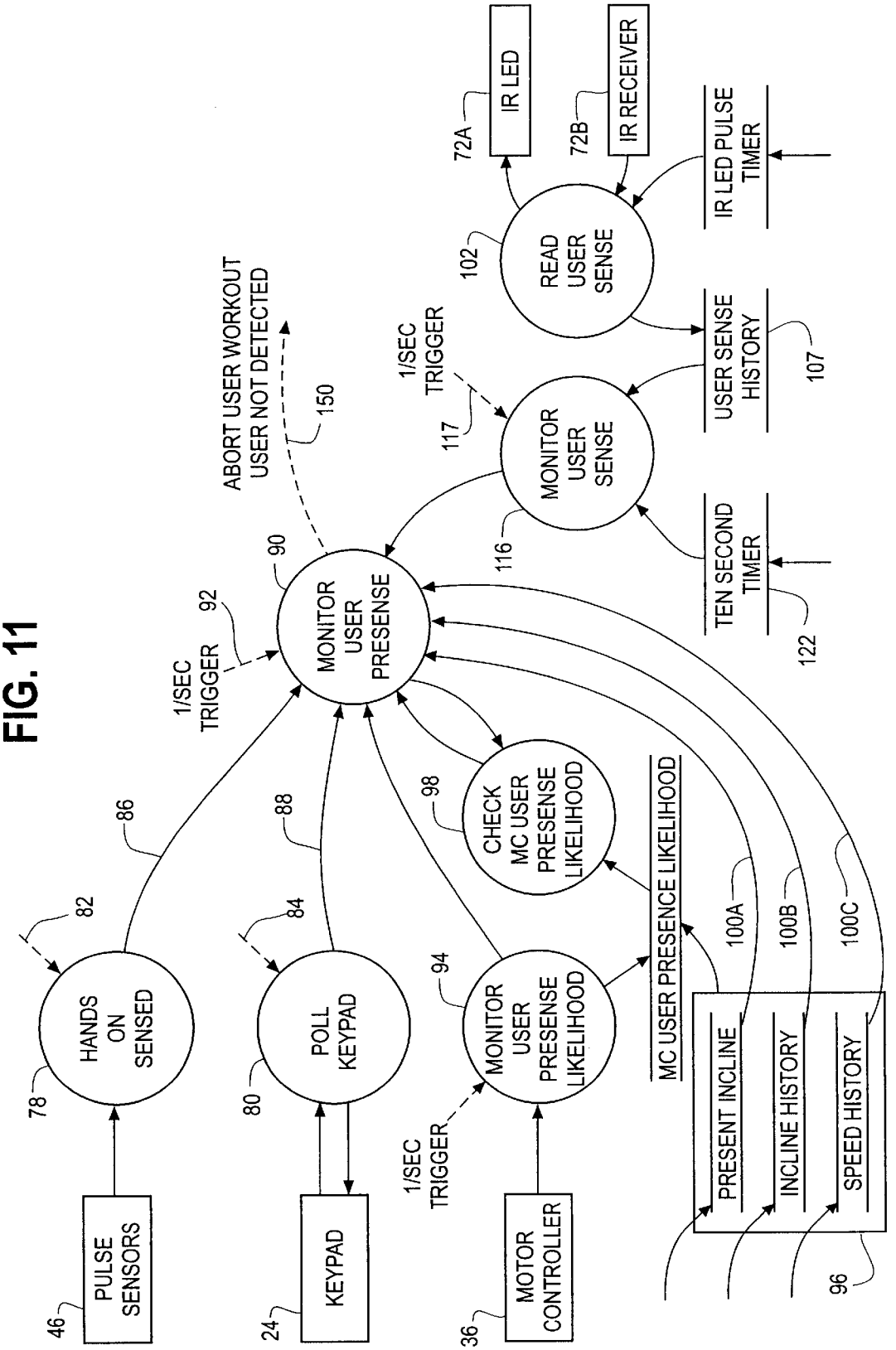

PULSE SENSORS
46
KEYPAD
24
MOTOR CONTROLLER
36
HANDS ON SENSED
78
POLL KEYPAD
80
MONITOR USER PRESENSE LIKELIHOOD
94
82
84
86
88
98
1/SEC TRIGGER
1/SEC TRIGGER
1/SEC TRIGGER
92
MONITOR USER PRESENSE
90
CHECK MC USER PRESENSE LIKELIHOOD
MC USER PRESENCE LIKELIHOOD
100A
100B
100C
PRESENT INCLINE
INCLINE HISTORY
SPEED HISTORY
96
ABORT USER WORKOUT
USER NOT DETECTED
150
117
MONITOR USER SENSE
116
TEN SECOND TIMER
122
USER SENSE HISTORY
107
READ USER SENSE
102
IR LED
72A
IR RECEIVER
72B
IR LED PULSE TIMER

FIG. 12A

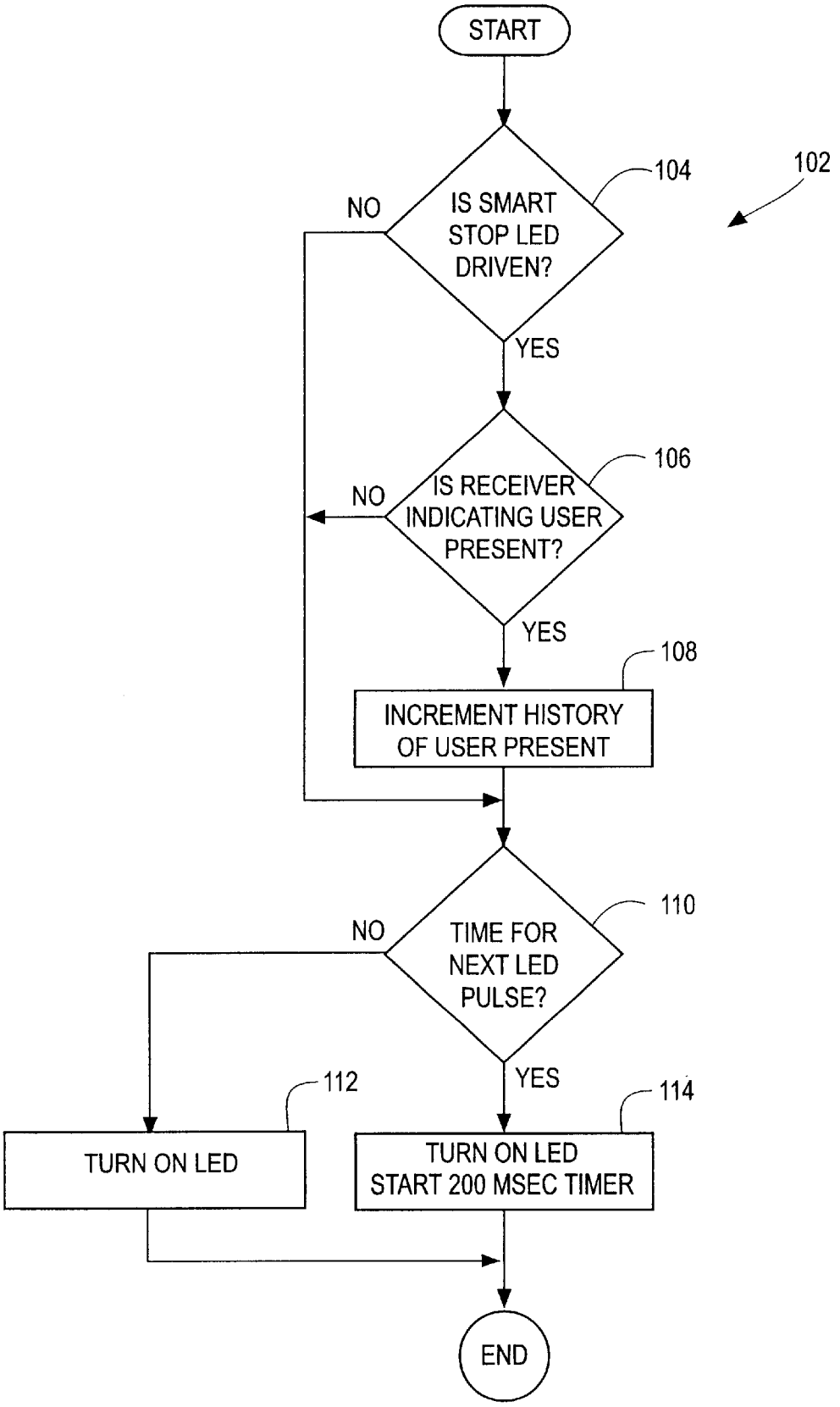

START
IS SMART STOP LED DRIVEN?
104
102
NO
YES
IS RECEIVER INDICATING USER PRESENT?
106
NO
YES
INCREMENT HISTORY OF USER PRESENT
108
TIME FOR NEXT LED PULSE?
110
NO
YES
TURN ON LED
112
TURN ON LED START 200 MSEC TIMER
114
END

FIG. 12B

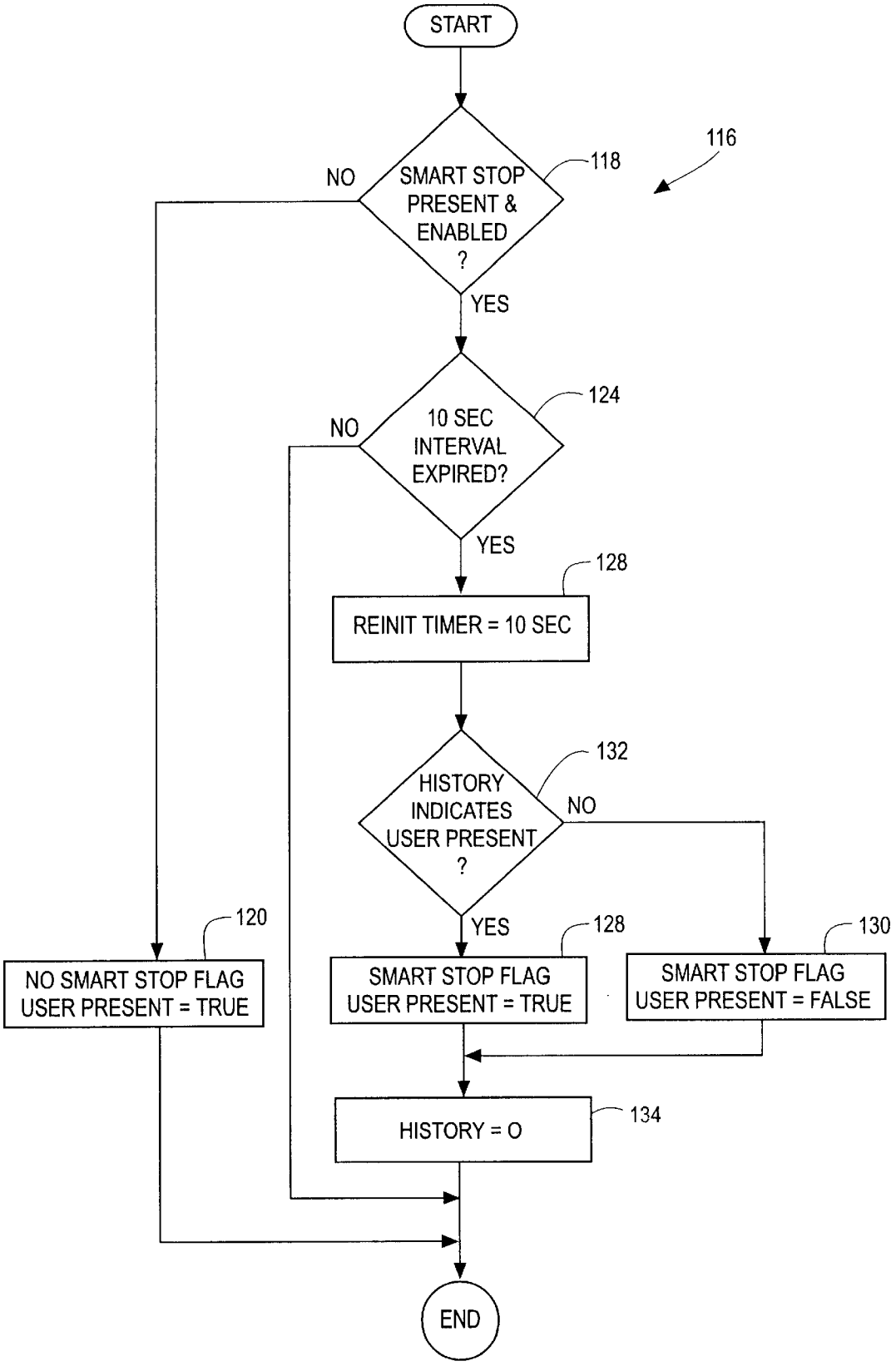

START
SMART STOP PRESENT & ENABLED ?
118
116
NO
YES
10 SEC INTERVAL EXPIRED?
124
NO
YES
REINIT TIMER = 10 SEC
128
HISTORY INDICATES USER PRESENT ?
132
NO
YES
NO SMART STOP FLAG USER PRESENT = TRUE
120
SMART STOP FLAG USER PRESENT = TRUE
128
SMART STOP FLAG USER PRESENT = FALSE
130
HISTORY = O
134
END

FIG. 12C

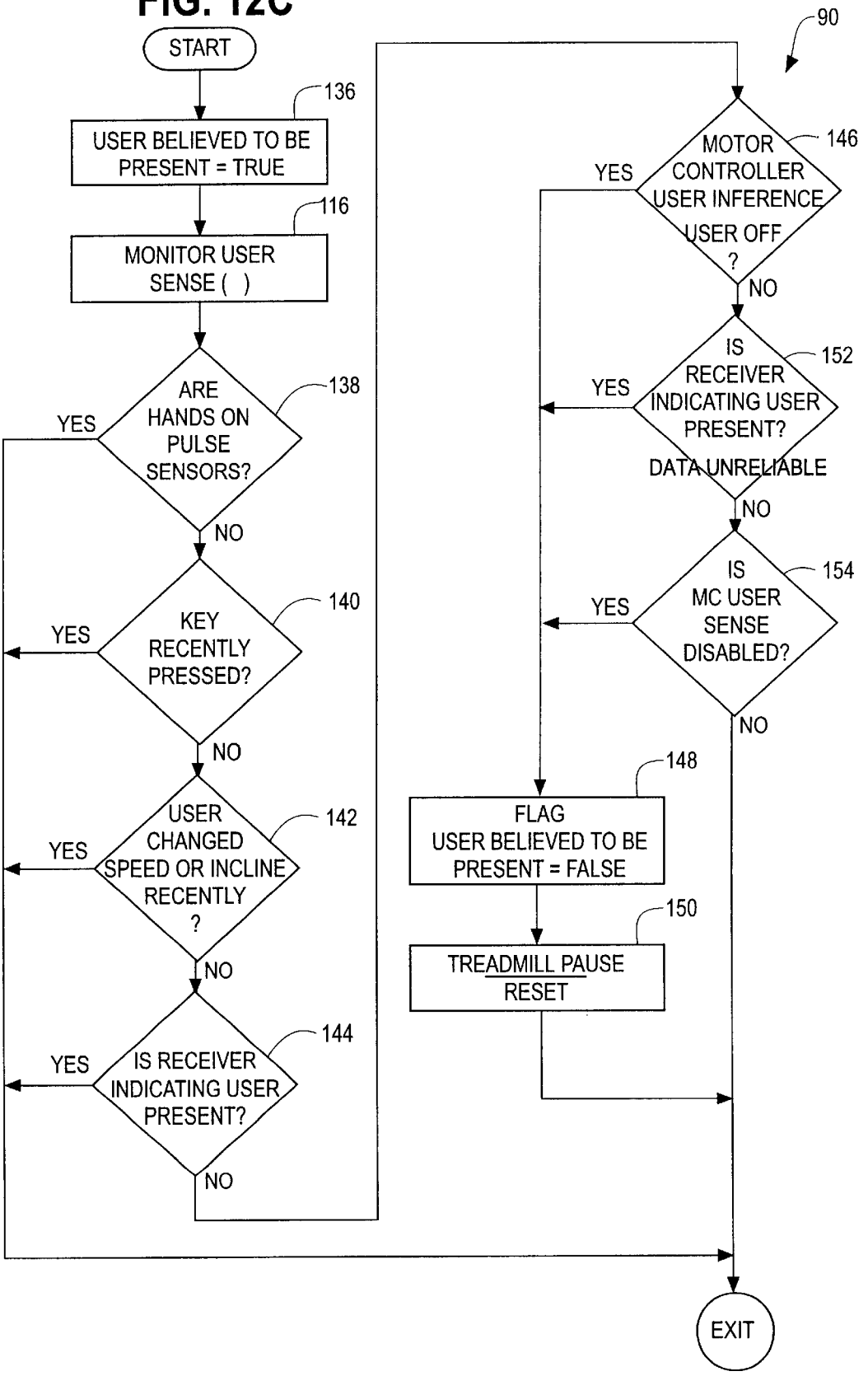
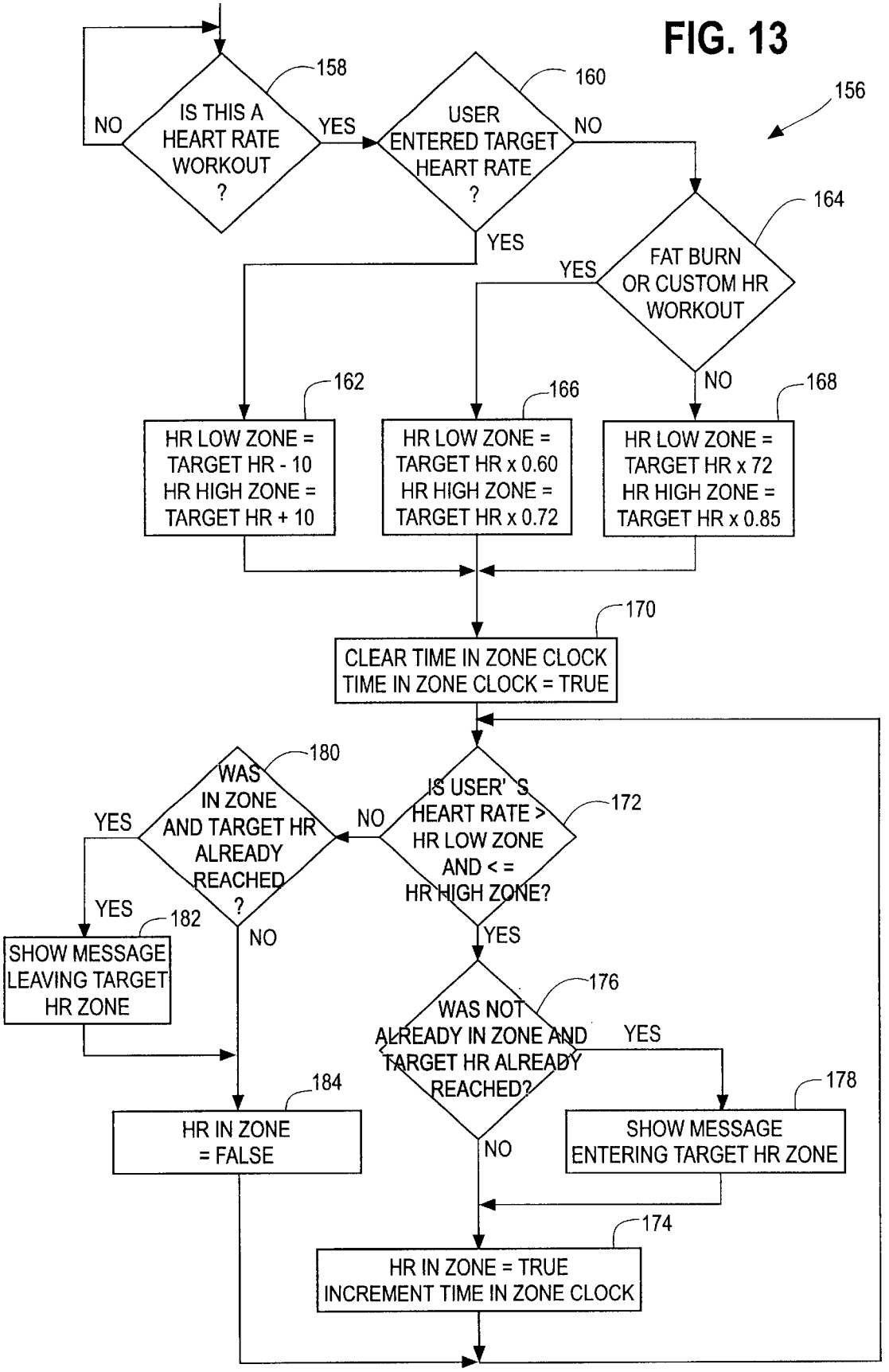

START
136
USER BELIEVED TO BE PRESENT = TRUE
116
MONITOR USER SENSE ( )
138
ARE HANDS ON PULSE SENSORS?
YES
NO
140
KEY RECENTLY PRESSED?
YES
NO
142
USER CHANGED SPEED OR INCLINE RECENTLY ?
YES
NO
144
IS RECEIVER INDICATING USER PRESENT?
YES
NO
90
146
MOTOR CONTROLLER USER INFERENCE USER OFF ?
YES
NO
152
IS RECEIVER INDICATING USER PRESENT? DATA UNRELIABLE
YES
NO
154
IS MC USER SENSE DISABLED?
YES
NO
148
FLAG USER BELIEVED TO BE PRESENT = FALSE
150
TREADMILL PAUSE RESET
EXIT

FIG. 13


156
158
IS THIS A HEART RATE WORKOUT ?
NO
YES
160
USER ENTERED TARGET HEART RATE ?
NO
YES
164
FAT BURN OR CUSTOM HR WORKOUT
YES
NO
162
HR LOW ZONE = TARGET HR - 10
HR HIGH ZONE = TARGET HR + 10
166
HR LOW ZONE = TARGET HR x 0.60
HR HIGH ZONE = TARGET HR x 0.72
168
HR LOW ZONE = TARGET HR x 72
HR HIGH ZONE = TARGET HR x 0.85
170
CLEAR TIME IN ZONE CLOCK
TIME IN ZONE CLOCK = TRUE
180
WAS IN ZONE AND TARGET HR ALREADY REACHED ?
YES
NO
172
IS USER' S HEART RATE > HR LOW ZONE AND < = HR HIGH ZONE?
NO
YES
182
SHOW MESSAGE LEAVING TARGET HR ZONE
YES
NO
176
WAS NOT ALREADY IN ZONE AND TARGET HR ALREADY REACHED?
YES
NO
178
SHOW MESSAGE ENTERING TARGET HR ZONE
184
HR IN ZONE = FALSE
174
HR IN ZONE = TRUE
INCREMENT TIME IN ZONE CLOCK

TREADMILL CONTROL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation in part of application Ser. No. 09/651,249, filed Aug. 30, 2000, U.S. Pat. No. 6,626,803, which claims the benefit of Provisional application Ser. No. 60/230,733, filed Sep. 7, 2000.

FIELD OF THE INVENTION

This invention generally relates to exercise equipment and in particular to exercise treadmills having control systems utilizing microprocessors.

BACKGROUND OF THE INVENTION

Exercise treadmills are widely used for performing walking or running aerobic-type exercise while the user remains in a relatively stationary position. In addition exercise treadmills are used for diagnostic and therapeutic purposes. Generally, for all of these purposes, the person on the treadmill performs an exercise routine at a relatively steady and continuous level of physical activity. One example of such a treadmill is provided in U.S. Pat. No. 5,752, 897.

Although exercise treadmills that operate using a microprocessor based control system have reached a relatively high state of development, there are a number of significant improvements in the program software that can improve the user's exercise experience.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide an exercise treadmill having improved user programs.

A further object of the invention is to provide a treadmill having a control panel that includes a standard set of user controls with a second set of quick start user controls that permits the user to select certain predetermined treadmill operating parameters such as speed to initiate a workout or to change to one of the predetermined speeds during a workout.

Another object of the invention is to provide a treadmill having a control panel that includes user controls that permit the user to program custom user workouts which have certain operating parameters such as speed and inclination where the custom workouts have greater flexibility than the standard workouts normally programed in a treadmill.

An additional object of the invention is to permit the user to switch programs while the treadmill is operating by merely pressing a particular program button without having to stop the treadmill and start a new program.

A further object of the invention is to provide an automatic cooldown feature that automatically begins upon conclusion of the user's workout where the duration of the cooldown is determined by the length of time of the user's workout and where the treadmill includes a heart rate management system, the cooldown can be terminated by the user's heart rate reaching 60% of maximal.

Another object of the invention is to increase the frequency of display information on the user display that is relevant to the manner in which the treadmill is being used and to decrease the frequency of the display information that is not relevant.

A still further object of the invention is to provide a user detect feature that can use a detector such as an IR receiver/transmitter to stop the operation of the treadmill in order to

overcome the problem of users leaving treadmills before the end of their programs which can result in treadmills continuing to run for a period of time. This feature can be further enhanced by using treadmill operating criteria such as key pad or motor controller activity to determine if a user is on the treadmill.

Yet an additional object of the invention is to provide a frame tag module secured to the frame of the treadmill and that includes a nonvolatile electrically erasable programmable memory chip and a real time clock.

It is also an object of the invention to provide a treadmill with a quick start feature.

Another object of the invention is to provide a display of the amount of time a user spends in a specified heart rate zone.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of an assembled exercise treadmill according to the invention;

FIG. **2** is a block diagram of the control system for the treadmill of FIG. **1**;

FIG. **3** is a plan view quick start/quick speed control including a set of user switches for a quick start feature for use with the control system of FIG. **1**;

FIGS. **4** and **5** are flow charts illustrating the operation of the quick start/quick speed control of FIG. **3**;

FIGS. **6** and **7** are flow charts illustrating the operation of a custom workout feature for use with the control system of FIG. **2**;

FIG. **8** is a flow chart illustrating the operation of the control system of FIG. **2** to implement a feature whereby the user can select a new workout program while the treadmill of FIG. **1** is operating in another workout program;

FIGS. **9** and **10**A–B are flow charts illustrating the operation of an automatic cooldown feature for use with the control system of FIG. **2**;

FIG. **11** is a data flow diagram for a user detect feature for use with the treadmill of FIGS. **1** and **2**;

FIGS. **12**A–C are flow charts further illustrating the operation of the user detect feature of FIG. **11**; and

FIG. **13** is a flow chart illustrating the operation of a time in heart rate zone feature for use with the treadmill of FIG. **1**.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** shows the general outer configuration of an exercise treadmill **10**, according to the invention. The treadmill includes a control panel **12** having a set of displays **14**; a set of workout program control buttons **16**; a set of operational controls **18-22** including a pair of time control buttons **18**, a pair of incline control buttons **20** and a pair of speed control buttons **22**; a numerical keypad **24**; and a stop button **26**. In addition, the treadmill **10** includes such conventional treadmill elements such as a belt **28**, a deck **30** and an inclination mechanism **32** of the type described in U.S. Pat. No. 6,095,951.

FIG. **2** is a representative block diagram of a control system **34** for the treadmill **10**. The control system **34** is generally similar to the treadmill control systems of the type shown in FIG. **16** of U.S. Pat. No. 6,095,951 and controls an AC motor **38** having a motor controller **36** to propel the belt **28**. The control system **34** uses a microprocessor based system controller **40** to control the control panel displays **14**

including a message display **14**, the user controls **16–22** and **26** along with the keypad **24**, an optional remote display **42** and a remote keypad **44**. In addition, the control system **34** serves to control a heart rate monitoring system of the type described in U.S. Pat. No. 5,313,487 utilizing a set of pulse sensors **46** and a deck or belt lubrication system **48** of the type shown in U.S. Pat. No. 5,433,679 along with the inclination mechanism **32**. The control system also controls a user detect or sense system **50**.

FIGS. **3–5** illustrate a quick start feature that can be implemented in the control system **34**. In particular, a quick start keypad **52** can be attached to the control panel **12** or some other part of the treadmill **10**. The keypad **52** is provided with a set of three buttons: a walk button **54**, a jog button **56** and a run button **58** that can be used by the user to immediately initiate a workout or change a workout having preferably a predetermined speed, for example corresponding to walk, jog or run. The operational controls **18–22** can also be used to set other predetermine workout parameters such as inclination, time, distance or calories. User operation is described in FIG. **4** and operation of the program is described in the flow chart of FIG. **5**. Along with a quick start, as indicated in FIGS. **4** and **5**, the keypad **52** can be used by the user to immediately implement the predetermined speeds or other workout parameters while another workout is in progress. In addition, it is also possible to use a single quick start button **59** on the control panel **12** in combination with the operational controls **18–22** to initiate the quick start feature.

FIGS. **6** and **7** are flow charts describing the logic of a preferred embodiment of a custom workout program that can be implemented in the control system **34**. Generally, this feature permits a user or his trainer to use the control keys **18–22**, the keypad **24** and the displays **14** to design and program into the control system **34** a custom workout having greater flexibility than the standard workouts normally programed in a treadmill. For example as described in FIGS. **6** and **7**, the trainer can define a heart rate workout utilizing the pulse sensors and heart rate management system **46** consisting of a series of segments, up to 30, of a fixed duration in seconds, each segment containing a predetermined target heart rate. As indicated at a block **60** in the flow charts of FIGS. **6** and **7**, the user can select the custom program mode by pressing a custom button **62** which is one of the program buttons **16** on the control panel **12**. In this case the heart rate management program can be used to control the inclination mechanism **32** of the treadmill **10** thereby regulating the user's heart rate for each interval or segment of the program. Also, custom interval hill workouts can be designed where each segment of the workout represents a different incline of the treadmill **10**. Similarly, custom interval speed workouts can be designed by the trainer where each segment of the workout utilizes a different speed. Here, it is desirable to provide the user with an aural warning over a speaker **64** shown in FIG. **2** of speed changes to prevent surprise transitions. Thus, it is possible to provide a wide variety of custom workouts where the user or trainer can define a number of workout parameters such as the initial speed, duration of the workout, distance and calories burned.

FIG. **8** is a flow chart illustrating the operation of the control system **34** to execute workout programs where, as indicated a pair of blocks **66** and **68**, the control system **34** also permits the user to switch workout programs on the fly by merely pressing one of the program buttons **16** without having to stop the treadmill **10** and start a new workout program. Specifically, the user can select a new workout program having different parameters including, for example, speed, incline, intervals and heart rate while in the midst of a first workout program.

FIGS. **9** and **10**A–B show in flow chart form the logic of an automatic cooldown feature that can be implemented in the control system **34**. In the protocol described in FIGS. **9** and **10**A–B, cooldown will begin automatically upon conclusion of the user's workout. Here, the duration of the cooldown is determined by the length of time of the user's workout or can also be terminated by the user's heart rate reaching 60% of maximal if a heart rate management program of the type identified above is being used. In addition, cooldown can be initiated by the user at any time by pressing a cooldown button **70** located on the control panel **12**. In the system described in FIGS. **9** and **10**A–B, the cooldown sequence will normally automatically progress each minute except that the user can advance the cooldown by pressing the cooldown button **70** or extend the cooldown by using arrow keys on the keypad **24**.

Another feature of the treadmill **10** is the provision in the system controller **34** to only display information on the user displays **14** that is relevant to the manner in which the treadmill **10** is being used. Because the number of discrete displays on the user displays **14** is limited and non-relevant information can be annoying to a user, it is desirable to provide only that information to the user that is most useful for the particular workout that he is performing at the moment. For example, the treadmill **10** having its incline mechanism **32** set at something other than zero will accumulate and can display on one the displays **14** the total vertical distance the user has climbed during the workout. However, if the treadmill **10** is set at zero inclination, the user might become annoyed with a message on the displays **14** always having a zero reading. Thus, in the preferred embodiment of the invention the system controller **40** of the control system of **34** will be programed to only generate a total climb figure on one of the displays **14** at periodic intervals such as 5 minutes. By the same token, generally only runners are interested in their pace such as minutes per mile, so this information will not be displayed by the system controller **40** on the displays **14** for walkers. Also, calories per hour, watts and mets will only be displayed on one of the displays **14** upon a workload change such as a significant speed or incline change so as to eliminate the same message from being displayed on the displays **14** over and over.

FIG. **11** is a data flow diagram and FIGS. **12**A–C are flow charts illustrating the logic applied by the system controller **40** to implement a user detect feature for use with the treadmill **10**. In order to overcome the problem of users leaving treadmills before the end of workout programs which can result in treadmills continuing to run for an extended period of time, the treadmill **10** can be provided with a mechanism for stopping the belt **28** that is responsive to various criteria for indicating whether or not the user is on the treadmill **10**. Preferably, all of the various resources of information available to the system **34** are used to control this feature. For example, information can be obtained from the motor controller **36** to determine the load on the motor **38** for a predetermined speed which would indicate the presence of a user on the belt **28**. This information can also include timing of the use of the key pad **24**, the inclination mechanism **32** and use of the pulse sensors **46**. In addition, detectors such as an IR detector **72**, a weight sensor **74** using a load cell, and a foot pressure sensor **76** can be used to infer the presence of a user on the belt **28**. As indicated in FIGS. **11** and **12**C, combinations of this type of information in combination with information received from the IR receiver/transmitter **72** can be used to optimize the determination of the presence of a user on the belt **28**.

It is also possible to use a detector such as the infrared receiver/transmitter **72** shown in FIGS. **1** and **2** alone as a user detect mechanism. In the preferred embodiment of this detector, a receiver/transmitter **72** transmits an infrared beam which is amplitude modulated at 40 Khz for 500 μsecs every 500 msec. If a user is on the treadmill belt **28**, some portion of the light will be reflected back to the receiver/transmitter **72** which is sensitive not only to the frequency of the beam but also to the 40 Khz modulation. This provides the system controller **40** with an indication that the user is on the treadmill belt **28**. In this embodiment, when the user leaves the treadmill **10** with the belt **28** still moving and the IR detector **72** does not detect the user, the system controller **40** will cause the treadmill **10** to wait a predetermined time, such as 10 seconds, and then switch to a pause mode. In the pause mode the belt **28** is stopped and a "pause" message is displayed on one of the displays **14**. If there is no user input for another predetermined time to the control system **34**, such as 1 minute, the pause mode will time out and the system **34** will reset. In this mode the system controller **40** will also cause the treadmill inclination mechanism **32** to return the inclination of the treadmill **10** to a zero. It should be noted that types of active detectors other than the IR detector **72** can be used such as transmitter receiver combinations using sound or radio frequencies.

FIGS. **11** and **12**A–C provide a more detailed description of the preferred logic and data flow used in the preferred embodiment of the user detect feature. FIG. **11** is a data flow diagram that represents the flow of data from various sensors such as the pulse sensors **46**, the keypad **24**, the motor controller **36** and the IR sensor **72** to the system controller **40** in FIG. **1**. FIGS. **12**A–C illustrate the logic performed by the system controller **40** on this data in implementing the user detect feature. With reference to the diagram of FIG. **11**, the pulse sensor **46** and the keyboard **24** are periodically monitored, as shown by at a data circle **78** and a data circle **80** for example every one second as indicated by a dashed line **82** and a dashed line **84** respectively. An indication that the user is operating the treadmill **10** based on the information in the data circles **78** and **80** is transmitted, as illustrated by a line **82** and a line **88**, to a data circle **90** representing the user detect logic or "monitor user presence" and is implemented in the system controller **40**. This user detect logic as indicated by the monitor user presence circle **90** in FIG. **11** is described in more detail in connection with FIG. **12**C and is triggered every one second as indicated by a dashed line **92**.

Similarly, the motor controller **36** is monitored as indicated by a data circle **94** at periodic intervals such as every one second as indicated by a dashed line **96**. The object of monitoring the motor control is to determine if the load on the motor **36** reflects the presence of a user on the belt **28**. For example, if there is a user on the belt **28**, it will take more energy to move the belt **28** for a given speed which will be reflected in various parameters of the motor controller **36** as it operates to maintain a predetermined or set speed of the motor **38**. In the preferred embodiment, where the motor **38** is an AC motor such parameters as the voltage applied to the motor's armature windings and measurements of motor slip can be used for comparison to a predetermined belt or motor speed either selected by the user or by a workout program being executed by the system controller **40**. It will be understood that the parameters used for this load versus speed comparison will depend upon the type of motor and motor controller being used in the treadmill and that for instance in a DC motor, motor current can be used. Also, in the preferred embodiment other criteria is used in connection with the motor control user presence determination **94**. For example, as illustrated by the criteria in a box **96**, the present incline of the inclination mechanism **32**, inclination mechanism history and speed motor history can be used. This criteria provides an indication as to whether there are other factors that might affect the speed vs load relationship other than a user on the belt **28**. For example, if the incline of the deck **30** has recently changed or is too high or if the motor speed has recently changed, the speed versus load relationship might not necessarily be representative of a user on the belt **28**. As indicated by a data circle **98**, the stability of this criterial is used as a check on the reliability of the motor load versus speed information **94**. This information, as indicated by a set of lines **100**A–C is also used by the motor sense logic **90**.

The preferred operation of the IR detector **72** in determining user presence on the belt **28** is illustrated in FIG. **11** and FIG. **12**A and FIG. **12**B. Overall operation of the IR detector **72** is indicated by a data circle **102** in FIG. **11** and detailed in FIG. **12**A. In this embodiment, the read user sense procedure **102** is called every 250 microseconds and as indicated in a set of decision blocks **104** and **106** a determination is made as to whether the IR LED is on and whether the IR receiver detects a user. If a user is detected, the routine **102** increments a user present history counter **107** as shown at a block **108**. Then as indicated by a decision block **110** and a set blocks **112** and **114** the IR LED **72**A is reset.

Also in the preferred embodiment, at one second intervals, as shown in FIG. **11** and FIG. **12**B, a monitor user sense procedure indicated by a data circle **116** is called by the system controller **40** as indicated by a dashed line **117**. If as indicated at a decision block **118** the user detect feature indicated by the term "smart stop" in FIG. **12**B is not enabled, a flag is set to true at a block **120** indicating to the system controller **40** that there is a user present so that the treadmill **10** will not go into the pause mode. A ten second timer indicated at **122** is used with this procedure. If the smart stop feature is enabled and the ten second interval counted by the timer **122** has expired as indicated by a decision block **124** and the user present history counter **107** shows an absence of a user on the belt **28** as indicated by a decision block **126**, the user present flag is set to false at a block **126** otherwise it is set to true at a block **130**. This procedure **116** also resets the ten second timer **122** to ten seconds at a block **130** if the ten second interval has expired and as indicated at a block and resets the user present history counter **107** to zero at a block **134**. In this manner, the monitor user sense routine **116** is able to determine if the IR detector has not detected a user on the belt **28** for a period of ten seconds.

The preferred of the user detect or monitor user sense logic **90** is illustrated in FIG. **12**C. As described above this routine **90** is called every one second by the system controller **40**. First, as indicated at a block **136**, the user present flag is set to true and then the monitor user sense routine **116** is called. Then, as indicated by a series of decision blocks **138**, **140** and **142** the routine **90** checks various treadmill operating parameters including whether hands have been detected on the pulse sensors **46**, if the key pad **24** has been used recently and if the user has changed the incline mechanism **32** or speed recently based on information shown in the box **96** of FIG. **11**. In addition the user sense **116** is checked to determine if a user has been detected on the belt **28**. If the answers to any of these questions is yes, the routine **90** exits. If the answer is no, then the routine **90** checks the motor controller presence likelihood or inference data **98** at a

decision box **146** and if it appears that the user is not on the belt **28**, the routine **90** sets the user present flag true at a box and then proceeds to a treadmill pause and reset routine indicated by a box **150** and a dashed line in FIG. **11**. In the preferred embodiment as discussed above, the treadmill **10** will enter the pause mode for one minute and then if there is no further user activity, the system controller **40** will reset the treadmill **10**. However, if the motor controller presence inference data **98** at a decision box **146** can not make an inference that the user has left the belt **28**, the routine **90** then first checks at a decision box **152** to determine if the data **98** is too unreliable to use this data by, for example, checking the information in the box **96**. If the information **96** suggests that the motor controller data is too unreliable, the routine **90** then branches to the pause and reset routine **150**. Otherwise, the routine **90** then checks at a decision box **154** to determine if the the motor controller presence inference routine **98** has been disabled and if it has then branches to the pause and reset routine **150**.

Another feature of the treadmill **10** is a frame tag module **77** as shown in FIG. **2** which is preferably secured to one of the side frames of the treadmill **10** and is adapted to communicate with the system controller **40**. In the preferred embodiment, the frame tag module **77** includes a nonvolatile electrically erasable programmable memory chip (EEPROM) **79** and a real time clock **81**. Included with the EEPROM **79** is a 10 year battery (not shown). Preferably, the clock **81** will be initialized to GMT at the time of manufacture of the treadmill **10** and then set to local time when the treadmill **10** is installed at a customer location and each entry into the EEPROM **79** will be date stamped by the clock **81**. In normal operation, each time the treadmill **10** is powered up, the system controller **40** will retrieve treadmill configuration information from the frame tag module **77**. Included in this information can be such data items as English or metric units for display on the displays **14**, maximum and minimum treadmill belt speeds, language selection as well as accumulated treadmill operational data such as the total time, the total miles, the belt time, the belt miles and the number of program selections. Preferably, when the treadmill **10** is in operation, the system controller **40** will cause data relating to each user workout and operation of the treadmill **10** to be stored in the EEPROM **79** along with all information relating to system errors that might occur. In addition, all information relating to any service procedure is stored in the EEPROM **79**. This information stored in the EEPROM **79** including set up, operational and service data can be displayed on the displays **14** by the system controller **40** so that the history of the treadmill **10** can be read by service personnel. One of the advantages of the frame tag module **77** is if any of the major electrical or mechanical components of the treadmill **10** is replaced, the operational history of the treadmill **10** is not lost. For example, if the control panel **12** containing the system controller **40**, is replaced the treadmill's history will not be lost. The frame tag module **77** can also be replaced without losing the machine's history. In this case, because when the treadmill **10** is powered up, this information is transmitted from the old frame tag module **77** to the system controller **40**, this information can then be transmitted back to the new frame tag module **77** after it has been installed on the treadmill **10** thereby maintaining the treadmill's history with the treadmill **10**.

FIG. **13** is a flow chart illustrating the preferred operation of a time in heart rate zone routine **156** implemented in the system controller **40** of the treadmill **10**. In this feature, the user's heart rate is continuously monitored by the heart rate monitoring system using the pulse sensors **46** while in a preprogramed heart rate workout such as fat burn or cardio workout to provide the user a display on one of the displays **14** of an indication of the time in a predetermined heart rate zone. The user's heart rate zone is determined by comparing the user's actual heart rate with that of the target heart rate as entered by the user on the key pad **24** or calculated for the user by the heart rate management system. After the routine **156** establishes that the workout program is a heart rate workout as indicated at a decision block **158**, the routine **156** then determines at a decision box **160** whether the user has entered his own target heart rate using the key pad **24**. If the user has input his desired target hearts rate, the appropriate heart rate zone is calculated as indicated by a box **162**. In this example, the zone is preferably + or −10 beats from the target heart rate. In the event that the user has not entered his target heart rate, a decision block **164** indicates that the routine **156** determines if the programed workout is a Cardio workout or a fat burn workout and the desired heart rate zone is calculated as indicated by a block **166** or a block **168**. For the fat burn workout, the target is preferably between 60 and 72 percent of the calculated maximal heart rate of (220-age). For Cardio workout, the target is preferably between 72 and 85 percent of the calculated maximal heart rate of (220-Age). After the appropriate heart rate zone has been calculated the routine **156** clears a time in zone clock as shown at a block **170**.

As shown in FIG. **13**, if the user is in the heart rate zone as determined by a decision block **172** the time in zone clock is incremented and a heart rate in zone flag is set to true as shown by a block **174**, each second is accumulated and can be displayed on one of the displays **14** or a dedicated TIME-IN-ZONE display (not shown.) If the user is in the heart rate zone and has attained his target heart rate previously as indicated by a decision block **176** and then an entry message such as "ENTERING TARGET HEART RATE ZONE" can be displayed on the displays **14** or the dedicated display as shown by a block **178**. It is preferred that visual feedback, via a live heart rate zone chart on the displays **14** be used to graphically show the user his heart rate relative to the heart rate zone. On the other hand, if the user's heart rate was in the zone, but then changes so as to no longer be in the zone as determined at a decision block **180**, an exit message such as "LEAVING TARGET HEART RATE ZONE" is displayed on the displays **14** or the dedicated display as shown at a block **182** and the heart rate in zone flag is set to be false as indicated by a block **184**. In the preferred embodiment, heart rate programs implemented in the system controller **40** with time in zone as the goal can be selected by the user with one of the workout control buttons **16**. Additionally, at the conclusion of a workout, a percentage of the workout time in the heart rate zone can be displayed on one of the displays **14**. This information can also be stored, either in the control system **34** or the frame tag **76** or via a network connection, to provide tracking information so the users can ascertain progress in their workout routines. This information is useful to determine the overall efficiency of the workout time, as it is believed that the most efficient calorie burn may occur while in the heart rate zone. It is also possible to provide real-time recommendations to the user as to how to improve his time in zone efficiency by, for example, instructing the user via the displays **14** to adjust speed, incline, resistance, etc. In addition, it is possible to allow the exercise equipment such as the treadmill **10**, possibly with user acceptance, to automatically perform these adjustments to create a TIME-IN-ZONE MANAGEMENT workout. Although the above sys-

tem has been described in the embodiment of the treadmill **10**, this feature can equally be used in other types of aerobic type exercise equipment having heart rate management systems such as exercise bikes, step machines and elliptical steppers. Also, the above system can use types of heart rate monitors other than the pulse sensor or heart rate monitor system **46** described above such as monitors that transmit a pulse signal from a pulse sensor belted to a user to a receiver on the exercise apparatus.

It should be noted that the various features described above have been described in terms of their preferred embodiments in the context of the particular treadmill **10** and control system **34** disclosed herein. The manner in which these features can be implemented will depend upon a number of factors including the nature of the treadmill and control system. With respect to programing, there are many different types of hardware and programing languages and techniques that would be suitable for implementing these features that would fall within the scope of this invention.

We claim:

1. An exercise treadmill, comprising:

a frame structure including two rotatable pulleys, said pulleys being positioned substantially parallel to each other, and a pair of spaced apart longitudinal frame members for providing longitudinal structural support for said frame structure;

a motor for rotating a first one of said pulleys;

a belt secured over said pulleys so as to move in a longitudinal direction when said first pulley is rotated;

an inclination mechanism secured to a first end of said frame structure effective to permit selective inclination of said frame structure by a user;

a control system operatively connected to said motor and said inclination mechanism;

a control panel secured to said frame structure and operatively connected to said control system wherein said control panel includes at least one display and a set of user controls for controlling the treadmill including said belt speed and said inclination mechanism, to permit a user to operate the treadmill for a workout; and

a stop program operatively associated with said control system for stopping the movement of said belt when no user is detected on said belt for a first predetermined amount of time wherein said stop program uses information representing treadmill operating criteria from said control system to detect the user on said belt.

2. The exercise treadmill of claim **1** wherein said operating criteria includes operation of said user controls.

3. The exercise treadmill of claim **1** wherein said operating criteria includes operation of said motor.

4. The exercise treadmill of claim **1** wherein the treadmill includes pulse sensors and wherein said operating criteria includes operation of said pulse sensors.

5. The exercise treadmill of claim **1** wherein said operating criteria includes operation of said inclination mechanism.

6. The exercise treadmill of claim **1** additionally including a detector operatively connected to said control system for detecting the presence of a user on said belt and said stop program utilizes said operating criteria to provide an indication of the absence of the user on said belt in combination with said detector to stop the movement of said belt.

7. The exercise treadmill of claim **1** wherein said first predetermined time is approximately 10 seconds.

8. The exercise treadmill of claim **1** wherein said stop program places the treadmill in a pause mode after said first predetermined time and then resets the treadmill after a second predetermined amount of time.

9. An exercise treadmill, comprising:

a frame structure including two rotatable pulleys, said pulleys being positioned substantially parallel to each other, and a pair of spaced apart longitudinal frame members for providing longitudinal structural support for said frame structure;

a motor for rotating a first one of said pulleys;

a belt secured over said pulleys so as to move in a longitudinal direction when said first pulley is rotated;

an inclination mechanism secured to a first end of said frame structure effective to permit selective inclination of said frame structure by a user;

a control system operatively connected to said motor and said inclination mechanism;

a control panel secured to said frame structure and operatively connected to said control system wherein said control panel includes at least one display and a set of user controls for controlling the treadmill including said belt speed and said inclination mechanism, to permit a user to operate the treadmill for a workout;

a detector operatively connected to said control system for detecting the presence of a user on said belt; and

a user detect program operatively associated with said control system and responsive to one or more treadmill operating criteria received from said control system for stopping the movement of said belt when said operating criteria indicates no user is detected on said belt for a first predetermined amount of time.

10. The exercise treadmill of claim **9** wherein said operating criteria is selected from the group consisting of use of said user controls, speed of said belt, operation of said inclination mechanism, operation of said motor and operation of a pulse sensor.

* * * * *

APPENDIX E

United States Patent [19]

Dalebout et al.

[11] **Patent Number: 5,034,576**

[45] **Date of Patent: Jul. 23, 1991**

[54] **CONSOLE SWITCH**

[75] Inventors: **William T. Dalebout; Kent Ashby,** both of Logan, Utah

[73] Assignee: **Proform Fitness Products, Inc.,** Logan, Utah

[21] Appl. No.: **482,223**

[22] Filed: **Feb. 20, 1990**

[51] **Int. Cl.**[5] **H01H 27/06**

[52] **U.S. Cl.** **200/43.04;** 200/43.08; 200/330; 200/334; 200/332; 272/69

[58] **Field of Search** 200/43.04, 329, 330, 200/331, 334, 43.08, 543; 272/69; 74/523; 180/272; 246/186

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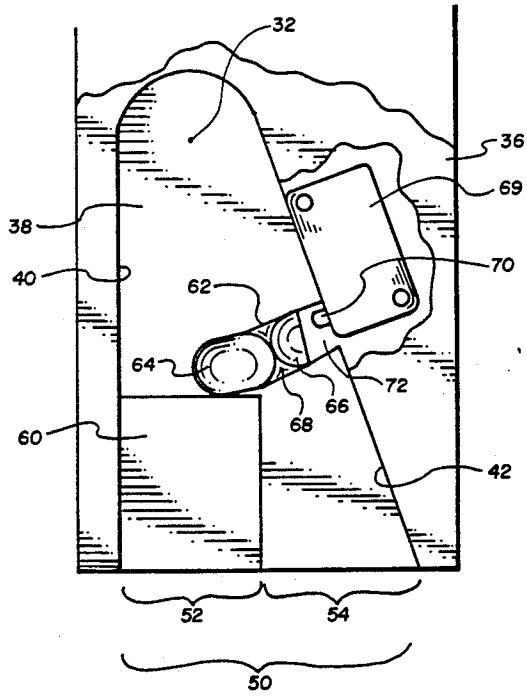
Vitamaster, of Tyler, TX, published a product instruction book showing treadmills with a "safety pull pin".

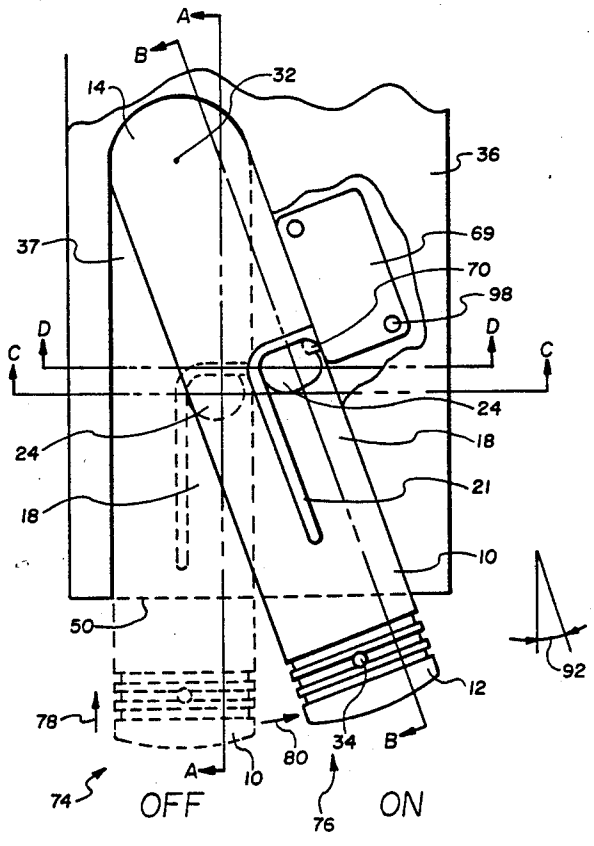
Primary Examiner—Renee S. Luebke
Assistant Examiner—Glenn T. Barrett
Attorney, Agent, or Firm—Trask, Britt & Rossa

[57] **ABSTRACT**

A switch apparatus for an electrical machine comprises a keyway and a removable key. A spring-loaded protrusion on the key prevents direct insertion of the key into an "ON" position, and communicates with a guideway for movement of the key between the "OFF" and "ON" positions. The key is directly removable from both the "ON" and "OFF" positions simply by pulling, to deactivate the machine in an emergency or accident. Unauthorized and accidental operation of the machine may be prevented by control of the key.

14 Claims, 6 Drawing Sheets





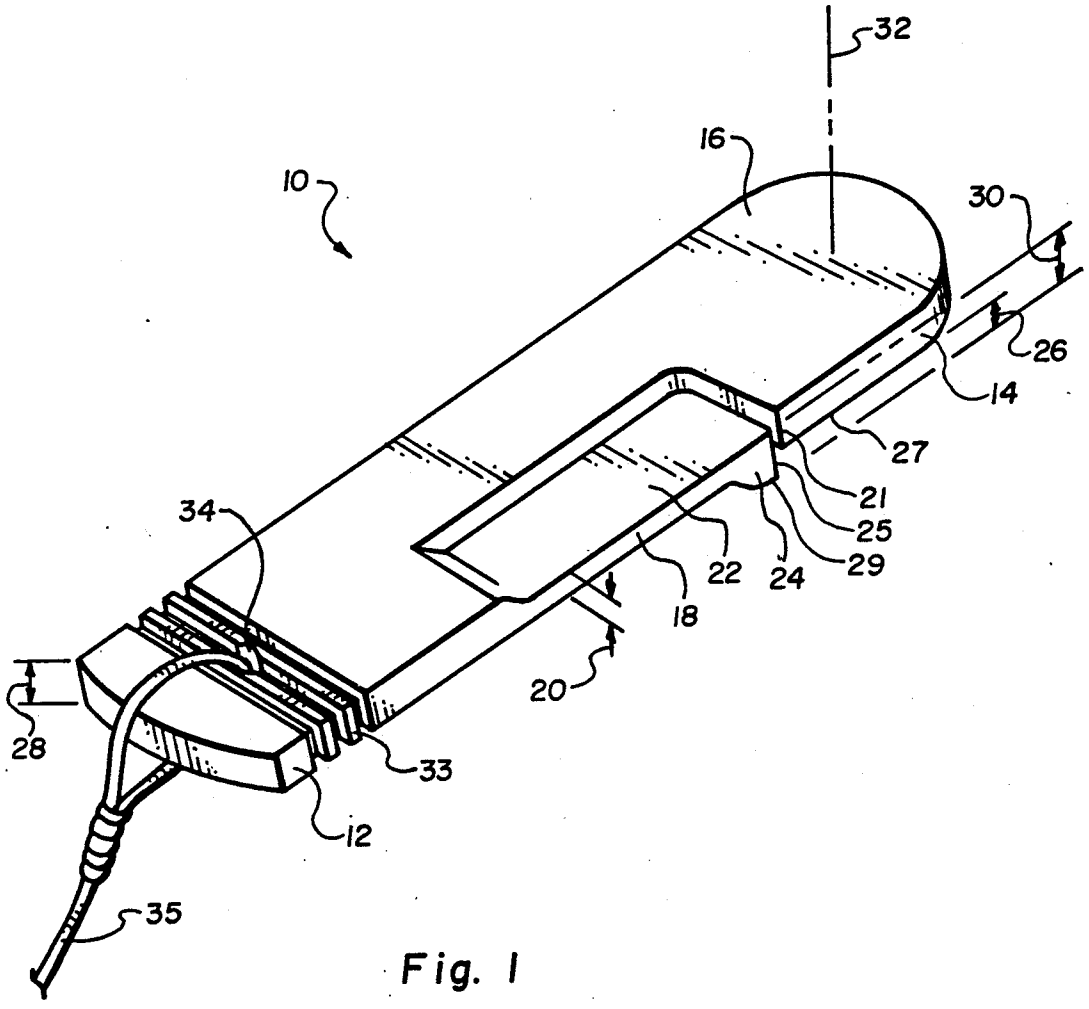


Fig. 1

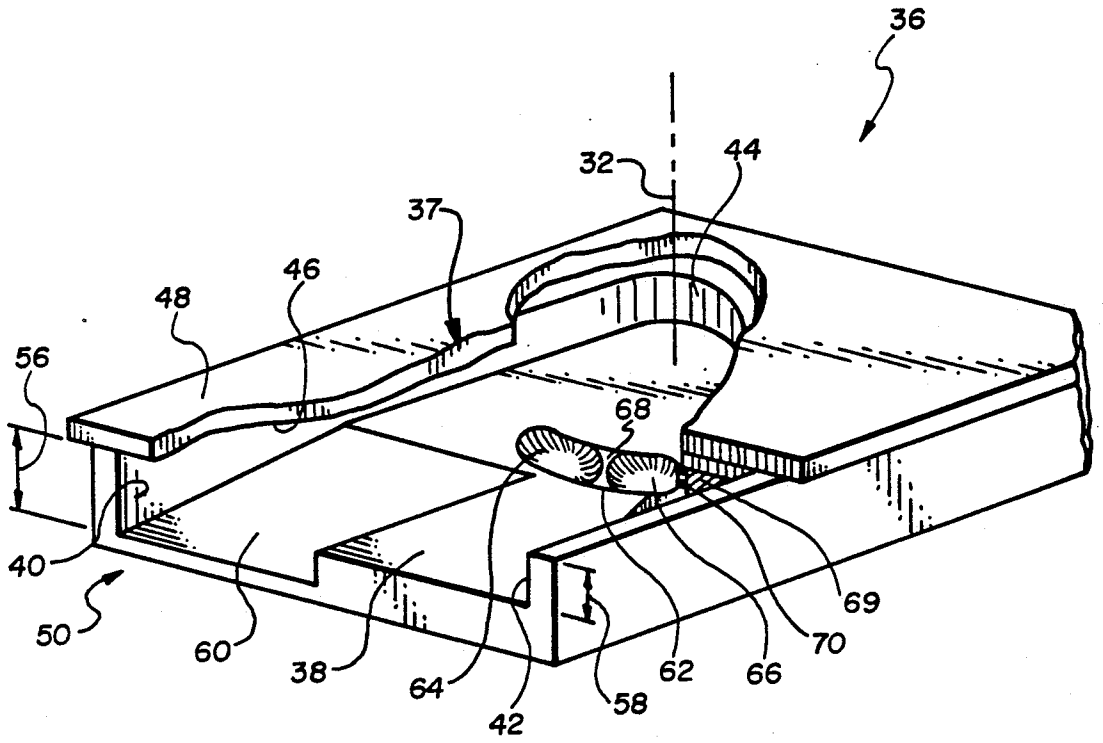


Fig. 2

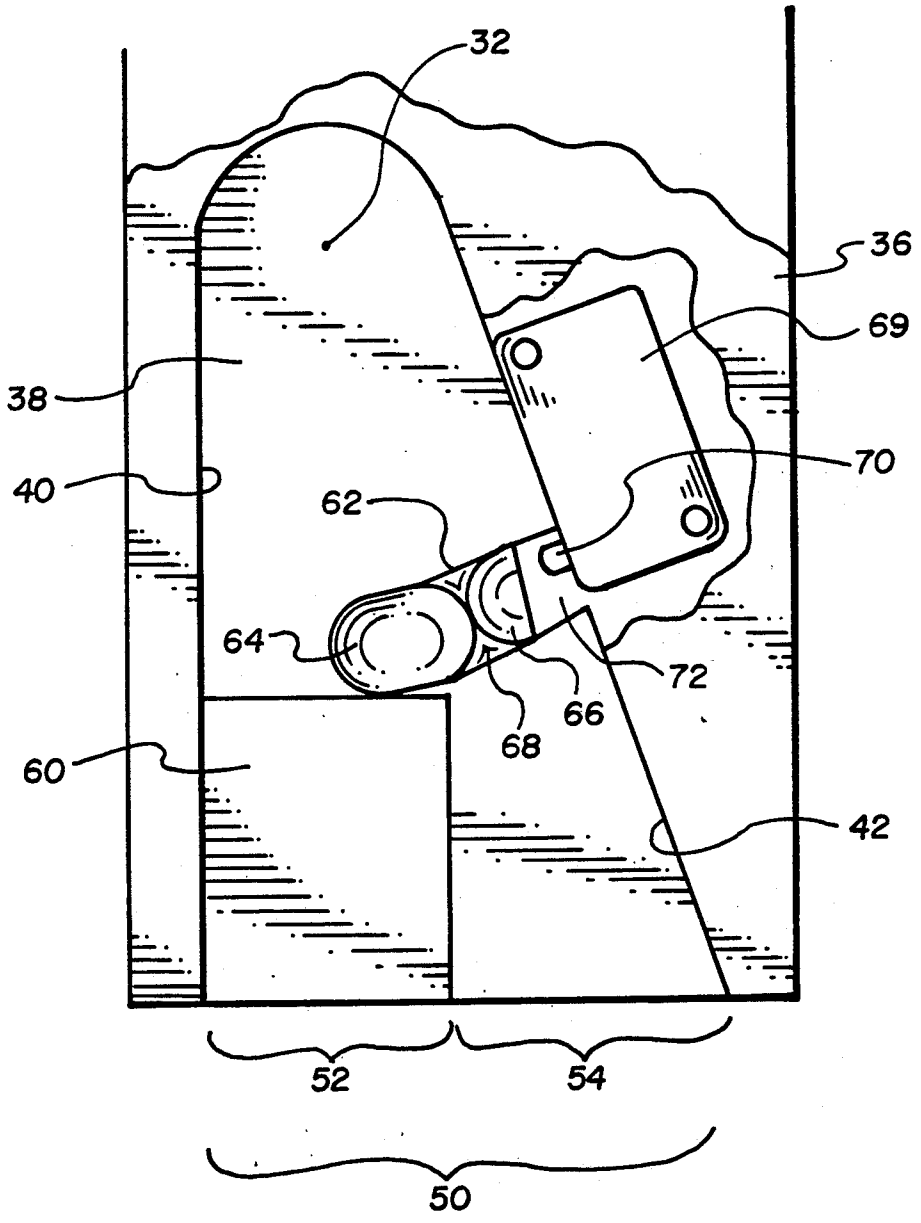


Fig. 3

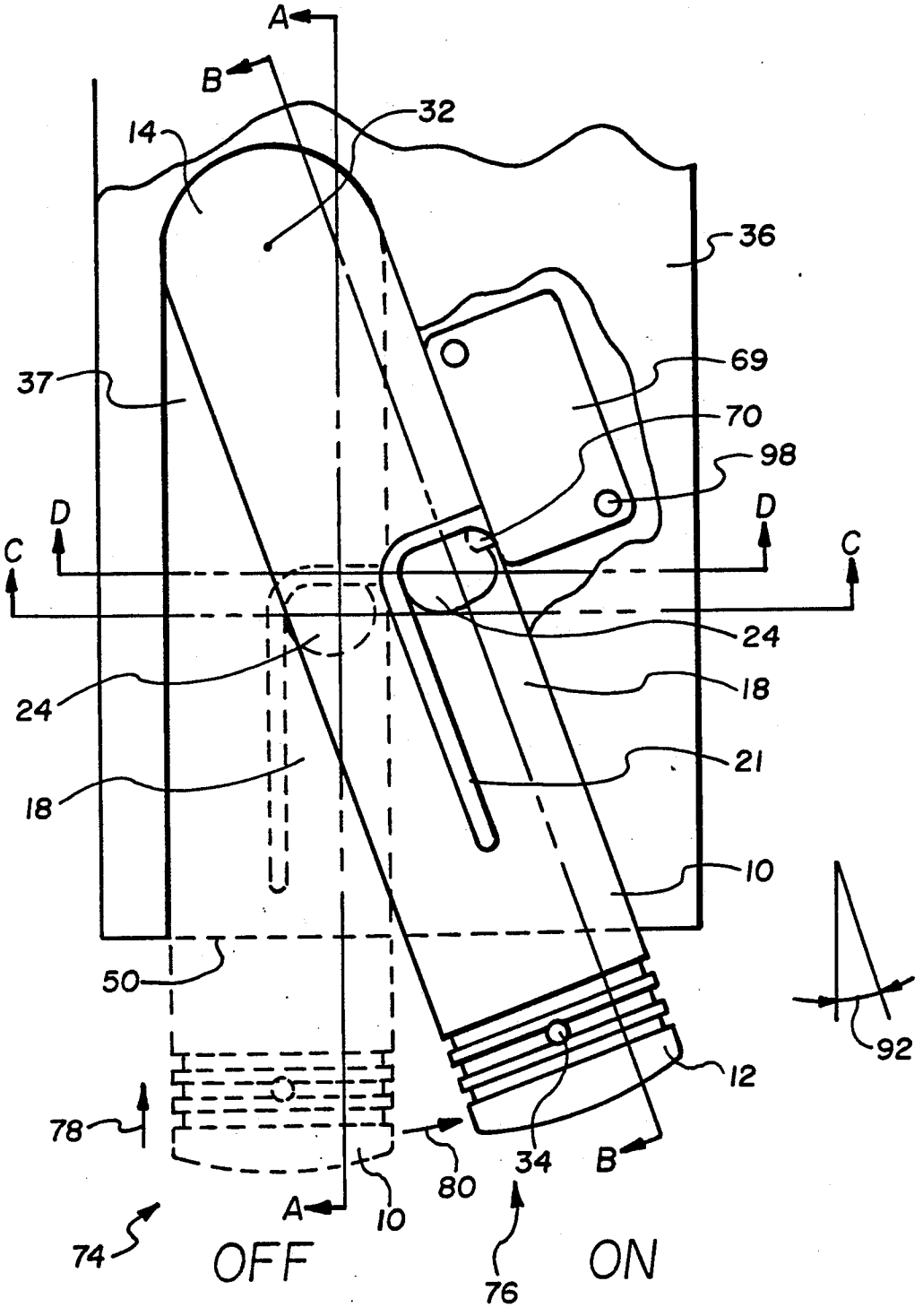

A
B
14
32
36
37
69
70
98
D
D
C
C
24
24
18
18
21
10
50
92
12
78
80
34
B
A
10
74
OFF
ON
76

Fig. 4

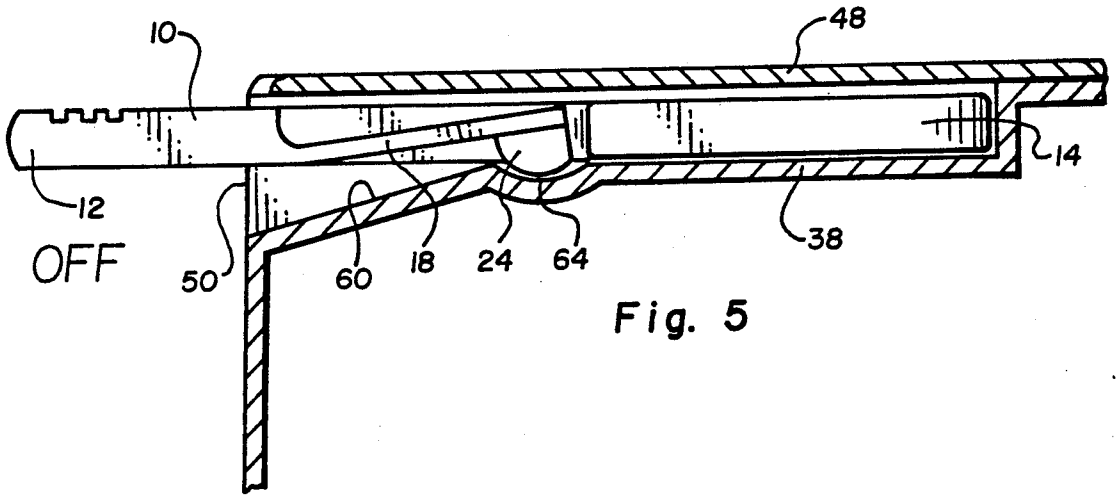


Fig. 5

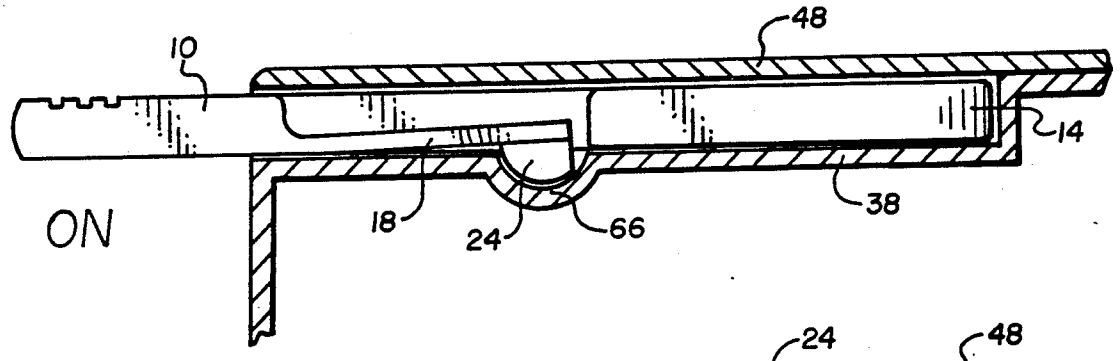


Fig. 6

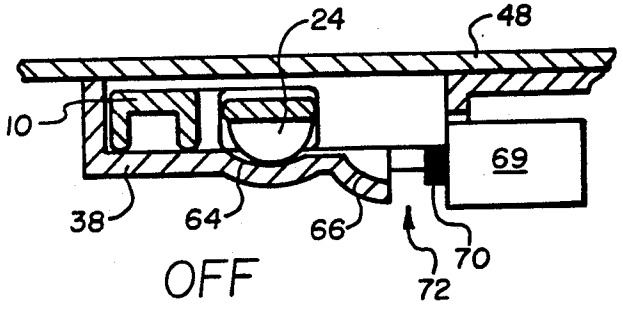


Fig. 7

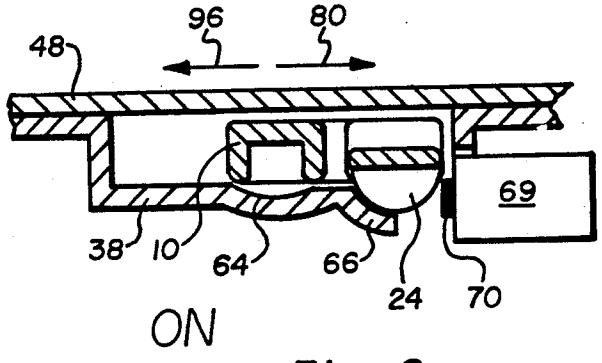


Fig. 8

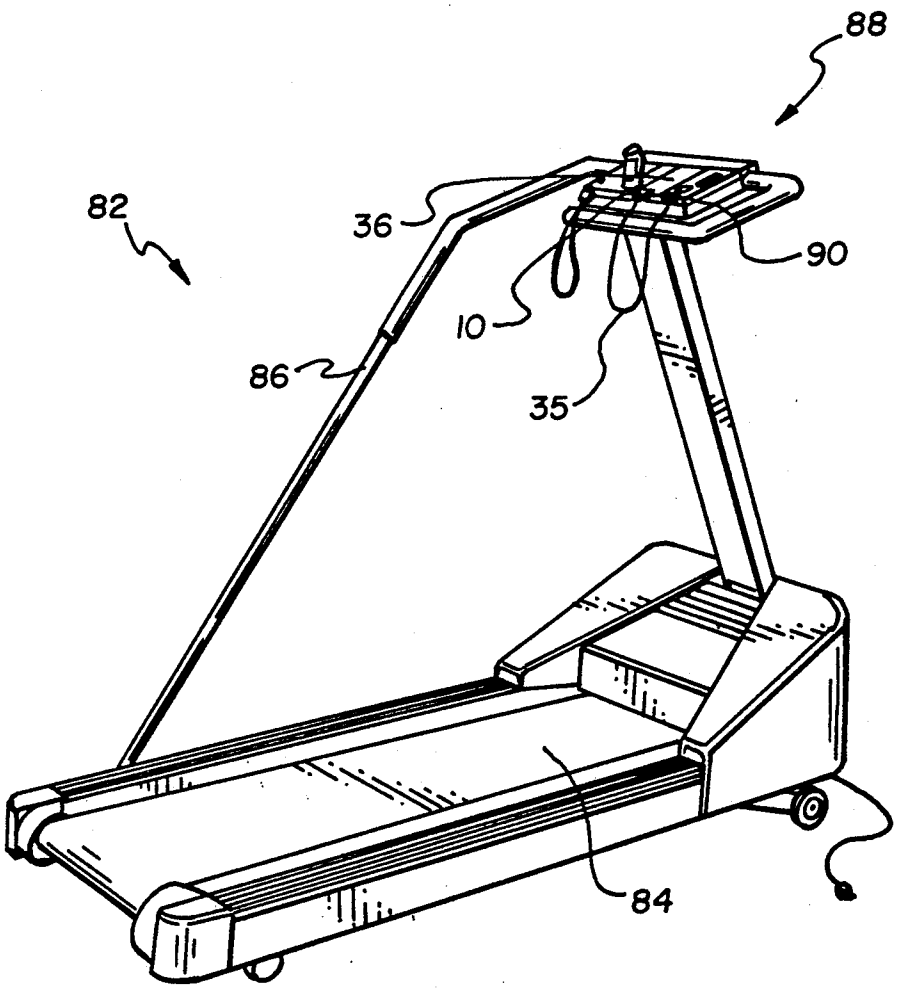


Fig. 9

CONSOLE SWITCH

BACKGROUND OF THE INVENTION

1. Field

This invention relates to electrical switches. More particularly, the invention pertains to electrical safety switches for exercise machines and the like.

2. State of the Art

Safety of the user is a major concern in the design and manufacture of powered machines. Powered treadmills and like machines having exposed moving parts may injure a user who accidently or deliberately misuses the machine. The popular domestic use of such machines recommends use of means to prevent accidental activation by children, pets or others. In addition, the possibility of a user falling on or from a machine makes it desirable to have a mechanism by which the machine may be de-activated in such events. A mechanism to prevent or eliminate "surprise" activation is desirable. In addition, some means to automatically and immediately halt the machine in case of an accident is desirable.

BRIEF DESCRIPTION OF THE INVENTION

An apparatus for controlling the activation of an electrically powered machine such as an exercise treadmill includes a keyway with an electrical switch, and a removable key for prevention of accidental activation by children. By insertion in the keyway, a normal OFF position is attained. The key may then be normally hand manipulated between the "OFF" position and an "ON" position. Means are provided to maintain the key in the desired position, yet permit ready movement to the other position for activating or deactivating the machine.

In addition, a "panic" feature permits immediate deactivation of the machine by simply retracting the key from the keyway. The key may be directly pulled from the keyway whether the key is in an "OFF" or an "ON" position. Thus, for example, a lanyard may connect the key to a clip attached to the user's clothing. If the user slips or falls on the machine, the key will be pulled from the keyway to immediately stop the machine.

The removable key enables the prevention of accidental or unauthorized activation of the machine by children, pets or others to whom it is accessible. The invention also prevents activation immediately upon insertion of the key, but requires a second motion of the hand or finger to activate the machine.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the safety key of the invention;

FIG. 2 is a perspective, partially cutaway view of the keyway of the invention;

FIG. 3 is a partially cutaway plan view of the keyway of the invention;

FIG. 4 is a partially cutaway plan view of the keyway showing the key in an "ON" position and in a phantom "OFF" position;

FIG. 5 is a sectional view of the invention along lines A—A of FIG. 4;

FIG. 6 is a sectional view of the invention along lines B—B of FIG. 4;

FIG. 7 is a sectional view of the invention along lines C—C of FIG. 4;

FIG. 8 is a sectional view of the invention along lines D—D of FIG. 4; and

FIG. 9 is a perspective view of the invention adapted to an exercise treadmill machine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As depicted in FIG. 1, safety key 10 is an elongate member with proximal end 12 which is hand manipulable and distal end 14 which is adapted to be inserted into a keyway of a keyway housing. This embodiment has a generally planar upper surface 16 and includes a resilient elongate arm 18 of reduced thickness 20. Arm 18 is separated from the remainder of the key 10 by L-shaped gap 21. The upper surface 22 of arm 18 is displaced downwardly from surface 16. The distal end 23 of arm 18 includes a downward extending protrusion 24 with a generally flat forward vertical surface 25 extended downwardly a distance 26 from lower surface 27 of the key 10. The purpose of this protrusion 24 will be later described.

The thickness 28 of key 10 provides for a generally rigid key. The reduced thickness 20 of arm 18 provides resilience and allows the arm to flex upwardly to where the most protruding surface 29 of protrusion 24 is generally coincident with the lower edge 27 of the key 10. In this position, the upper surface 22 does not rise above the level of surface 16. In other words, the vertical dimension 30 of the arm 18 and protrusion 24 is not significantly greater than the general thickness 28 of the key 10.

Safety key 10 may be turned about axis 32 in its distal end 14 to activate and deactivate the machine through switch actuator 70.

The proximate end 12 preferably includes means 33 for increasing friction in handling, so that it may be easily held and manipulated. In this embodiment, handle means are shown as slots 33 formed in the proximal end 12.

The key 10 preferably includes a lanyard hole 34 or other means for attaching a lanyard 35. The lanyard 35 may be attached to a clip or other device for attachment, not shown, to the clothing or person of the user. Thus, during use, tripping and/or a fall of the user will result in the key 10 being pulled from the keyway housing 36 shown in FIG. 2, to immediately deactivate the machine.

FIGS. 2 and 3 show the keyway housing 36 into which key 10 is inserted for machine operation. The keyway housing 36 defines the keyway 37, and has a base 38, sidewalls 40 and 42, curved rear wall 44, and the inner surface 46 of cover 48. The front opening 50 of keyway 37 has two portions, i.e., an insertion opening 52 and an activation opening 54, both shown in FIG. 3. The vertical dimension 56 of the insertion opening 52 is greater than the vertical dimension 58 of the activation opening 54, and vertical dimension 56 meets or exceeds the combination of key thickness 28 and protrusion distance 26. This permits insertion of key 10 with protrusion 24 into insertion opening 52. The thickness 28 of safety key 10 is slightly less than dimension 58 so that the key easily slides in the keyway 37.

Base 38 is shown as including a ramp 60 in which the keyway thickness is uniformly decreased from that of dimension 56 to that of dimension 58. As safety key 10 is inserted into insertion opening 52 and moved rearwardly therein, protrusion 24 is gradually compressed upwardly to a compressed condition. As the key is fully

inserted the protrusion 24 drops into guideway 62 which comprises a groove in base 38. The key 10 is now in a fully inserted normally "OFF" position, and may be rotated about axis 32 in its distal end to an "ON" position.

Guideway 62 is, in this embodiment, a groove which guides the protrusion 24 between the "OFF" and "ON" positions. Preferably, groove 62 includes two deepened depressions 64 and 66, respectively, for retaining the protrusion 24 in the respective "OFF" and "ON" positions. A rib or slight elevation 68 presents the desired resistance to movement between the two positions. In addition, the depressions 64 and 66 present resistance to movement of the protrusion outward in response to a force removing the key from the keyway.

A switch housing 69 is positioned with its actuator 70, e.g. a push button, within depression 66, so that movement of key 10 to the "ON" position activates the actuator 70. In the embodiment shown, a portion 72 of depression 66 is recessed to avoid interference with operation of actuator 70.

Turning now to FIGS. 4 through 8, the operation of key 10 within keyway 37 is illustrated in more detail. Key 10 is shown in phantom in an "OFF" position 74 in keyinsertable portion 52 and also in an "ON" position 76 in non key-insertable portion 54.

Looking at the "OFF" position as depicted in FIGS. 4, 5, and 7, key 10 is shown fully inserted into keyway 37 with protrusion 24 resting in first depression 64 and arm 18 partially compressed upwards.

This "OFF" position was attained by inserting distal end 14 of the key into the key-insertable portion 52 (See FIG. 3) in direction 78, until arm 18 reached a fully compressed condition and the protrusion 24 subsequently dropped into depression 64.

The "ON" position is then attained by moving the proximate end 12 of the key 10 in direction 80 within the keyway until protrusion 24 falls into second depression 66 and activates the switch actuator 70 to start the machine.

In the preferred form, second depression 66 is deeper than the first depression 64 in order to overcome the spring force of the push button spring-loaded actuator 70 of switch 69, as well as to prevent vibration of the operating machine from moving protrusion 24 out of depression 66, turning off the machine.

An exercise treadmill 82 using the invention is depicted in FIG. 9. The treadmill includes belt 84, side rail 86 and control console 88. A keyway housing 36 is part of console 88, and is shown with a safety key 10 inserted therein. A lanyard 35 is attached to the key 10 and has a clothing clip 90 attached at its other end. When clip 90 is attached to a users clothing, any movement beyond the range of the lanyard 35 will pull the key 10 from the keyway housing 36, shutting off the machine.

In this application, key 10 is typically about 4½ inches in length, one inch in width, and ¼ inch in thickness. Protrusion 24 extends downward from the arm about 3/16 inch. Arm 16 is about 1¼ inches long.

The activation device of the invention may be used with any electrically powered machine. It is especially adapted to machines requiring control of its use, i.e., to prevent unauthorized use. Machines which may present danger if accidently activated may enhance their safety with this invention.

Those machines in which the user is normally in a given operating position, and in which danger is presented by movement of the user away from that position during machine operation, may benefit much from the use of this invention. For example, if a user trips or falls from the machine such movement will pull key 10 from the keyway housing 50 to deactivate the machine. The treadmill is but one of many possible applications.

The angle 92 between the "ON" and "OFF" positions is shown as 20 degrees. Preferably, the angle is such that the "ON" and "OFF" positions are readily obvious, but the stroke 94 between positions is minimized to reduce the size of the keyway housing 50.

The switch activation apparatus of this invention may be generally constructed of metal, plastic or other generally rigid material. The required flexure of resilient arm 18 is minimal, so that plastic or metal materials may be used for the arm as well. In the preferred embodiment, the key 10 is constructed of a rigid plastic, and the reduced thickness of the arm results in the required flexibility.

The switch actuator 70 is preferably located within second depression 66 so that it is not easily accessible to activation by a tool, i.e. screwdriver inserted into the keyway. If desired, however, less critical machines may use adaptation in which the actuator 70 is depressed and activated by another portion of the key 10.

Actuator 70 may be a push button, or may be a lever or other type of actuator actuatable by the key.

The embodiment of key and keyway is exemplary of the invention. For various applications, the location of protrusion, switch, and guideway may be varied as desired.

Guideway 62 is shown as a groove in this example. Alternatively, it may comprise a ridge or ridges, or other construction which intercepts and guides the protrusion.

Reference herein to details of the illustrated embodiments is not intended to restrict the scope of the appended claims which themselves recite those features regarded as important to the invention.

We claim:

1. An apparatus for activating and deactivating an electrically powered machine, comprising:

a keyway adapted to receive a safety key, said keyway having a keyway housing with a base, side walls, a curved rear wall and a cover, said keyway having a key-insertable portion defining an "off" position, and a non key-insertable portion defining an "on" position, said keyway having an arcuate guideway to guide said safety key between an "OFF" position and an "ON" position;

an electrical switch having actuator means adapted to be actuated by said safety key when in said "ON" position; and

a safety key having a proximate end for operation by the user and an arcuate distal end for insertion in said key insertable portion of said keyway whereby said arcuate distal end pivots within said curved rear wall of the safety keyway housing between said "OFF" position in which said electrical switch is deactivated and said "ON" position in which said electrical switch is activated, said safety key including protrusile means for movement in said guideway wherein said protrusile means engages said guideway to hold said safety key in one of said "ON" or "OFF" positions and said protrusile means prevents said safety key being inserted into said non key-insertable portion.

2. The apparatus of claim 1, wherein a dimension of said keyway is enlarged in said key-insertable portion to

permit insertion of said key therein and wherein a dimension of said non key-insertable portion is reduced to block insertion of said key therein.

3. The apparatus of claim 2, wherein said dimension of said key-insertable portion permits passage of said protrusion therethrough, and said dimension of said non key-insertable portion obstructs passage of said protrusion thereinto while permitting removal of said key therefrom.

4. The apparatus of claim 2, wherein said dimension of said key-insertable portion decreases with insertion distance to communicate with said protrusion and compress said protrusion toward said key.

5. The apparatus of claim 4, wherein said key includes means for attachment to a user of said machine, wherein movement of said user removes key from said keyway to deactivate said machine without hand manipulation of said key.

6. The apparatus of claim 5, wherein said attachment means comprises a lanyard having one end attached to said key and the opposite end having means attachable to said user.

7. The apparatus of claim 1, wherein said key is movable from said "OFF" position to said "ON" position by rotation about said distal end of said key.

8. The apparatus of claim 1, wherein said guideway comprises a groove having depressions therein for retaining said protrusion in said "OFF" and said "ON" positions.

9. The apparatus of claim 1, wherein said key is formed of plastic by one-piece molding.

10. An apparatus for activating and deactivating an electrically powered machine, said apparatus comprising:

a keyway adapted to receive a safety key, said keyway having a keyway housing with a base, side walls, and a cover, said keyway having a key-insertable portion defining an "OFF" position, and a non keyinsertable portion defining an "ON" position, and said keyway guides said safety key between an "OFF" position and and "ON" position;

an electrical switch having actuator means adapted to be actuated by said safety key when in said "ON" position; and

a safety key having a proximate end for operation by the user and a distal end for insertion in said key-insertable portion of said keyway, said keyway having a guideway extending between said "ON" and "OFF" positions, said safety key including protrusile means comprising resilient means with a protrusion positioned to extend normally away from said safety key and adapted to flex with said resilient means to prevent said safety key from being inserted into said non key-insertable portion and permit said safety key to be inserted into said key-insertable portion, said protrusile means positioned to move in said guideway between said "OFF" position in which said electrical switch is deactivated and said "ON" position in which said electrical switch is actuated when said safety key is inserted in said keyway and retain said key in one of said "ON" or "OFF" positions.

11. The apparatus of claim 10, wherein the key has a thickness and said thickness is selected to provide substantial rigidity thereof, and said resilient means comprises an elongate arm portion of said key, said arm portion having a proximate end fixedly connected to said key and a distal end having a protrusion extending normally away from said key, said arm portion being of reduced thickness for increased flexibility for compressional movement of said protrusion towards said key.

12. A safety switch apparatus for activating and deactivating an electrical machine, comprising:

a keyway housing having a first keyway opening for insertion of a key to a fully inserted "OFF" position, and a second keyway opening wherein insertion of said key is blocked, said keyway housing including a guideway for guiding said key between said "OFF" position and an "ON" position;

a key insertable in said first keyway opening and movable between said "OFF" position and said "ON" position; and

means for directly retracting said key through said second keyway opening from said "ON" position without passing through said normal "OFF" position.

13. An apparatus for activating and deactivating an electrically powered machine, comprising:

a keyway adapted to receive a safety keyway, said keyway having a keyway housing with a base, side walls, and a cover, said keyway having a key-insertable portion defining an "OFF" position and a non keyinsertable portion defining an "ON" position, and said keyway guides said safety key between an "OFF" position and an "ON" position;

an electrical switch having actuator means positioned for actuation by said safety key when in said "ON" position; and

a safety key having a proximate end for operation by the user and a distal end for insertion in said key-insertable portion of said key said keyway having a guideway extending between said "ON" and "OFF" positions, said safety key including protrusile means in communication with said guideway for movement in said guideway from said "OFF" position in which said electrical switch is deactivated to said "ON" position in which said electrical switch is activated to operate said actuator means against a first resistance wherein said protrusile means engages said guideway to hold said safety key in one of said "ON" or "OFF" positions, said safety key being capable of removal from said keyway through said non key-insertable portion from said "ON" position against a second resistance without passing through said "OFF" position.

14. An exercise treadmill including: an electrically powered endless belt;

a support console supported above said endless belt; and apparatus carried by said console for activating and deactivating said electrically powered endless belt, said apparatus comprising;

a keyway adapted to receive a safety key, said keyway having a keyway housing with a base, side walls, a curved rear wall, and a cover, said keyway having a key-insertable portion defining an "OFF" position and a non key-insertable portion defining an "ON" position and said keyway having a guideway to guide said safety key between an "OFF" position and an "ON" position;

an electrical switch having actuator means positioned for actuation by said safety key when in said "On" position;

a safety key having a proximate end for operation by the user and an arcuate distal end for insertion in said keyinsertable portion of said keyway whereby

said arcuate distal end pivots within said curved rear wall of the safety keyway housing between said "OFF" position in which said electrical switch is deactivated and said "ON" position in which said electrical switch is activated, said safety key including protrusile means for arcuate movement in said guideway when said arcuate distal end of said safety key is pivoted against the curved rear wall of the keyway wherein said protrusile means engages said guideway to hold said safety key in one of said "ON" or "OFF" positions and said protrusile means prevents said safety key from being inserted into said non key-insertable portion;

a flexible tether sized to extend from said support console to a user positioned on said exercise treadmill, said tether having a first end secured to the proximate end of said safety key; and a second end secured to the user positioned on said exercise treadmill.

* * * * *

APPENDIX F

US009072930B2

(12) **United States Patent**
Ashby et al.

(10) **Patent No.: US 9,072,930 B2**
(45) **Date of Patent: Jul. 7, 2015**

(54) **SYSTEM AND METHOD FOR MEASURING RUNNING EFFICIENCIES ON A TREADMILL**

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(72) Inventors: **Darren C. Ashby**, Richmond, UT (US); **Greg W. Law**, Smithfield, UT (US)

(73) Assignee: **ICON Health & Fitness, Inc.**, Logan, UT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 195 days.

(21) Appl. No.: **13/860,217**

(22) Filed: **Apr. 10, 2013**

(65) **Prior Publication Data**

US 2013/0274066 A1 Oct. 17, 2013

Related U.S. Application Data

(60) Provisional application No. 61/623,059, filed on Apr. 11, 2012.

(51) **Int. Cl.**

A63B 24/00	(2006.01)
A63B 22/02	(2006.01)
A63B 71/06	(2006.01)

(52) **U.S. Cl.**

CPC ***A63B 24/0087*** (2013.01); ***A63B 24/0062*** (2013.01); ***A63B 22/0235*** (2013.01); ***A63B 71/0622*** (2013.01); *A63B 2024/0065* (2013.01); *A63B 2071/063* (2013.01); *A63B 2071/068* (2013.01); *A63B 2220/17* (2013.01); *A63B 2220/51* (2013.01); *A63B 2220/58* (2013.01); *A63B 2220/806* (2013.01)

(58) **Field of Classification Search**

CPC A63B 24/00
USPC 482/1–9, 51, 54, 900–902
See application file for complete search history.

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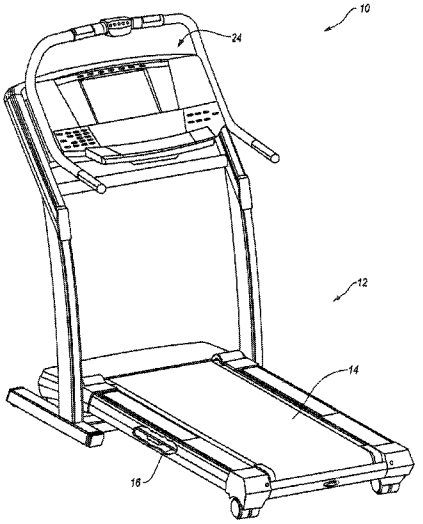
* cited by examiner

Primary Examiner — Glenn Richman
(74) *Attorney, Agent, or Firm* — Holland & Hart LLP

(57) **ABSTRACT**

A treadmill may comprise a deck, a treadbelt covering at least a portion of the deck, and a drive motor configured for driving the treadbelt. The treadmill may further comprise a sensor, a console, and a computer. The sensor may be configured to detect an amount of power utilized by the drive motor, and the console may be configured to convey information to a user. The computer may comprise a memory and a processor, and be configured for electric communication with the sensor and the consol. The computer may be programmed to analyze data received from the sensor, to provide a communication to a user through the consol that provides information about the user's running form based on the analyzed data received from the sensor, and to provide a communication to the user through the consol that provides information on how the user may change their current running form to improve running efficiency.

7 Claims, 4 Drawing Sheets



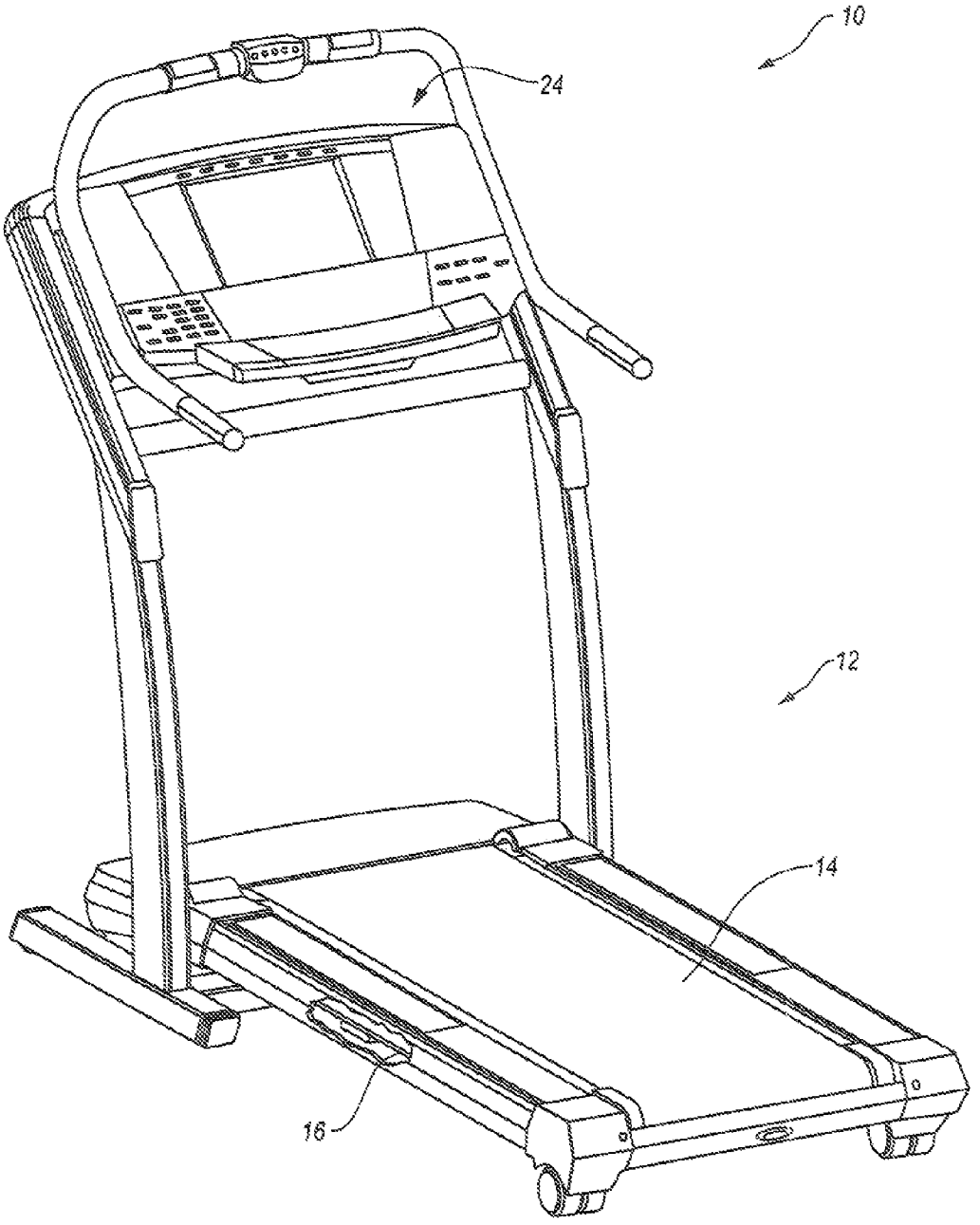


Fig. 1

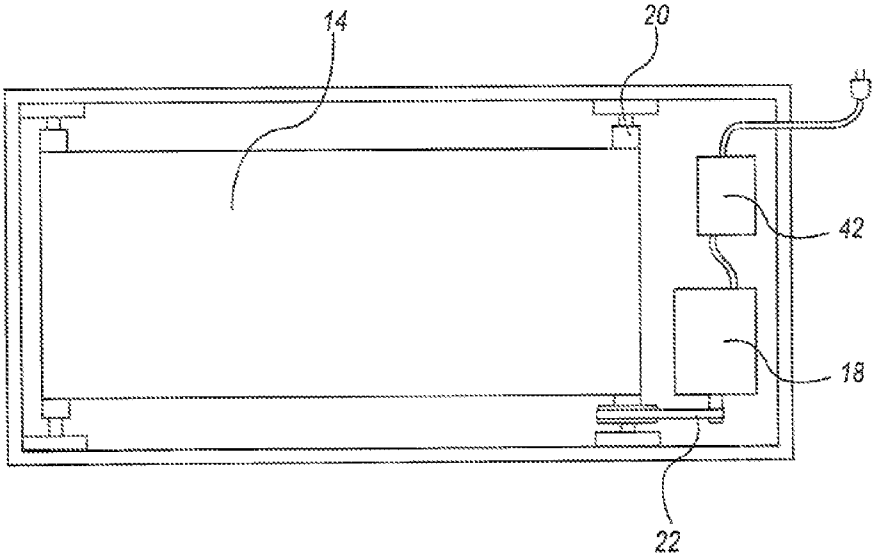


Fig. 2

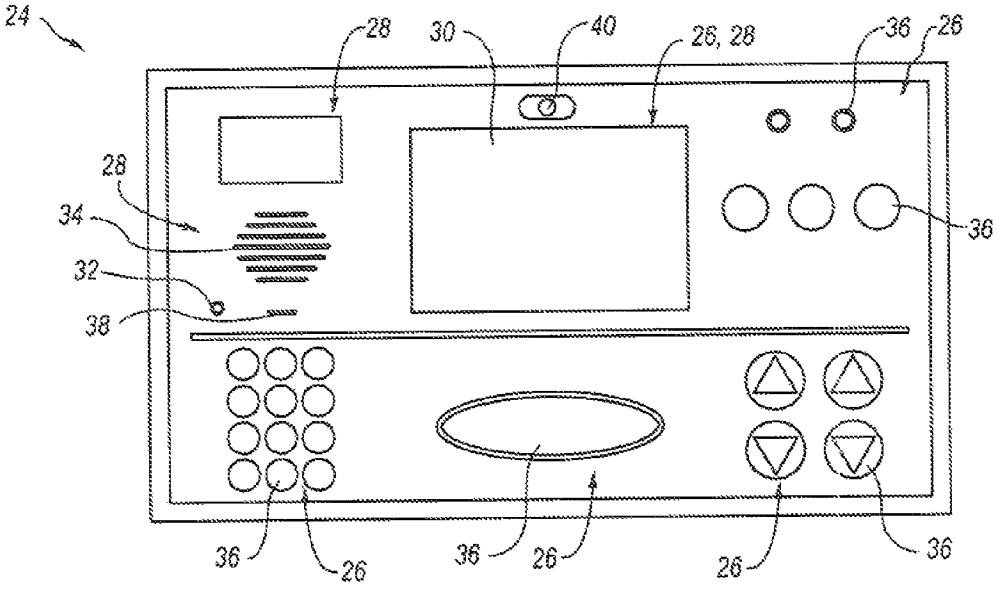


Fig. 3

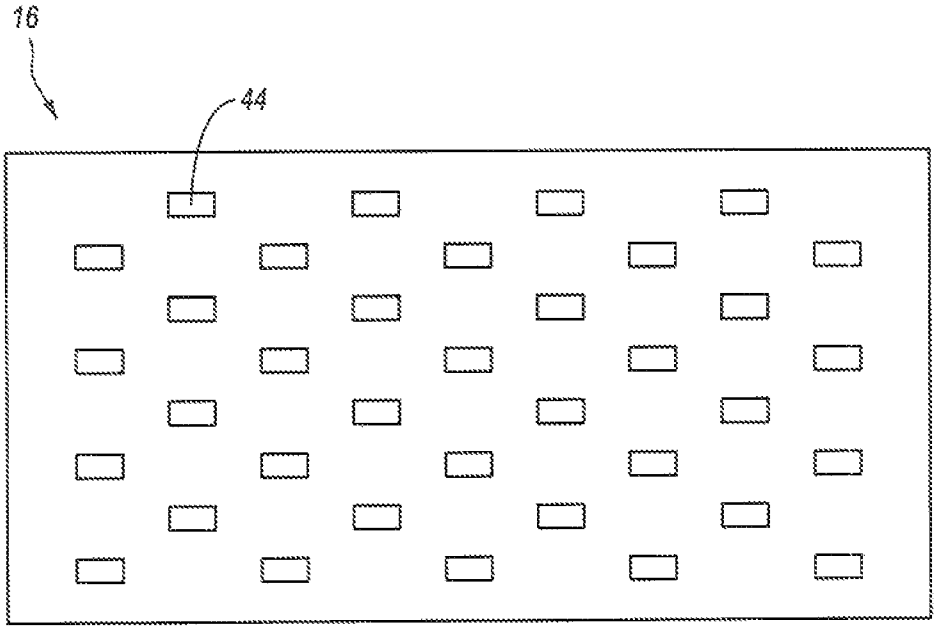


Fig. 4

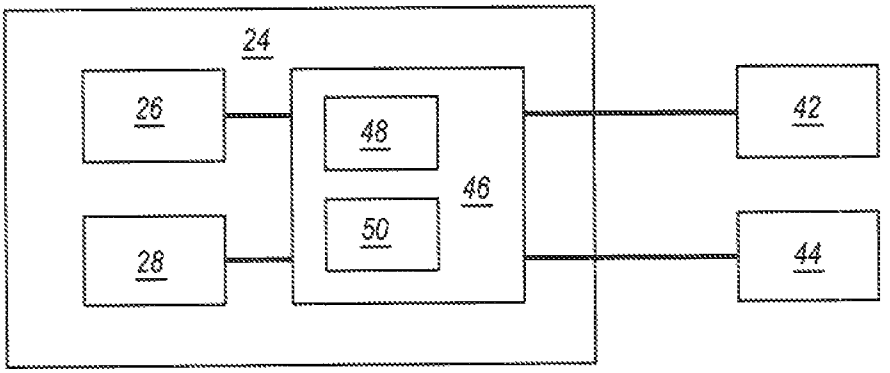


Fig. 5

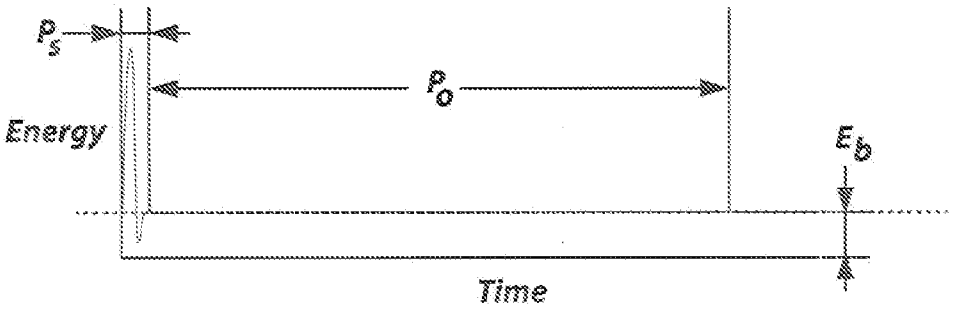


Fig. 6

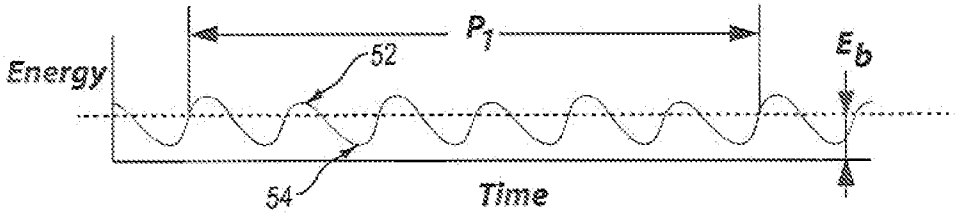


Fig. 7

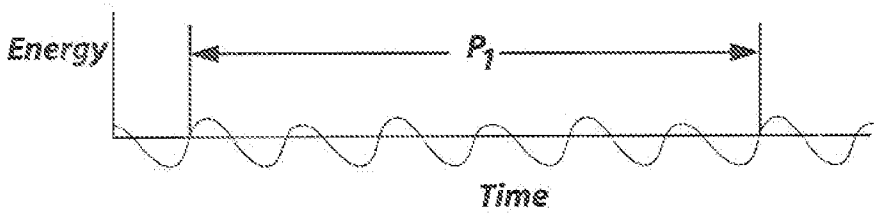


Fig. 8

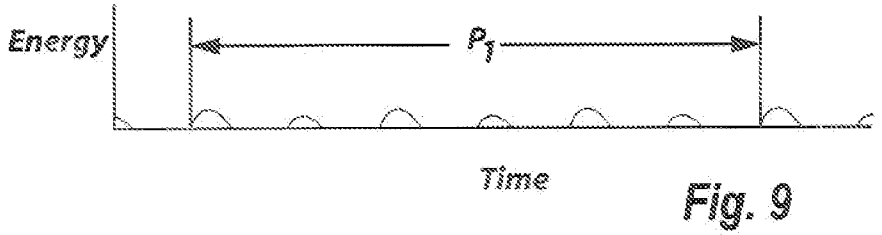


Fig. 9

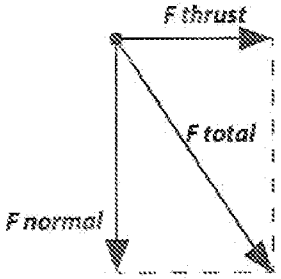


Fig. 10

SYSTEM AND METHOD FOR MEASURING RUNNING EFFICIENCIES ON A TREADMILL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 61/623,059 filed Apr. 11, 2012.

TECHNICAL FIELD

In general, the present disclosure relates to exercise devices. More specifically, the present disclosure relates to treadmills that include at least one sensor for detecting the energy used by a drive motor of the treadmill and a console for communicating information about the user's running form based on the analyzed data received from the at least one sensor.

BACKGROUND

It is useful for runners, and especially endurance runners, to improve their running efficiency. If a runner can improve their running form to run more efficiently, they can improve running speed and running distance. A runner may attempt to determine their running efficiency by evaluating the way that they feel during or after a run. However, factors other than the runner's form may affect the way that the runner feels. For example, weather conditions, diet, sickness and other factors may affect the way a runner feels. Accordingly, it may be difficult for a runner to get an accurate assessment of how efficiently they are running, or how a change in their running form is affecting their running efficiency.

U.S. Pat. No. 7,736,273 to Cox et al., filed 10 Mar. 2009, incorporated herein in its entirety by this reference, describes an interface box removably disposed on incoming power wiring of a treadmill, and describes utilizing electronic signature analysis (ESA) for gait analysis. However, Cox et al. does not describe how one might determine a running efficiency of a runner with the ESA, or how one might determine interaction forces between the runner and the treadmill with the ESA. Rather, for analyzing a runner's athletic performance, Cox et al. describes that one could establish characteristic 'signatures' of elite runners and compare them with other developing runners.

In view of the foregoing, there is a need for devices and methods that may effectively measure, calculate, and report running efficiency and/or interaction forces. Additionally, there is a need for devices and methods that may facilitate improvement in running efficiency.

SUMMARY

In one aspect of the disclosure, a treadmill comprises a deck, a treadbelt, a drive motor, a console, and a computer.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the treadbelt covering at least a portion of the deck.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the drive motor being configured for driving the treadbelt.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the sensor being configured to detect an amount of power utilized by the drive motor.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the console being configured to convey information to a user.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer comprising a memory and a processor.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being configured for electric communication with the sensor and the consol.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to analyze data received from the sensor.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to provide a communication to a user through the console that provides information about the user's running form based on the analyzed data received from the sensor.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to provide a communication to the user through the console that provides information on how the user may change their current running form to improve running efficiency.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to analyze the signal from the sensor to determine a user's running cadence.

In Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to analyze the signal from the sensor to determine an impact force when a user's foot impacts the treadbelt.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the console including a video display.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to deliver a video signal to the console to provide video information to the user via the video display that depicts how the user may change their current running form.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the console having a speaker.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being programmed to deliver an audio signal to the console to provide audio information to the user via the speaker that describes how the user may change their current running form.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being further programmed and configured to analyze data collected from the sensor after a communication to the user through the console that provides instructions on how the user may change their current running form to improve running efficiency, and to compare the data with previously acquired data.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include the computer being further programmed and configured to communicate a change in running efficiency via the console utilizing the compared data.

In a further aspect of the disclosure, a method of improving running efficiency may comprise measuring power usage of a drive motor of a treadmill while a user is running on the treadmill for a first period of time.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include analyzing the measured power usage of the drive motor for the first period of time with a computer.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing the user with information about the user's running form based on the analyzed data.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing the user with information on how the user may change their current running form to improve running efficiency.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include measuring power usage of the drive motor while the user is running on the treadmill for a second period of time after the user is provided with the information on how the user may change their current running form to improve running efficiency.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include comparing the measured power usage of the drive motor over the first period of time with the measured power usage of the drive motor over the second period of time and evaluating improvement in the user's running efficiency.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing a communication to the user with information on improving foot placement.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing a communication to the user with information on improving posture.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing a communication to the user with information on improving arm swing.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing a communication to the user comprising a calculated running cadence over the first period of time and a target running cadence.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include communicating a rhythm to the user having a tempo that substantially matches the user's running cadence over the first period of time.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include incrementally increasing the tempo of the rhythm communicated to the user until the tempo of the rhythm substantially matches the target running cadence.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include analyzing the measured power usage of the drive motor with the computer by calculating at least one of a running efficiency and a running inefficiency.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include analyzing the measured power usage of the drive motor with the computer by calculating a total force applied to the treadmill by the user.

In a further aspect of the present disclosure, a method of improving running efficiency may comprise measuring power usage of a drive motor of a treadmill while a user is running on the treadmill for a first period of time and analyzing the measured power usage of the drive motor over the first period of time with a computer to determine the user's average running cadence over the first period of time.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing a rhythm having a tempo substantially matching the user's average running cadence over the first increment of time.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include incrementally increasing the tempo of the rhythm until the tempo of the rhythm substantially matches a target running cadence.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include incrementally increasing the tempo of the rhythm may comprise increasing the rhythm in increments of 5 beats per minute.

Another aspect of the disclosure may include any combination of the above-mentioned features and may further include providing the rhythm providing music to the user that is associated with the rhythm.

In another aspect, which may be combined with any of the aspects herein, providing the rhythm may further comprise providing a visual display of the rhythm.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate various embodiments of the present method and system and are a part of the specification. The illustrated embodiments are merely examples of the present system and method and do not limit the scope thereof.

FIG. **1** illustrates a perspective view of a treadmill according to an embodiment of the present disclosure.

FIG. **2** illustrates a plan view of an interior of a base portion of the treadmill of FIG. **1**.

FIG. **3** illustrates a front view of a console of the treadmill of FIG. **1**.

FIG. **4** illustrates a bottom plan view of a deck of the treadmill of FIG. **1**.

FIG. **5** is a schematic view depicting a computer of the treadmill of FIG. **1**.

FIG. **6** is a graph illustrating energy usage over time by the drive motor of the treadmill of FIG. **1** while the treadmill is operating without a user running thereon.

FIG. **7** is a graph illustrating energy usage over time by the drive motor of the treadmill of FIG. **1** while the treadmill is operating with a user running thereon.

FIG. **8** is a graph illustrating the energy usage of the drive motor depicted in FIG. **7** shifted by a baseline amount.

FIG. **9** is a graph illustrating the shifted energy usage of the drive motor depicted in FIG. **8** with negative values removed.

FIG. **10** is a force diagram depicting forces applied to the treadmill of FIG. **1** by a user.

Throughout the drawings, identical reference numbers designate similar, but not necessarily identical, elements.

DETAILED DESCRIPTION

The present disclosure provides a treadmill that can sense the electric load on a drive motor as a person exercises on the treadmill and analyze this data to determine the person's

running efficiency, the person's running cadence, and/or the person's running form. Additionally, this data may be analyzed along with data from sensors associated with a platform of the treadmill to provide the forces that the person's feet impart on the treadmill.

Unless specified or limited otherwise, the terms "connected" and "associated with" are used broadly and encompass both direct and indirect connections and associations. Further, these terms are not restricted to mechanical attachments, but also include frictional, adhesive, magnetic and other attachments.

A treadmill according to an embodiment of the present disclosure is illustrated in FIG. **1**. As illustrated, a treadmill **10** may include a frame **12**, a treadbelt **14** and a deck **16**. The frame **12** may comprise various parts of the treadmill **10** and may impart structural stability and/or support to the treadmill **10**. The treadbelt **14** is exposed at an upper region of the deck **16**, and provides a movable surface upon which a user may walk and/or run. The treadmill **10** may additionally include a drive motor **18** associated with the treadbelt **14**, positioned and configured to drive the treadbelt **14**, as shown in FIG. **2**. For example, the drive motor **18** may be connected to a roller **20** with a belt **22** and the treadbelt **14** may be positioned over the roller **20**.

Referring again to FIG. **1**, the treadmill **10** may also include a console **24**. The console **24** may be mounted on the treadmill **10** so that it may be readily accessible and viewable to a user positioned on the treadmill IO. As shown in FIG. **3**, the console **24** may include inputs **26** and outputs **28** to allow the user to communicate with the treadmill **10** via the console **24**. The console **24** may include a visual display, such as a video screen (e.g., a touch screen **30**), to provide visual communications to the user. The console **24** may also include an audio output, such as an audio jack **32** for the connection to headphones that may be worn by a user and/or a speaker **34**, to provide audio communications to the user. Input devices may allow a user to input data into the console **24**, such as a desired operating speed, a desired incline, information about the user (e.g., a user's weight), and other information. For example, the inputs **26** of the console may include one or more of buttons **36**, a touch screen **30**, a microphone **38**, and a camera **40** for facilitating the input of information.

The treadmill **10** may also include one or more sensors for collecting data while a user is running and/or walking on the treadmill **10**. A sensor may be positioned to sense the energy utilized by the drive motor **18**. For example, an electrical current sensor **42** may be positioned and configured to sense electrical current utilized by the drive motor **18**, as shown in FIG. **2**. Similarly, load sensors may be positioned to detect loads on the deck **16**. In some embodiments, at least one load cell **44** may be associated with the deck **16** and configured to detect forces acting on the deck **16**, as shown in FIG. **4**. As a non-limiting example, a load cell **44** may comprise one or more of strain gauges, a hydraulic load cell, a diaphragm load cell, a spool-type load cell, and/or a ring-type load cell.

The console **24** may include a computer **46** located therein, which may include a processor **48** and a memory **50**, as illustrated in FIG. **5**. In further embodiments, the computer **46** may not be located within the console **24**, but may be in communication with the console **24**. The computer **46** may be in communication with the inputs **26** and outputs **28** of the console **24** and configured to receive data from the inputs **26** of the console **24**. Additionally, the computer **46** may be configured to receive data signals from each sensor of the treadmill **10**, such as the electric current sensor **42** and the load cells **44** and to analyze the data with the processor **48**. The computer **46** may be programmed to utilize the analysis to modify the settings of the treadmill **10** and to provide specific communications to the user. For example, a program may be provided in the memory **50** of the computer **46**.

In operation, a baseline energy consumption of the drive motor **18** for a specific setting (i.e., a specific speed setting) may be determined. For example, the treadmill **10** may be run at the specific setting and average steady-state energy consumption may be determined by measuring energy consumption with the sensor for a period of operation P_o after a start-up period Ps, as illustrated in FIG. **6**. The measured energy consumption over the period of operation P_o may then be averaged by the computer **46** to determine the baseline energy consumption E_b of the drive motor **18** for the specific setting. In further embodiments, the baseline energy consumption for each setting may be programmed into the computer **46**. In yet further embodiments, a baseline energy consumption may not be utilized.

A user may then run on the treadmill **10** and the electric current sensor **42** may detect a change in energy usage by the drive motor **18**, which may indicate to the computer **46** that the user is running on the treadmill **10**. Energy usage data for the drive motor **18** may then be sensed by the electric current sensor **42** over a first period of time P_1 and collected by the computer as the user runs on the treadmill, as shown in FIG. **7**. The energy usage data from the first period of time P_1 may then be analyzed to determine information about the user's running form.

In some embodiments, the energy usage data from the first period of time P_1 may be shifted by the baseline energy consumption E_b, as shown in FIG. **8**. For example, the baseline energy consumption E_b may be subtracted from the energy usage data from the first period of time P_1. After the energy consumption contributed to baseline operation of the treadmill is removed from the data, the data may more accurately reflect the power input into the system via the user as the user is running.

At time increments wherein a user's leading foot impacts the treadbelt **14** of the treadmill **10**, a user may exert a force on the treadbelt **14** that opposes the direction of movement of the treadbelt **14**, thus, the drive motor **18** may utilize additional energy to maintain the relative speed of the treadbelt **14**. At time increments wherein a user pushes against the treadbelt **14** to move the user forward, relative to the treadbelt **14**, a force is applied in the direction of movement of the treadbelt **14**. Accordingly, the drive motor **18** may utilize less energy to maintain the relative speed of the treadbelt **14** at these times. The more force that is applied by the user opposing the direction of the treadbelt **14**, the more energy that will be utilized by the drive motor **18** to maintain the relative speed of the treadbelt **14**. Similarly, the more force that is applied by the user in the direction of movement of the treadbelt **14**, the less energy will be utilized by the drive motor **18** to maintain the relative speed of the treadbelt **14**. When plotted on a graph of energy consumption versus time with the baseline energy consumption E_b subtracted from the energy consumption data, as shown in FIG. **8**, the data may show periodic positive and negative energy consumption.

The data for the first period of time P_1 may be integrated by the computer **46** to calculate a number that correlates to a user's exerted power while running. For example, a plurality of discrete measurements occurring over the first period of time P_1 may be added together by the computer **46** with a summing function. Optionally, after the data has been integrated over the first period of time P_1, the calculated integrand may be divided by the number of strides occurring during first period of time P_1 by the computer **46** to provide a scaled inefficiency number, which may be communicated to the user

via the console **24**. The larger the scaled inefficiency number, the greater the inefficiency of the user's running form. Optionally, the scaled inefficiency number may be subtracted from a constant, such as **100**, by the computer **46** to provide a scaled efficiency number, which may be communicated to the user via the console **24**.

Data that correlates to energy input into the treadmill **10** by a user that opposes the drive motor **18** (e.g., data corresponding to force applied by a user that opposes the motion of the treadbelt **14**) may be especially significant in determining inefficient running form. In view of this, in some embodiments, the computer **46** may integrate only a portion of the data, such as the portion of the data that corresponds to energy utilized by the drive motor **18** that exceeds the baseline energy consumption E_b by the drive motor **18**. For example, the collected energy data may be shifted by the baseline energy consumption E_b amount, as shown in FIG. **8**, and any data that is positive may be integrated by the computer **46**, while any data that is negative may be discarded or ignored and not considered in the analysis, as shown in FIG. **9**. Optionally, after the data has been integrated over the first period of time P_1, the calculated integrand may be divided by the number of strides occurring during first period of time P_1 by the computer **46** to provide a scaled inefficiency number, which may be communicated to the user via the console **24**. The larger the scaled inefficiency number, the greater the inefficiency of the user's running form. Optionally, the scaled inefficiency number may be subtracted from a constant, such as 100, by the computer **46** to provide a scaled efficiency number, which may be communicated to the user via the console **24**. The greater the scaled efficiency number, the greater the efficiency of the user's running form.

In addition to providing information about the user's running efficiency. the energy consumption data collected by the electric current sensor **42** may also be analyzed to provide additional information about the user's running form. For example, the computer **46** may be programmed to calculate a derivative of the energy consumption data, which may be utilized by the computer **46** to provide a magnitude of a force that the user imparts in a direction parallel to the ground at a particular point in time. In some embodiments, a derivative of the energy consumption data at a specific time may be estimated by calculating the difference between a data point collected at that time and an adjacent data point (e.g., a data point collected at a time before or after). In view of this, at any discrete time during the runner's stride, which corresponds to a discrete foot position at that time, may be analyzed by the computer **46** to determine how much positive or negative force F_{thrust} is generated by the user that contributes to the user's locomotion (i.e., forces that are parallel to the ground or thrust force), as shown in FIG. **10**. Additionally, the load sensors associated with the deck may detect the magnitude of the force F_{normal} that the user imparts in a direction perpendicular to the ground (i.e., normal force) at a discrete time during the runner's stride, which may be analyzed to determine how much force F_{normal} the user imparts downward on the ground (e.g., forces that are perpendicular or normal to the ground). In view of this, a force F_{thrust} component that is parallel to the ground and a force F_{normal} component that is perpendicular to the ground at a discrete time may be calculated. Utilizing vector addition, or any other summation techniques, to combine the force F_{thrust} and F_{normal} components, as illustrated in FIG. **10**, the computer may be programmed to calculate a total force F_{total} vector, describing both the magnitude and direction of the force F_{total} that the user imparts on the treadmill **10** through their feet at any discrete time or foot position.

The drive motor **18** energy usage data collected by the electric current sensor **42** may also be analyzed to by the computer **46** to determine a user's running cadence. As the energy data will be cyclic, rising and falling with the user's strides, the computer **46** may be programmed to analyze repeating features of the data, which may be indicative of a user's running cadence. For example, the computer may be programmed to analyze the occurrence of peaks **52** and/or valleys **54** in the data, as shown in FIG. **7** and/or may evaluate when the measured data crosses a specific value (e.g., each time a measured data point is substantially equal to the value E_b) to evaluate the length of time between each stride and determine a running cadence.

After the computer **46** has analyzed the energy data from the electric current sensor **42**, and optionally the data from one or more load cells **44**, the computer may be programmed to provide a communication to the user via the console **24** that is specific to the analyzed data to facilitate an improvement in the user's running form. In some embodiments, the computer **46** may be programmed to report at least one of a scaled running inefficiency number and a scaled running efficiency number to the user in response to the analyzed data. Additionally, the computer **46** may be programmed to communicate advice on improving the user's running efficiency via the console **24**.

In some embodiments, the computer **46** may instruct the user to change their running form to adjust which part of the foot first impacts the treadbelt **14**, specifically to land on the ball of the foot or on the full foot and to avoid striking with the heel. For example, the computer **46** may be programmed to provide proper foot placement instructions in response to an analysis that indicates a relatively high scaled running inefficiency number and/or that indicates relatively high impact forces occurring between the user's foot and the treadmill **10**. In some embodiments, the instructions may be communicated in an audiovisual presentation via the console **24**. For example, a video may show an example of a runner displaying efficient foot placement and form while running.

In further embodiments, the computer **46** may instruct the user to adjust their posture to improve their running form and their running efficiency after analyzing the data. After the computer **46** provides instructions to the user via the console **24**, the user may continue running on the treadmill **10** and additional data may be collected from the electric current sensor **42**, and optionally, one or more load cells **44**, over a second period of time. The computer **46** may then analyze the data collected over the second period of time. After the data is analyzed, the analysis from the data collected over the second period of time may be compared to the analysis of the data collected over the first period of time P_1 (i.e., a time period prior to the computer providing the instructions to the user). The effects of the change to the user's running form may then be calculated by the computer **46** and reported to the user. For example, an improvement in running efficiency may be reported, such as a percentage increase in running efficiency, via the console **24**. For another example, a specific reduction of impact force F_{total} and/or F_{normal} between the user's foot and the treadmill may be reported. The process may be repeated as desired by the user to improve the user's running efficiency and to monitor the user's running efficiency, impact forces, and/or cadence as the user runs on the treadmill **10**.

INDUSTRIAL APPLICABILITY

In general, the present invention relates to treadmills that include a sensor for detecting the energy used by a drive

motor of the treadmill and a console for communicating information about the user's running form based on the analyzed data received from the sensor. For example, running efficiency is important to runners, especially endurance runners, as an improvement in running efficiency may improve running speed and running distance.

Currently, it is difficult for a runner to determine an accurate running efficiency. A runner may evaluate the way that they feel during or after a run, but, factors other than the runner's form may affect the way that the runner feels, such as, weather conditions, diet, sickness and other factors. Accordingly, it may be difficult for a runner to get an accurate assessment of how efficiently they are running, or how a change in their running form is affecting their running efficiency.

The present disclosure provides a treadmill that can sense the electric load on a drive motor as a person exercises on the treadmill and analyze this data to determine the person's running efficiency, the person's running cadence, and/or the person's running form. Additionally, this data may be analyzed along with data from sensors associated with a platform of the treadmill to provide the forces that the person's feet impart on the treadmill. In view of this, the treadmill may provide a runner an accurate assessment of running form factors, such as running efficiency, at home or at a local gym. Additionally, the treadmill may coach the user to improve running efficiency by providing feedback and advice to the user.

The user may input and receive communications through the console, which may interact with the user both visually and aurally. A user may input information about themselves, such as weight, and about their desired workout, such as running speed. Additionally, the console may provide communications to the user with information about their running form and advice on how to improve running form. The console may include a visual display, such as a video screen, to provide visual communications to the user. The console may also include an audio output, such as an audio jack for the connection to headphones that may be worn by a user and/or a speaker, to provide audio communications to the user. The inputs of the console may include one or more of buttons, a touch screen, a microphone, and a camera.

The treadmill may analyze data from sensors with a computer to evaluate the user's running form and utilize this analysis to determine what information to communicate to the user through the console. The sensors may include a sensor positioned to sense the energy utilized by the drive motor, and optionally, load sensors positioned to detect loads on the deck.

In response to the analyzed data, the treadmill may communicate information about the user's running form, such as running efficiency, total impact forces, and running cadence. Additionally, the treadmill may communicate information about how the user may improve their running efficiency, such as by improving foot placement, posture, arm swing, and cadence.

Specifically, the computer may provide instructions to the user to run with their body essentially straight and leaning slightly forward and to avoid bending at the hip or leaning back. The computer may instruct the user to look straight ahead and think of balancing a book on their head, and/or to breath deep to straighten posture and open the lungs before running. Additionally, the computer may instruct the user to utilize minimal, compact arm swings pumping straight forward and back with the arms relaxed and close to the body and the elbows at about 90 degrees. For example, the computer may be programmed to provide instructions for proper running posture in response to an analysis that indicates a relatively high scaled running inefficiency number and/or that indicates relatively high impact forces occurring between the user's foot and the treadmill. In some embodiments, the instructions may be communicated in an audiovisual presentation via the console. For example, a video may show an example of a runner displaying efficient posture while running.

In yet further embodiments, the computer may instruct the user to adjust their running cadence after analyzing the data. Specifically, the computer may provide the user with their current running cadence and provide a target running cadence for the user via the console. For example, the computer may be programmed to provide cadence instructions in response to an analysis that indicates a relatively low running cadence. To facilitate an increase of the user's running cadence over a period of time, the computer may provide a rhythm to the user via the console that has a tempo that corresponds to the users current running cadence. The rhythm may be audible and/or visible, and may also incorporate music, with the music synchronized with the rhythm. The tempo of the rhythm may initially correspond to the user's current running cadence. The tempo of the rhythm may then be incrementally increased (e.g., the tempo of the rhythm may be incrementally increased by 5 beats per minute) while the user is running and the user may try to match their running cadence with the tempo of the rhythm. The tempo of the rhythm may be incrementally increased until the rhythm matches the target running cadence. For example, the tempo of the rhythm may be increased until the tempo of the rhythm matches a target tempo of about 180 beats per minute.

After providing communications to the user advising on how to improve running form and efficiency, the treadmill may analyze their running and determine how much the changes in the user's running form have affected their running efficiency. In view of this, the user may adopt changes in running form that provide improvement to their running efficiency and become a more efficient runner.

What is claimed is:

1. A treadmill comprising:

a deck;

a treadbelt covering at least a portion of the deck;

a drive motor configured for driving the treadbelt;

an electrical property sensor in communication with the drive motor and configured to detect an amount of power utilized by the drive motor;

a console configured to convey information to a user;

a computer comprising a memory and a processor, the computer configured for electric communication with the electrical property sensor and the console, the computer programmed to analyze data received from the electrical property sensor, to provide a communication to a user through the console that provides information about the user's running form based on the analyzed data received from the electrical property sensor, and to provide a communication to the user through the console that provides information on how the user can change their current running form to improve running efficiency.

2. The treadmill of claim **1**, wherein the computer is programmed to analyze the signal from the electrical property sensor to determine a user's running cadence.

3. The treadmill of claim **1**, wherein the computer is programmed to analyze the signal from the electrical property sensor to determine an impact force when a user's foot impacts the treadbelt.

4. The treadmill of claim 1, wherein the console comprises a video display; and

wherein the computer is programmed to deliver a video signal to the console to provide video information to the user via the video display that depicts how the user can change their current running form.

5. The treadmill of claim 1, wherein the console comprises a speaker; and

wherein the computer is programmed to deliver an audio signal to the console to provide audio information to the user via the speaker that describes how the user can change their current running form.

6. The treadmill of claim 1, wherein the computer is further programmed and configured to analyze data collected from the sensor after a communication to the user through the console that provides instructions on how the user can change their current running form to improve running efficiency, and to compare the data with previously acquired data.

7. The treadmill of claim 6, wherein the computer is further programmed and configured to communicate a change in running efficiency via the console utilizing the compared data.

* * * * *

APPENDIX G

US008277377B2

(12) **United States Patent**
Quy

(10) **Patent No.: US 8,277,377 B2**
(45) **Date of Patent: Oct. 2, 2012**

(54) **METHOD AND APPARATUS FOR MONITORING EXERCISE WITH WIRELESS INTERNET CONNECTIVITY**

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(22) Filed: **Sep. 15, 2008**

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Related U.S. Application Data

(63) Continuation of application No. 11/649,703, filed on Jan. 3, 2007, now abandoned, which is a continuation of application No. 11/184,274, filed on Jul. 18, 2005, now Pat. No. 7,156,808, which is a continuation of application No. 10/418,845, filed on Apr. 18, 2003, now Pat. No. 6,936,007, which is a continuation of application No. 09/738,270, filed on Dec. 15, 2000, now Pat. No. 6,602,191.

(60) Provisional application No. 60/172,486, filed on Dec. 17, 1999.

(51) **Int. Cl.**
A61B 5/00 (2006.01)

(52) **U.S. Cl.** **600/300**; 600/301; 128/903; 128/920

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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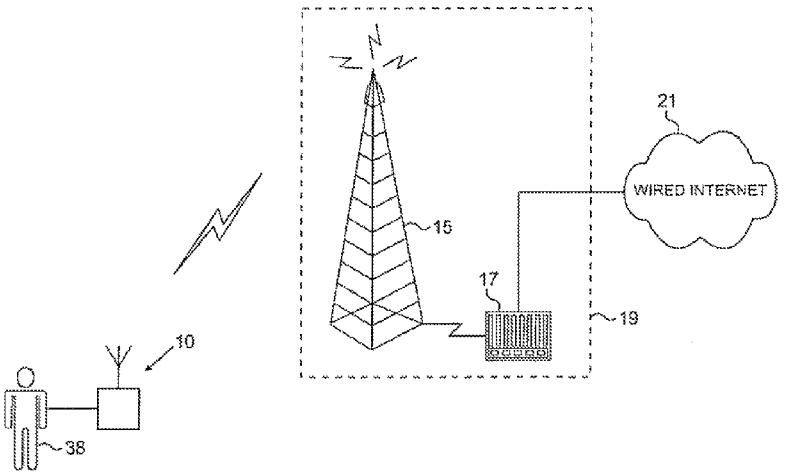
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(57) **ABSTRACT**

A method and apparatus are provided for wireless monitoring of exercise, fitness, or nutrition by connecting a web-enabled wireless phone to a device which provides exercise-related information, including physiological data and data indicating an amount of exercise performed. The connection may be by way of a wireless connection using protocols such as Bluetooth® or 802.11, or by way of a wired connection. An optional adaptor may be included if necessary. An application for receiving the exercise-related information and providing a user interface may be downloaded to the web-enabled wireless phone from an internet server. The exercise-related information may be transmitted to an internet server, and the server may calculate and return a response.

19 Claims, 8 Drawing Sheets



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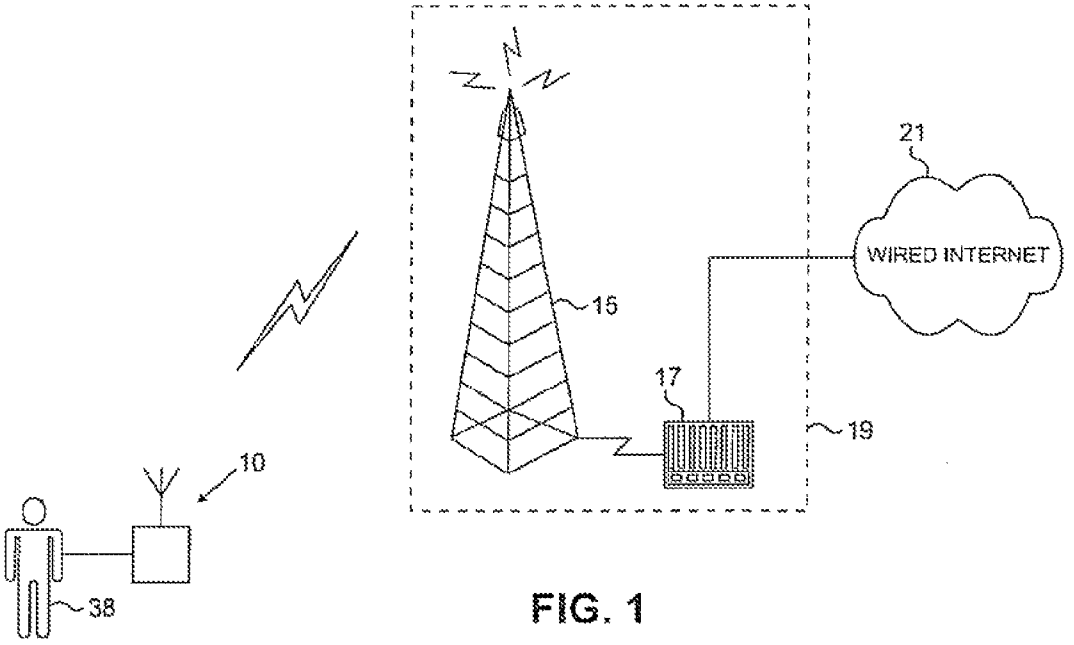


FIG. 1

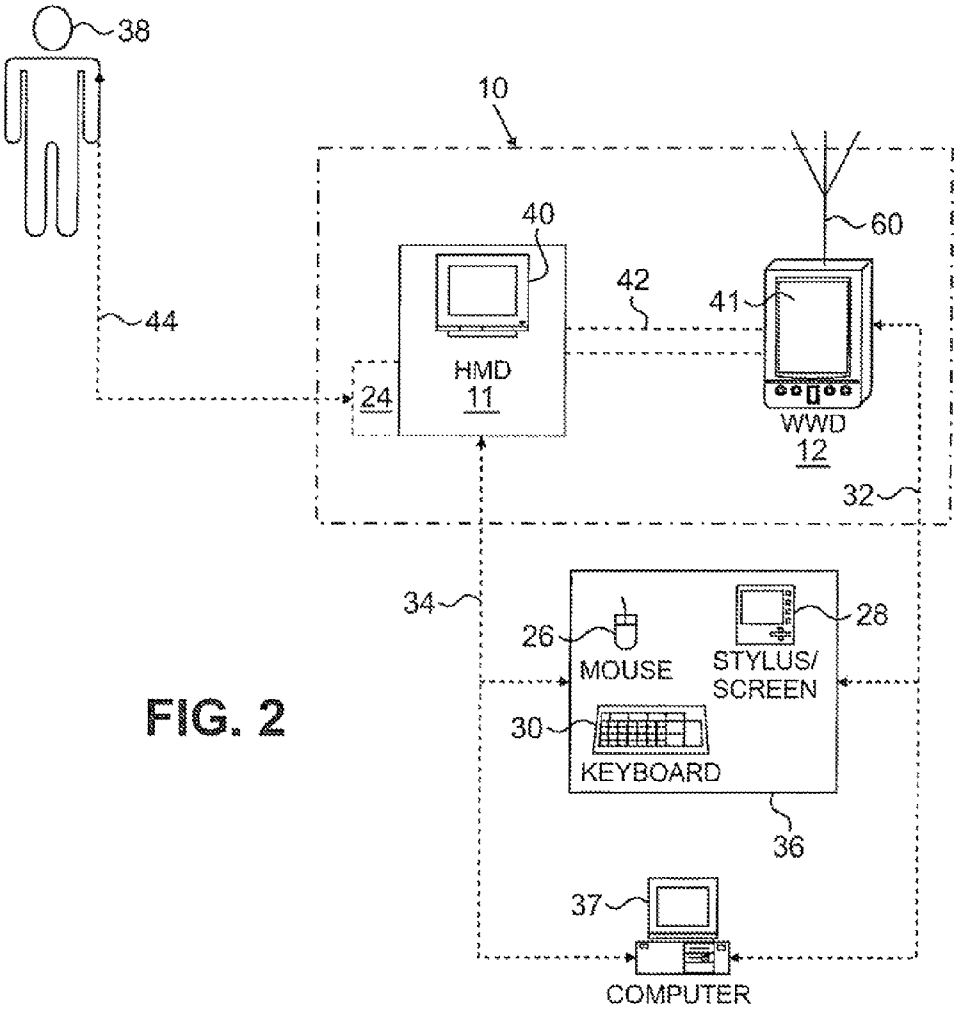

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STYLUS/
SCREEN
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KEYBOARD
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37
COMPUTER

FIG. 2

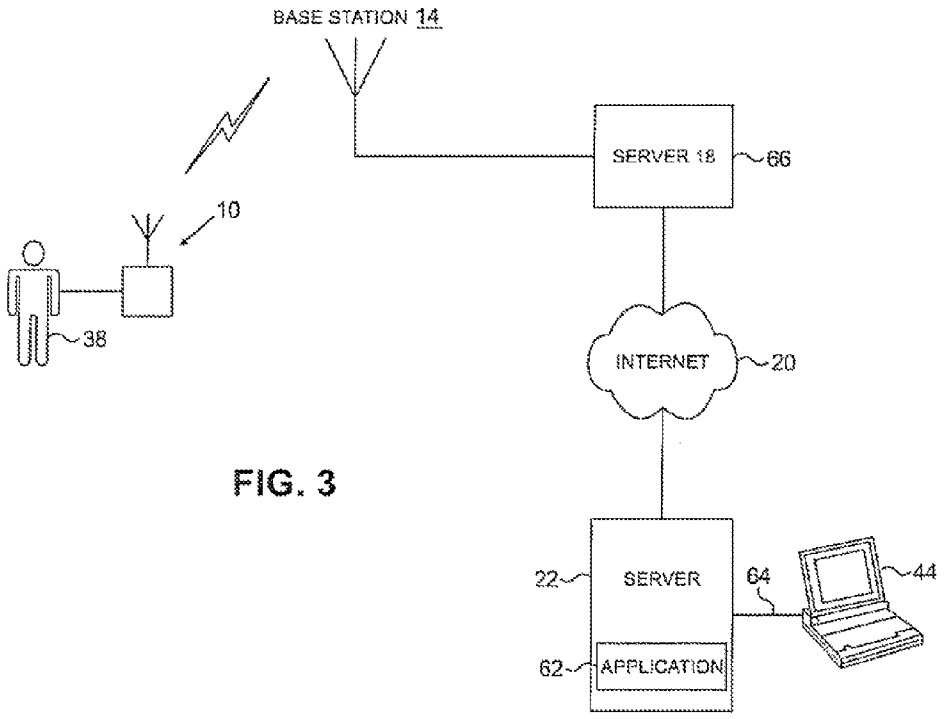

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SERVER 18
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INTERNET
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SERVER
64
44
62
APPLICATION

FIG. 3

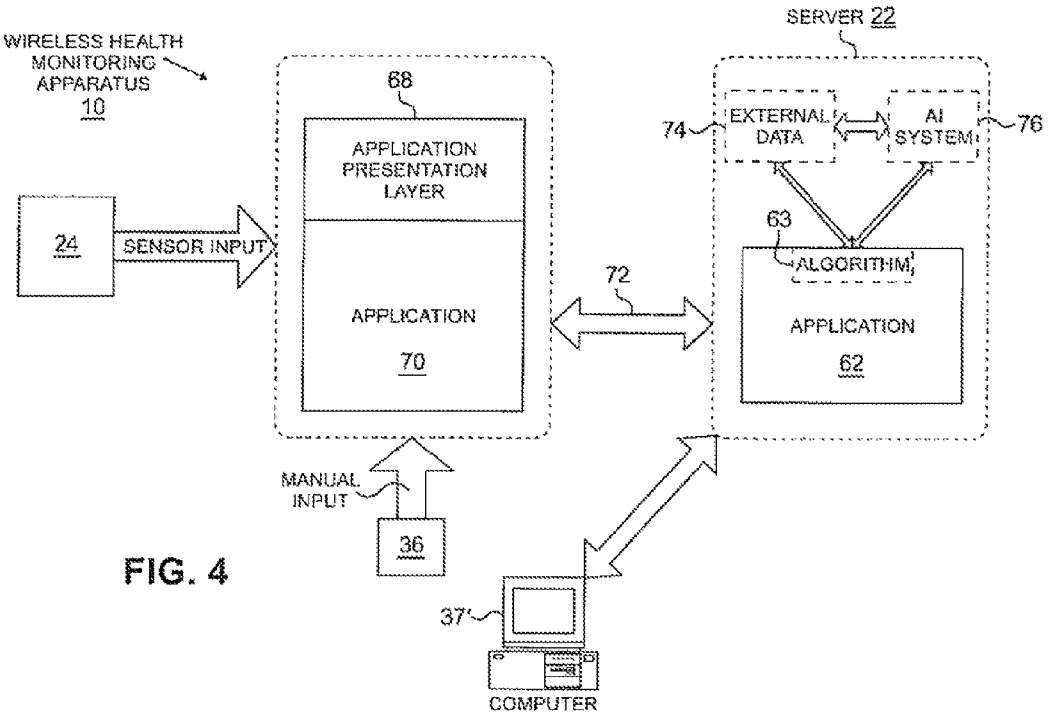

WIRELESS HEALTH MONITORING APPARATUS 10
24
SENSOR INPUT
68
APPLICATION PRESENTATION LAYER
APPLICATION 70
72
SERVER 22
74
EXTERNAL DATA
AI SYSTEM
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63
ALGORITHM
APPLICATION 62
MANUAL INPUT
36
37'
COMPUTER

FIG. 4

FIG. 5

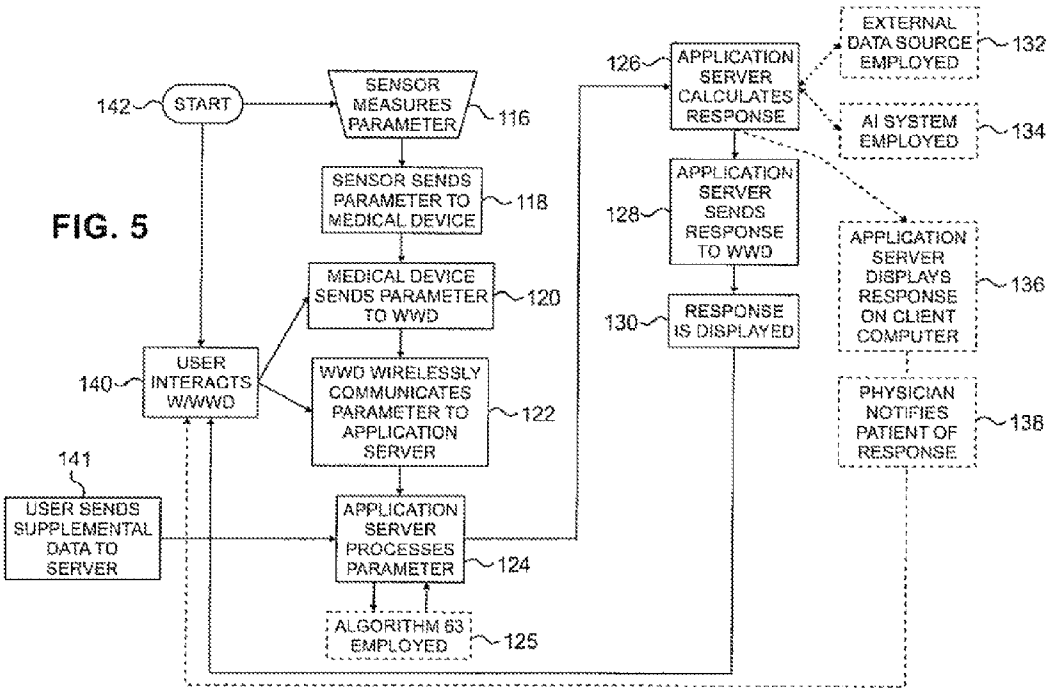
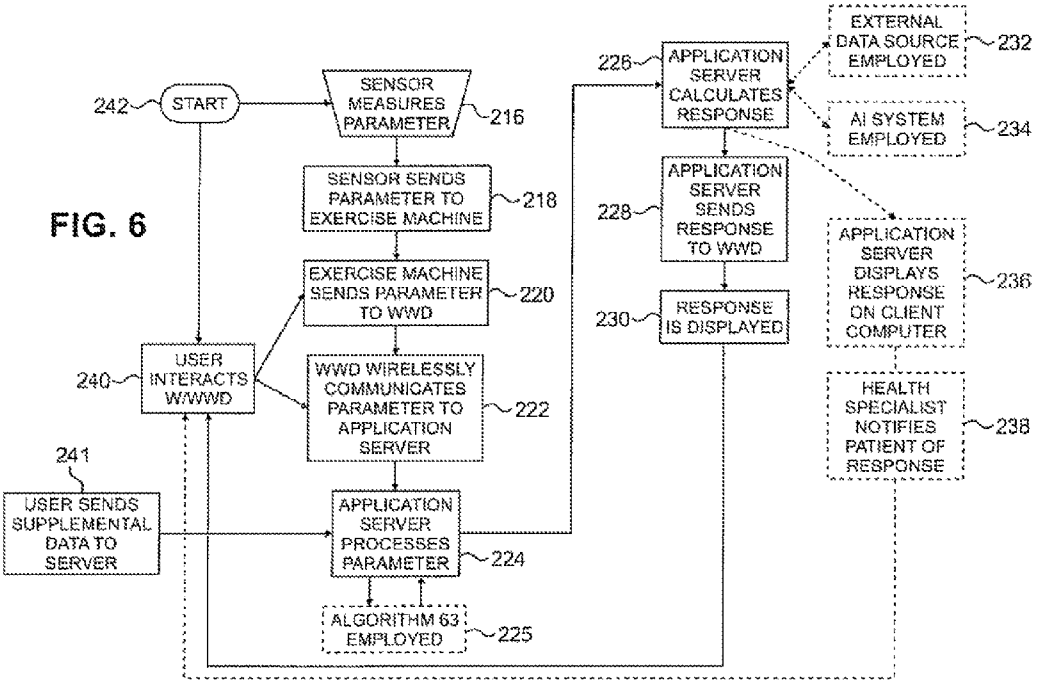

142
START
SENSOR MEASURES PARAMETER
116
SENSOR SENDS PARAMETER TO MEDICAL DEVICE
118
MEDICAL DEVICE SENDS PARAMETER TO WWD
120
140
USER INTERACTS WWWD
WWD WIRELESSLY COMMUNICATES PARAMETER TO APPLICATION SERVER
122
141
USER SENDS SUPPLEMENTAL DATA TO SERVER
APPLICATION SERVER PROCESSES PARAMETER
124
ALGORITHM IS EMPLOYED
125
126
APPLICATION SERVER CALCULATES RESPONSE
128
APPLICATION SERVER SENDS RESPONSE TO WWD
130
RESPONSE IS DISPLAYED
EXTERNAL DATA SOURCE EMPLOYED
132
AI SYSTEM EMPLOYED
134
APPLICATION SERVER DISPLAYS RESPONSE ON CLIENT COMPUTER
136
PHYSICIAN NOTIFIES PATIENT OF RESPONSE
138

FIG. 6


242
START
SENSOR MEASURES PARAMETER
216
SENSOR SENDS PARAMETER TO EXERCISE MACHINE
218
EXERCISE MACHINE SENDS PARAMETER TO WWD
220
WWD WIRELESSLY COMMUNICATES PARAMETER TO APPLICATION SERVER
222
240
USER INTERACTS W/WWD
241
USER SENDS SUPPLEMENTAL DATA TO SERVER
APPLICATION SERVER PROCESSES PARAMETER
224
ALGORITHM 63 EMPLOYED
225
226
APPLICATION SERVER CALCULATES RESPONSE
228
APPLICATION SERVER SENDS RESPONSE TO WWD
230
RESPONSE IS DISPLAYED
EXTERNAL DATA SOURCE EMPLOYED
232
AI SYSTEM EMPLOYED
234
APPLICATION SERVER DISPLAYS RESPONSE ON CLIENT COMPUTER
236
HEALTH SPECIALIST NOTIFIES PATIENT OF RESPONSE
238

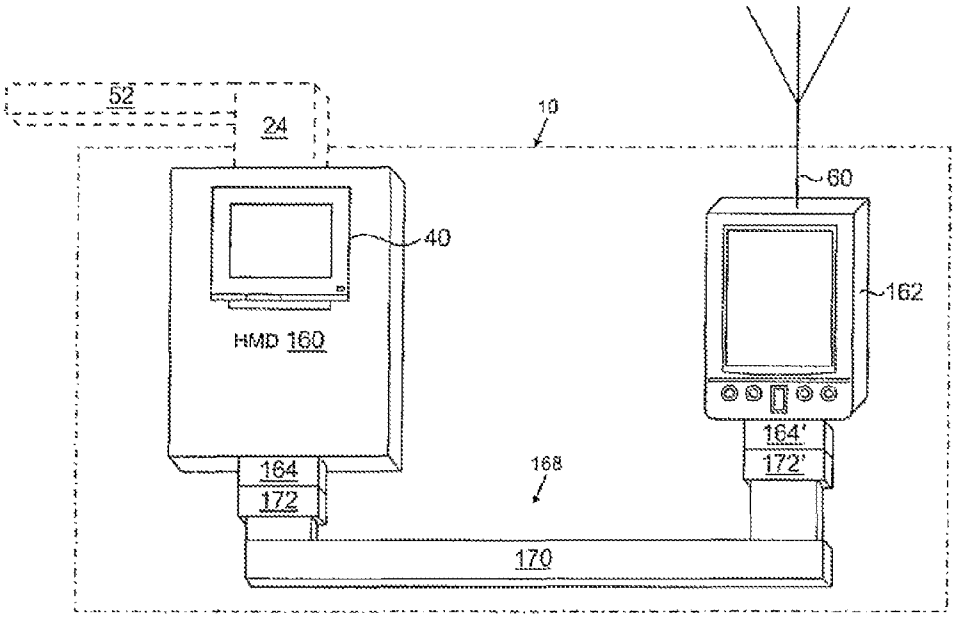


FIG. 7

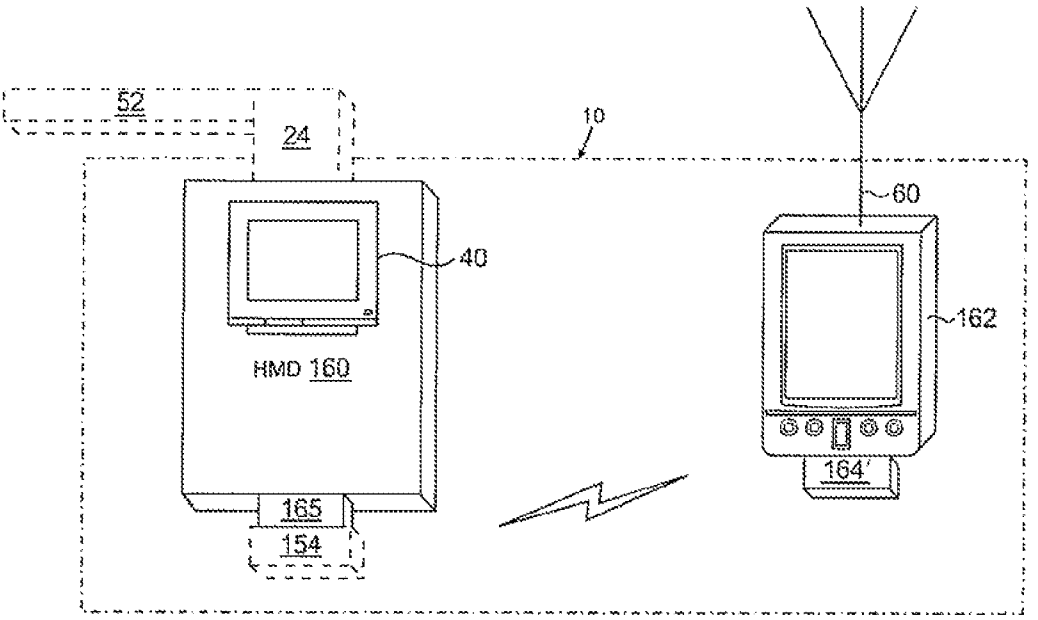


FIG. 8

METHOD AND APPARATUS FOR MONITORING EXERCISE WITH WIRELESS INTERNET CONNECTIVITY

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation of U.S. patent application Ser. No. 11/649,703, filed Jan. 3, 2007, entitled "Method and Apparatus for Health and Disease Management Combining Patient Data Monitoring with Wireless Internet Connectivity," which is a continuation of U.S. patent application Ser. No. 11/184,274, filed Jul. 18, 2005, entitled "Method and Apparatus for Health and Disease Management Combining Patient Data Monitoring with Wireless Internet Connectivity," now U.S. Pat. No. 7,156,808, which is a continuation of U.S. patent application Ser. No. 10/418,845, filed Apr. 18, 2003, now U.S. Pat. No. 6,936,007, which is a continuation of U.S. patent application Ser. No. 09/738,270, filed Dec. 15, 2000, now U.S. Pat. No. 6,602,191, which is a conversion of U.S. Provisional Application Ser. No. 60/172,486, filed Dec. 17, 1999. The disclosure of each of the prior applications is incorporated herein by reference in its entirety.

REFERENCE TO GOVERNMENTAL SUPPORT

(none)

REFERENCE TO MICROFICHE APPENDIX

(none)

FIELD OF THE INVENTION

The present invention relates to monitoring of living subjects, and more particularly to health-monitoring of persons where measured or input health data is communicated by a wireless device to and from a software application running on an internet-connected server and where the same may be studied and processed by the software application, a health professional, or the subject.

BACKGROUND OF THE INVENTION

Several attempts have been made in the past to achieve efficient interactive communication of medical or health information between a subject or patient and a reviewer or provider of that information. In particular, communication of consumer physiological information has been a subject of such attempts. It is noted that in this regard the "reviewer or provider of medical or health information" is understood to include not only a physician but also a software application or algorithm that may analyze the information.

Medical or health information has been made available on a D-ROM accessible by a home computer system. This passive approach had certain disadvantages. First, although the personal computer is prevalent is the United States, it is generally too expensive for a consumer physiological monitoring system and there are many people who find it too complicated to set up and use for that purpose. High-risk, chronically ill patients, responsible for more than half of health care costs in the United States and forming the fastest growing segment of those requiring health care, are indeed the most likely not to be able to afford or use a system built around a personal computer. In addition, such systems are limited in their interactivity to the information stored on the CD.

Previous patents by the Inventor addressed both of these disadvantages, as well as the need to reduce health care costs through providing educational health care information and interactive physiological monitoring in the home environment by means of a user-friendly, interactive system (see, e.g., U.S. Pat. Nos. 5,601,435, 6,144,837, and continuations thereof).

These previous patents were based on a video game console, or a multimedia player using a conventional television screen as the display device to achieve a system which is simpler to use than systems based on a personal computer. An initial embodiment of the previous patents utilized a compact disc to provide interactive information for disease management.

Even with the advantages provided, these systems limited the user to location in which the device was located. Even where devices are portable, as in the case of a laptop computer with a modem, an ordinary POTS phone line must be found and used. Where the user's computer employs a broadband connection, such as DSL or satellite, the choices of location are even more limited.

Attempts have been made to remedy this deficiency. For example, many telemetry systems allow a "wireless" distance to be placed between a health measuring unit and a remote monitoring system. However, such systems are limited in their range.

Other systems have used cellular telephone technology to increase the wireless health monitoring range. However, these systems have several deficiencies, such as requiring significant modification of the mobile phone. For example, U.S. Pat. No. 5,772,586, issued Jun. 30, 1998 to Heinonon et al., discloses a method for monitoring the health of a patient. This system uses a specialized connection between the patient health measuring unit and the cellular phone, however. The patient health measuring unit is located in the battery space of the mobile phone and is connected to a communication bus of the mobile phone. Other systems have been proposed, but these suffer from similar deficiencies in that they are not designed to be used with "off-the-shelf" wireless devices or health measuring equipment.

The deployment of the above systems also currently lacks employment of full back-end server functionality with which to provide a wide range of interactive communication with the patient. Instead, such systems, if internet-enabled, are often limited to mere one-way non-interactive data transfer via a modem. While some systems are more enhanced, including that disclosed in U.S. Pat. No. 5,357,427, issued Oct. 18, 1994 to Langen, et al., and entitled "Remote Monitoring of High-Risk Patients using Artificial Intelligence", these systems are limited by the wired telecommunications infrastructure.

SUMMARY OF THE INVENTION

Embodiments of the present invention overcome one or more of the disadvantages of the prior art by providing a full-feature health-monitoring system that may wirelessly connect to a back-end server application via the internet. The invention allows wireless access to and from a wide variety of present medical or health-related instruments and devices, while maintaining the capability of connecting to future such devices.

In particular, the invention may be embodied in several systems. Two complementary such systems are described herein, although extensions to other such systems can be envisioned. First, an embodiment of the invention may be employed to manage the disease state or condition of a

patient. In this embodiment, the patient may employ a health monitoring device ("HMD"), in particular a medical device, and a wireless connection provides data from the medical device for processing via the internet including a review by a physician or other health care professional if required.

In the second embodiment, a health or lifestyle management plan may be implemented. Various health parameters, such as those relating to nutrition or exercise, may be entered into a health monitoring device, in this instance termed an "exercise machine", and the same may be wireless communicated to a server. An application may process and store the health parameters, and a health specialist may optionally review the same.

Wireless internet connectivity has many advantages. For example, in the first embodiment, a diabetic could connect a blood glucose meter to an internet-enabled wireless web device ("WWD") away from home and download data to a Diabetes Management Company's server and, in response, receive guidance displayed on the screen (or by voice) about choices for the next meal.

Alternatively, in the second embodiment, a person interested in tracking an exercise program may take the WWD to the local health club and attach the same to an exercise machine, send data output from various exercise machines over the Internet, and receive a personalized response from the server of a company specializing in Health & Lifestyle Management. The individual may input caloric content of foods eaten, and may further input caloric content of exercise performed. In this way, e.g., a person in a weight-loss program may see in great detail whether they are expending more calories in the form of exercise than the same individual is consuming in the form of food.

In general, in the health management embodiment, the system may be employed to monitor the physiologic status of a healthy subject while eating, exercising, or performing other activities. For clarity, such devices are termed herein "exercise machines". These may include an electronic body weight scale, a body fat gauge, biofeedback devices, physiotherapy or chiropractic equipment, blood pressure recorders, or the like, or any type of exercise machine or monitor, including a heart rate monitor, treadmill, rowing machine, stepper, or the like.

In more detail, the present invention provides a method and system for assisting patients to manage a disease or maintain healthy lifestyle by collecting health-related data and providing information in response to those data by means of a WWD designed to display interactive information through a connection to the Internet. The present invention may be connected to various HMDs, both medical and exercise-related in nature, and may communicate information via a wireless connection such as a wireless Internet connection.

A major advantage of embodiments of the invention is that the same frees the patient from the constraints of wired systems. The same allows users with consumer "off-the-shelf" wireless devices to significantly extend the range of connectivity over that of wired computer, television, or even wireless telemetry systems.

In a first embodiment of the present invention, the WWD is a web-enabled cellular phone. Here it is noted that the term "web" or "internet" are used interchangeably to refer to the internet in general. In a second embodiment, the WWD is a palm, handheld, or laptop computer, or a PDA, equipped with a wireless modem. In a third embodiment, the WWD may be a hybrid device that combines the functions of a computer, PDA and telephone.

An adaptor is used if necessary to convert the output signal of the medical monitoring device to a suitable input signal for the WWD. The adaptor allows connection of the WWD to a medical device, exercise machine or other variety of health care equipment, and the connection may be made via several techniques. As for wired techniques, a standard parallel bus or serial cable may be used if the input/output ports between the HMD and the WWD are appropriate. Otherwise, a suitable separate adaptor may be employed.

The connection may also be an input such as a disk drive or other media input for input of data, a USB port or phone jack or other such wired input, again employing an adaptor if required.

As for wireless techniques, infrared (IR), microwaves, radio frequency (RF), e.g., Bluetooth® or IEEE 802.11 protocols, optical techniques including lasers, and other such techniques may be used. The patient or subject may also input data manually, such as by a stylus, keypad, synchronization from a PC, or by various other techniques discussed below.

A major advantage of the invention is that by use of an optional adaptor, the system is compatible with current and prior HMDs as well as maintaining a capability of adapting to future such systems.

Other advantages of the invention may include one or more of the following. An embodiment of the invention may be used when a patient is traveling or otherwise away from their "wired" means of communication. The invention allows wireless health-monitoring to the level of accuracy previously achieved only by desktop so-called "wired" computer systems. The invention is protocol-independent.

The interaction between a WWD and a back-end server may provide a major additional advantage in certain embodiments of the invention. In particular, the relatively small amount of memory currently provided on a WWD as compared to a back-end server severely limits the functionality of applications running on the WWD, especially in terms of computing capacity, processing power, and user interface. By providing significant application functionality on the back-end, less memory and processing capabilities become necessary on the WWD (i.e., on the "front-end"). Thus, memory may be used in the WWD for an enhanced user interface or for other purposes, according to the user requirements.

In a method according to an embodiment of the invention, the patient connects to a specific Internet site and a software program, resident on a remote server located on the Internet, downloads an interactive user interface for that patient and an application for the measurement of the physiological data. The software may also be downloaded to the WWD from a personal computer via a synchronization operation in known fashion. The software provides a personalized display for the user and configures the WWD to control and monitor devices connected via a generic input/output port to the WWD. The software may be designed to suit the constraints of the small display screens of WWDs. The software, as well as inputs from the patient or other inputs, can control the manner, content, and display of information presented to the patient, and measured or input data can be stored for review by a health care provider or by a software algorithm or application. The algorithm may be of varying complexity, from a simple program that merely acknowledges receipt of information to an artificial intelligence algorithm, such as an expert system, collaborative filtering system, rules based system, case-based reasoning system, or other such artificial intelligence application.

Further information may be provided to or from the patient, including information entered manually. The patient may input this information via a personal computer, which then

may download the input information to the WWD via a synchronization operation using standard protocols, such as those for Palm PDA devices.

The user may also input supplemental information via a PC connected independently to the server via the internet. Such supplemental information may include data that is difficult or inconvenient to input on the WWD. In this way, the patient may be afforded a more convenient environment in which to manipulate data to supplement the data input to the WWD. The deployment of voice processing technology may be used to enable an even more convenient user interface: i.e., one to which patients can talk.

In all of these respects, the portable aspect of the WWD is important: to with, the user may conveniently carry the WWD on their person wherever they may go, allowing data entry at the time needed.

Other aspects, features, and advantages will be apparent from the summary above, as well as from the description that follows, including the figures and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a general embodiment of a wireless health-monitoring system according to the present invention;

FIG. **2** illustrates an embodiment of a wireless health-monitoring apparatus according to the present invention, showing the system of FIG. **1** up to a point of a wireless antenna;

FIG. **3** illustrates an embodiment of a back end of a health-monitoring system according to the present invention;

FIG. **4** illustrates a data flow diagram according to an embodiment of the present invention;

FIG. **5** illustrates an embodiment of a method of use for a wireless application and a server application according to the present invention, in which the same is implemented for disease and patient management;

FIG. **6** illustrates an embodiment of a method of use for a wireless application and a server application according to the present invention, in which the same is implemented for health management;

FIG. **7** illustrates an embodiment of a wired connection between a HMD and a WWD, also showing an optional adaptor; and

FIG. **8** illustrates an embodiment of a wireless connection between a HMD and a WWD, also showing an optional adaptor.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Various acronyms are used for clarity herein. Definitions are given below.

The term "HMD" may encompass not only devices with physiologic sensors but also devices with a keypad, keyboard, mouse, pointer, pressure sensor, or other such inputs that the patient or user may employ to perform data entry of the desired parameters. In general, HMDs include some means for determining a health parameter.

In a disease management embodiment, an HMD may be a blood glucose monitor, a blood pressure monitor, an ambulatory ECG recorder, a respiratory monitor, a temperature or heart rate monitor, and so on.

In a healthy lifestyle management embodiment, an HMD may be an exercise machine, including treadmills, rowers, steppers, exercise cycles, or other aerobic or anaerobic exercisers, or a monitor, include monitors for temperature, heart rate, blood pressure, amount of work or rate of work performed, etc.

The term "subject" as used herein primarily indicates a human subject. The same may be a medical patient under physician care, a person interested in maintaining health via accurate recording of nutrition and exercise, and so on. The term "user" is generally used to refer to the user of the device, which may be synonymous with the subject or may alternatively be a caregiver of the subject, etc. The term "patient" is used, in addition to a person under the care of a physician, to also refer to a "normal" or healthy individual who is interested in maintaining a healthy physiologic balance.

The term "signal communication" is used to mean any type of connection between components where the connection is, e.g., electromagnetic, and where the connection allows information to be passed from one component to another. This term may be used in a similar fashion as "coupled", "connected", "information communication", "data communication", etc. The following are examples of signal communication schemes. As for wired techniques, a standard bus or serial cable may be used if the input/output ports are compatible and an optional adaptor may be employed if they are not. As for wireless techniques, IR, microwaves, RF, e.g., Bluetooth® or IEEE 802.11 protocols, optical techniques including lasers, and other such techniques may be used. The patient or subject may even input data manually, such as by a stylus or keypad or by various other techniques discussed above and below.

The term "generic input/output port" is used to mean any type of convention, standard, universal, stock, consumer, or "off-the-shelf" type of port for data input and output. These may include both wired and wireless ports. A further description is given below.

Various embodiments of the invention are now described in more detail.

Referring to FIG. **1**, a system of the present invention is shown for monitoring health data from a patient or subject **38**. The system includes a wireless health-monitoring apparatus ("WHMA") **10** described in further detail below. WHMA **10** is linked in a wireless fashion to a wireless connection point of presence ("POP") **19**, the same including at least a base station antenna **15** coupled to a server **17**. Server **17** is in turn connected to the wired, or even a wireless (not shown) Internet **21**, which may include the World Wide Web.

Referring to FIG. **2**, an first embodiment of WHMA **10** is shown. WHMA **10** includes an HMD **11**, which may include an optional monitor screen **40**, coupled via an optional adaptor **42** to a WWD **12**. WWD **12** connects wirelessly via an antenna **60** to base station **15** (see FIG. **1**). One function of WWD **12** is to provide the user interface; other functions are described below.

As noted above, HMD **11** may include a physiologic sensor **24** or may include a manual system **36** for input of physiologic data via a connection **34**. Manual system **36** may also be used to input data directly into WWD **12** via a connection **32**. Manual system **36** may include, e.g., a keyboard **30**, a mouse **26**, a pen-type device **28**, and may also employ a separate monitor (not shown). Of course, the user may also view information on monitor **40** or on a screen **41** of WWD **12**. In many embodiments, the stylus-based system employed by many current PDA's, such as the Palm®, may be preferred for such manual data input.

Data may also be input via entry on a computer **37**. This data may then be synchronized to WWD **12** in known fashion. Alternatively, computer **37**, or another computer (see computer **37'** in FIG. **4**) may be used to connect to a server using the wired internet. This use may be particularly advantageous

when entering a large amount of data, such as a patient's medical history. As noted above, in this way the patient may be afforded a more convenient environment in which to manipulate data to supplement the data input to the WWD.

It will be clear to one of skill in the art given this teaching that cable **32**, as well as cables **34** and **44**, may be replaced with wireless circuitry to communicate signals wirelessly.

For medical devices and applications, physiologic sensor **24** may include, e.g., a sensor appropriate for measuring blood glucose levels, blood pressure, heart rate, or any other desired parameter as required by the physician. Sensor **24** may connect via an optional cable **44** to subject **38**. Alternatively, sensor **24** may be distal of HMD **11**, i.e., at or within subject **38**. In other words, if cable **44** is employed, sensor **24** may be proximal or distal of cable **44**. If a wireless communications capability is added, sensor **24** need not physically connect with HMD **11** or WWD **12** at all. That is, the same may measure a health parameter and may communicate the same to wireless health-monitoring apparatus **10** wirelessly. The short range wireless communications schemes which may be employed include infrared, radio frequency including Bluetooth® or IEEE 802.11protocols, or other such schemes.

As examples of sensor types, to measure blood glucose levels, sensor **24** may be a sensor that accepts a drop of blood, e.g., via a finger-prick. To measure heart rate, sensor **24** may be placed via an adhesive sensor disposed on the chest. Other health monitors may also be employed so long as the measured data may either be transferred to WWD **12**, e.g., via optional adaptor **42**, described in further detail below, or by being read by a user, e.g., from a display, and manually input to WWD **12**. Alternatively, the measured data may be transferred to WWD **12** via wireless communication schemes, such as RF includes Bluetooth® or IEEE 802.11protocols, infrared, optical, microwaves, etc., directly from sensor **24** or from HMD **11** as described in greater detail below.

The user, who may or may not be the same person as subject **38**, may input data to WWD **12** from history or experience. For example, in a health or exercise device, if subject **38** consumes a known number of calories, this information may be entered via manual system **36** directly into WWD **12** or into HMD **11**. Further, the user, the subject, and the sensor are not necessarily the sole sources of information. Data stored on the server, or on a separate server operated for health management may also be employed to result in a health benefit to subject **38**.

Referring to FIG. **3**, WHMA **10** is shown communicating wirelessly with the Internet. In doing so, WHMA **10** generally sends a wireless signal to a base station **14** (in known fashion) that is connected to a server **18** that is in signal communication (in known fashion) with the internet. Server **18** communicates via a protocol (in known fashion) to Internet **20**, which also communicates via a protocol (in known fashion) to a server **22** running an application **62**. Server **22** may be accessed (in known fashion) by a client computer **44** through a connection **64**.

As noted, the protocols for data communication are known. However, they currently vary amongst known techniques. The present invention is not limited to any particular protocols, and may be implemented in any languages supported by the WWD and server. Of course, as computing capabilities continue to increase, it is expected that the capabilities of WHMA **10**, servers **18** and **22**, as well as application **62** and client **44**, and other components, will correspondingly increase.

Application **62** running on server **22** may interact with WHMA **10** in a number of ways. Referring to FIG. **4**, WHMA **10** is shown in signal communication with server **22** via a connection **72**. Connection **72** schematically represents the wireless Internet connection and intervening pathways. WHMA **10** includes an application that may be viewed as having two components: a base wireless or device application **70** and an application presentation layer or user interface **68**. User interface **68** is employed to, e.g., present a menu of options to the user, to allow the user to choose inputs, and to generally operate the device. User interface **68** may vary widely in sophistication, e.g., from a simple data entry field to a full graphical user interface. These applications may accept as inputs data from a sensor **24** as well as from a manual input **36**.

Server **22** has a base server application **62** with which the same calculates or provides a response based at least in part on data from WHMA **10**. Application **62** may include an algorithm **63** for analyzing data from the HMD, and either application **62** or algorithm **63** may optionally access data from an external data source **74** and may further consult an artificial intelligence system **76**.

External data source **74** may be a memory or disk or other such storage that stores health data, such as healthy and unhealthy weight/height ranges, healthy and unhealthy cholesterol counts, the patient's or subject's prior medical or health history, healthy and unhealthy blood pressure values, information corresponding to the caloric and other nutritional content of foods, information corresponding to the caloric expenditure values of various exercises, algorithms for calculating various health parameters, etc. In general, any data that may benefit the health of a subject or patient may be stored in external data source **74**. External data source **74** may also include online access of health information from external web sites, ftp servers, or other sources.

Due to the current relatively small amount of memory and storage available on current WWDs, such external application processing as by application **62** and external data storage as by external data **74** may be particularly important.

As noted, application **62** or algorithm **63** may also consult AI system **76** for suggestions as to health benefits. AI system **76** may even interact with external data source **74** to extract useful information from the same. AI system **76** may employ, e.g., case-based reasoning, rules-based systems, collaborative filtering, neural networks, expert systems, or other such systems as are known.

It should also be noted that each of application **62**, algorithm **63**, external data source **74**, or AI system **76**, may physically reside on more than one server, e.g., on an array of servers for, e.g., storage or multiple processing purposes. Each of application **62**, algorithm **63**, external data source **74**, or AI system **76**, or combinations of each, may also respectively reside on different servers.

The extent to which server application **62** interacts with wireless application **70** depends on the use to which the system is put. For example, in a less interactive embodiment, device application **70** may act to measure a diabetic patient's blood glucose level and report the same to server application **62**. In this case, a physician may simply review the measured value and send the patient an email reporting that the value is acceptable or not. In a highly interactive embodiment, a patient may have numerous HMDs **11** connected via optional adaptors to a WWD **12**, and wireless application **70** may correspondingly send a large amount of health data to server application **62**. The physician, accessing server application **62**, may in turn send detailed care plans to a caregiver via connection **72**. The received data may be analyzed using algorithm **63**, external data source **74**, and AI system **76**. In this sense, the two applications may be highly interactive.

It is noted that an Application Service Provider (ASP) may operate application **62**. That is, application **62** may be leased by an ASP to the health care provider, and the ASP may perform all necessary upgrades and maintenance to application **62** and its associated components.

To initialize the system, the program starts and a wireless application is loaded into the WWD. The loading of the wireless application may occur via synchronization from a desktop or via downloading from a server over the internet. The server application may be loaded into an appropriate internet-connected server. Subject data may be loaded into the WWD or into the server. In the latter case, the subject information may later be transferred to the WWD or transferred to the server from the WWD, as called for by the application. The initialization scheme then ends.

The wireless application may access the server and server application, or vice-versa, as determined by the respective program instructions. Examples are now given for (1) a system of disease and patient management and (2) a system for health management employing an exercise machine.

Example Employing System for Disease Management

Referring to FIG. **5**, an example is given for a system of disease and patient management. In this figure, as well as in FIG. **6**, boxes in dotted lines may generally be considered optional.

In FIG. **5**, a medical device may determine health parameters and an optional physician review is provided. Health parameters may also be determined by user manual input.

The program is started (step **142**) and a sensor measures a health parameter (step **116**). The sensor may send the parameter to a medical device (step **118**). The medical device then sends the parameter to the WWD (step **120**). The WWD then wirelessly communicates the parameter to the application server (step **122**), e.g., via the wireless web. The application server processes the parameter (step **124**), and calculates or provides a response (step **126**) based at least in part on the parameter. The application server may optionally employ algorithm **63** (step **125**), external data (step **132**) or an AI system (step **134**) in the calculation. The application server then sends the response to the WWD (step **128**), where the response is displayed (step **130**).

It should be noted that the term "response" here is used generally may simply be an acknowledgement that the parameter was received by the application server. The term "calculate" is also used generally, and may entail a simple calculation as well as a complex one. A result may, e.g., be the result of a calculation.

As noted above, the sensor may connect to any type of medical device or other such device in which information pertaining to a patient's disease or condition may be ascertained. The parameter may be any value corresponding to such information.

The method may also use a manual input as shown. In this case, after the start (step **142**) of the application, the user may interact with the WWD (step **140**). The interact may be a data input, a command to read data from a medical device, a response to a physician question or statement, an acknowledgement of physician notification, etc. Calculations by the application server may further take into account supplemental data sent by the user to the server, e.g., in a wired fashion directly over the internet (step **141**).

FIG. **5** also shows a physician review and notification. In this option, the responses are displayed on a client computer (step **136**) in signal communication with the application server. A physician may then review the response on the client computer, and notify the patient of the responses (step **138**). For example, the physician may notify the patient of positive or negative responses. Of course, it should be noted that the "client computer" may simply be a pager, PDA, WWD, or other such device, as well as a more typical desktop or laptop computer.

In one implementation, a diabetic may keep a database on a server of a dietary history and a blood glucose history. With this data at-hand wirelessly, the diabetic may choose whether to eat a particular food by entering nutritional information about the food into a WWD, transmitting the same wirelessly to the server, and receiving a recommendation from the server. The recommendation may be based on the food and also on data or information that had previously been transmitted wirelessly, including data from a blood glucose monitor, data input manually, if any, as well as data from algorithm **63**, external data source **74**, and AI system **76**.

Example Employing System for Health Management Using a General Exercise Machine

Referring to FIG. **6**, an example is given for a system of health, nutrition, and/or exercise management. In this example, the HMD is an exercise machine as that termed has been defined above.

The program is started (step **242**) and a sensor measures a health parameter (step **216**), where the health parameter corresponds to health, fitness, nutrition, exercise, etc. The sensor may send the parameter to the exercise machine (step **218**). It is understood here that the "sensor" may be, e.g., a blood pressure monitor, but may also be a simple device connected to an aerobic exerciser that tracks miles ran, work performed, etc.

The exercise machine then sends the parameter to the WWD (step **220**). The WWD wirelessly communicates the parameter to the application server (step **222**), e.g., via the wireless web.

An alternative and complementary way of entering the parameter is by user input (step **248**). For example, the user may enter the parameter into the exercise machine or into the WWD. This parameter may correspond to an amount of exercise performed, an amount of food consumed, etc.

Calculations by the application server may also take into account supplemental data sent by the user to the server, e.g., in a wired fashion directly over the internet (step **241**).

The application server processes the parameter (step **224** and optionally step **225**), and calculates a response (step **226**) based at least in part on the parameter. The application server may optionally employ external data (step **232**) or an AI system (step **234**) in the calculation. The application server then sends the response to the WWD (step **228**), where the response is displayed.

The same definitional statements regarding the terms "response", "calculate", "sensor", etc., as given before, apply in this embodiment as well.

As an optional step, a health specialist may notify the patient or subject of the response (step **238**) after having the same displayed on their client computer (step **236**). The health specialist may be replaced in this example by an application that may also include an algorithm.

Adaptor Hardware

A description is given below of a particular type of adaptor hardware. As noted above, the adaptor may optionally be used to connect a HMD to a WWD.

In general, a connection is necessary between a HMD **11** and a WWD. The nature of this connection may vary. For example, the connection may be wired or wireless. For wired systems, the connection may be direct or an adaptor may be employed, either on one or both ends of the direct wired connection, to adapt the signal appropriately. In the same way, for wireless systems, the connection may be direct, if both HMD and WWD employ the same wireless protocol, or an adaptor may be involved to modify the signal of one or both devices. These connections, all of which are encompassed by the present invention, are discussed in more detail below.

Referring to FIG. **7**, an embodiment of the connection is shown. In this figure, a hardware (or "wired") connection is shown, i.e., an adaptor **168**, disposed between a HMD **160** and a WWD **162**. In most circumstances, it is assumed that the varieties of HMDs will vary more widely than the varieties of WWDs. Accordingly, HMD **160** will likely have one of a variety of types of connectors for input/output purposes, here shown as a connector **164**. Connector **164** mates with a connector **172** of adaptor **168**. At another point on adaptor **168** is a connector **172'** for connecting to a generic input/output port **164'** on WWD **162**. A cable **170** is disposed between the two connectors, cable **170** capable of including adaptor circuitry if desired.

Of course, the use and structure of adaptor **168**, between HMD **160** and WWD **162**, depends on factors such as the prevalence of an industry standard for such communications. In other words, if the output of HMD **160** is readily acceptable to WWD **162**, then the same may be directly connected or may be connected via a simple cable, the same basically extending from pin-to-pin. For example, a standard parallel bus or serial cable may be used if the input/output ports between the HMD and the WWD, which may be, e.g., RS232, are compatible. Otherwise, a suitable adaptor circuit as noted above may be employed. The connection may also be an input such as a disk drive or other media input for input of data, a USB port or phone jack or other such wired input, again employing an adaptor circuit if required.

It is noted as exemplary that several of the most prevalent PDA's currently employs the Palm® operating system. The same may be connected to the Internet in a wireless fashion using one of several available networks. In one version of a Palm® device, a 10-pin RS-232 serial port is provided. In this version of the Palm®, port **164'** can be used to communicate with HMD **160** and connector **164** via the optional adaptor **168** according to the following pin-out:

Pin Name Function
1 DTR Data Terminal Ready signal
2 VCC 3.3 Volts
3 RD (in) Receive data
4 RTS (out) Request to send
5 TD (out) Transmit data
6 CTS (in) Clear to send
7 GP**1** (in) Interrupt line
8 GP**2** (in) modem sync
9 unused unused
10 GND signal ground

On the other side of optional adaptor **168**, i.e., HMD **160**, connector **164** may vary more widely. It is noted that certain exercise machines are equipped with DB9 or DB25 RS232 serial connectors. In this case, the pin-outs are (for a DB25):

Pin Name Function
1—Protective/shielded ground
2 TD Transmit Data (a.k.a TxD, Tx)
3 RD Receive Data (a.k.a RxD, Rx)
4 RTS Request To Send
5 CTS Clear To Send
6 DSR Data Set Ready
7 SGND Signal Ground
8 CD Carrier Detect (a.k.a DCD)
Reserved for data set testing
Reserved for data set testing
Unassigned
12 SDCD Secondary Carrier Detect
13 SCTS Secondary Clear to send
14 STD Secondary Transmit Data
15 DB Transmit Clock (a.k.a TCLK, TxCLK)
16 SRD Secondary Receive Data
17 DD Receive Clock (a.k.a. RCLK)
18 LL Local Loopback
19 SRTS Secondary Request to Send
20 DTR Data Terminal Ready
21 RL/SQ Signal Quality Detector/Remote loopback
22 RI Ring Indicator (DCE raises when incoming call detected used for auto answer applications)
23 CH/CI Signal Rate selector
24 DA Auxiliary Clock (a.k.a. ACLK)
Unassigned

A connection may simply be made by providing optional adaptor **168** with adaptor circuitry, such as within cable **170** or within a circuit box therein, so as to match up the appropriate or complementary pins.

In other embodiments, such as for devices connected to proprietary connectors, a less standard and perhaps proprietary pin-out may be required.

Referring to FIG. **8**, an embodiment of a wireless implementation of the WHMA **10** is shown. In FIG. **8**, a wireless connection is shown between HMD **160** and WWD **162**. HMD **160** may have an integral wireless modulator/demodulator disposed within (not shown). More likely, however, is that HMD **160** has an adaptor **154** connectable thereto which performs these functions. Adaptor **154** may plug into a connector **165** on HMD **160**. WWD **162** may have an integral wireless modulator/demodulator (not shown), although an adaptor can also be used in this context. If an adaptor is used, the same may plug into generic input/output port **164'**.

While the device shown in FIG. **8** is described in the context of general wireless communications, various protocols may be employed. For radio frequency communications, protocols such as Bluetooth® or IEEE 802.11 protocols may be advantageously employed. Other techniques employing a similar configuration include those employing IR, microwaves, optical techniques including lasers, and so on.

It should be understood that the above is merely exemplary, and that the form of the adaptor may vary widely between HMDs and WWDs.

It will be understood that the above description of a "Method and Apparatus for Health and Disease Management Combining Patient Data Monitoring with Wireless Internet Connectivity" has been with respect to particular embodiments of the invention. While this description is fully capable of attaining the objects of the invention, it is understood that the same is merely representative of the broad scope of the invention envisioned, and that numerous variations of the above embodiments may be known or may become known or are obvious or may become obvious to one of ordinary skill in the art, and these variations are fully within the broad scope of the invention. For example, while certain wireless technologies have been described herein, other such wireless technologies may also be employed. Furthermore, while various types of medical devices have been mentioned, numerous other types may also be used in the embodiments of the invention, including pulse oximeters, syringe drivers, infusion pumps, spirometers, ventilators, anesthesia monitors,

and so on. Accordingly, the scope of the invention is to be limited only by the claims appended hereto, and equivalents thereof. In these claims, a reference to an element in the singular is not intended to mean "one and only one" unless explicitly stated. Rather, the same is intended to mean "one or more". All structural and functional equivalents to the elements of the above-described preferred embodiment that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the present claims. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed by the present claims. Furthermore, no element, component, or method step in the present invention is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. No claim element herein is to be construed under the provisions of 35 U.S.C. §§112, 6, unless the element is expressly recited using the phrase "means for".

What is claimed is:

1. A method for interactive exercise monitoring, the method comprising the steps of:

a. downloading an application to a web-enabled wireless phone directly from a remote server over the internet;

b. coupling the a web-enabled wireless phone to a device which provides exercise-related information;

c. rendering a user interface on the web-enabled wireless phone;

d. using the application, receiving data indicating a physiologic status of a subject;

e. using the application, receiving data indicating an amount of exercise performed by the subject;

f. wherein at least one of the data indicating a physiologic status of a subject or the data indicating an amount of exercise performed by the subject is received from the device which provides exercise-related information, and wherein the data indicating a physiologic status of a subject is received at least partially while the subject is exercising;

g. sending the exercise-related information to an internet server via a wireless network;

h. receiving a calculated response from the server, the response associated with a calculation performed by the server based on the exercise-related information; and

i. using the application, displaying the response.

2. The method of claim **1**, wherein the receiving data indicating a physiologic status of a subject includes receiving data from a physiological sensor coupled to an exercise machine.

3. The method of claim **1**, where the receiving data indicating an amount of exercise performed by the subject includes receiving data from an exercise machine.

4. The method of claim **1**, wherein the web-enabled wireless phone receives exercise-related information over a transmission medium, the transmission medium including a wired connection or a wireless connection.

5. The method of claim **4**, wherein the wireless connection includes an infrared connection or a radio frequency communication protocol including a short-range wireless transmission scheme.

6. The method of claim **5**, wherein the short-range wireless transmission scheme includes IEEE 802.11 protocol or short-wavelength radio transmission in the ISM band of 2400-2480 MHz.

7. The method of claim **4**, wherein the wired connection includes a USB connection, a cable, or a docking station.

8. The method of claim **1**, wherein the web-enabled wireless phone receives data via an adapter to convert a signal from the device to a suitable input for the wireless phone.

9. The method of claim **1**, wherein the data indicating an amount of exercise performed is received from a device selected from the group consisting of: a treadmill, a stepper, an exercise cycle, an accelerometer, a rowing machine, physiotherapy equipment, an aerobic or anaerobic exercise device, and a device that monitors an amount of work or rate of work performed.

10. A web-enabled wireless phone, containing a non-transitory computer-readable medium, the computer-readable medium comprising memory within a web-enabled wireless phone, the computer-readable medium comprising instructions for causing a processor in the web-enabled wireless phone to perform the method of claim **1**.

11. A non-transitory computer-readable medium, the computer-readable medium comprising memory within a web-enabled wireless phone, the computer-readable medium containing instructions for causing a processor in a web-enabled wireless phone to perform the method of claim **1**.

12. The method of claim **1**, wherein the data indicating a physiologic status of a subject is received from a device selected from the group consisting of: a heart rate monitor, a blood pressure monitor, a body temperature monitor, a respiratory monitor, a biofeedback device, an electronic body weight scale, and a body fat gauge.

13. A non-transitory computer-readable medium, containing an application for performing an interactive method of exercise monitoring, the application physically residing on a server, the method comprising the steps of:

a. downloading an application to a web-enabled wireless phone directly from a remote server over the internet;

b. receiving exercise-related information from a web-enabled wireless phone, wherein the exercise-related information includes data collected using the application and indicating a physiologic status of a subject and data indicating an amount of exercise performed by the subject, and wherein the data indicating a physiologic status of a subject is received at least partially while the subject is exercising;

c. calculating a response based on the exercise-related information;

d. transmitting the calculated response to the web-enabled wireless phone for subsequent display, the display using the application.

14. The non-transitory computer-readable medium of claim **13**, wherein the method further comprises:

a. enabling the web-enabled wireless phone to receive exercise-related information from a device; and

b. transmitting to the web-enabled wireless phone the device application including a user interface on which the calculated response may be rendered.

15. The non-transitory computer-readable medium of claim **13**, wherein the calculating a response includes calculating a response to assist a person in monitoring calorie expenditure, losing weight, or maintaining a healthy lifestyle.

16. The non-transitory computer-readable medium of claim **13**, wherein the instructions further cause the web-enabled wireless phone to receive the exercise-related information via an adapter, the adapter to convert a received data signal to a suitable input for the web-enabled wireless phone.

17. The non-transitory computer-readable medium of claim **13**, wherein the data indicating an amount of exercise performed by the subject is received from a device which is selected from the group consisting of: a pedometer, a treadmill, a stepper, an exercise cycle, an accelerometer, a rowing

machine, physiotherapy equipment, an aerobic or anaerobic exercise device, and a device that monitors an amount of work or rate of work performed.

18. The non-transitory computer-readable medium of claim **13**, wherein the receiving exercise-related information includes receiving exercise-related information over a wireless or a wired connection.

19. The non-transitory computer-readable medium of claim **13**, wherein the data indicating a physiologic status of a subject is received from a device which is selected from the group consisting of: a heart rate monitor, a blood pressure monitor, a body temperature monitor, a respiratory monitor, a biofeedback device, an electronic body weight scale, and a body fat gauge.

* * * * *

APPENDIX H

US009460632B2

(12) **United States Patent**
Watterson

(10) **Patent No.: US 9,460,632 B2**
(45) **Date of Patent: Oct. 4, 2016**

(54) **SYSTEM AND METHOD FOR REWARDING PHYSICAL ACTIVITY**

(71) Applicant: **ICON Health & Fitness, Inc.**, Mendon, UT (US)

(72) Inventor: **Scott R. Watterson**, Logan, UT (US)

(73) Assignee: **ICON Health & Fitness, Inc.**, Logan, UT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 357 days.

(21) Appl. No.: **13/911,706**

(22) Filed: **Jun. 6, 2013**

(65) **Prior Publication Data**

US 2013/0330694 A1 Dec. 12, 2013

Related U.S. Application Data

(60) Provisional application No. 61/656,768, filed on Jun. 7, 2012.

(51) **Int. Cl.**

G09B 19/00	(2006.01)
A61B 5/00	(2006.01)
A61B 5/11	(2006.01)

(52) **U.S. Cl.**

CPC ***G09B 19/00*** (2013.01); ***A61B 5/0022*** (2013.01); *A61B 5/1118* (2013.01)

(58) **Field of Classification Search**

CPC A61B 5/1118; A61B 5/0022; A61B 2562/0219; G09B 19/00

USPC 434/247–248

See application file for complete search history.

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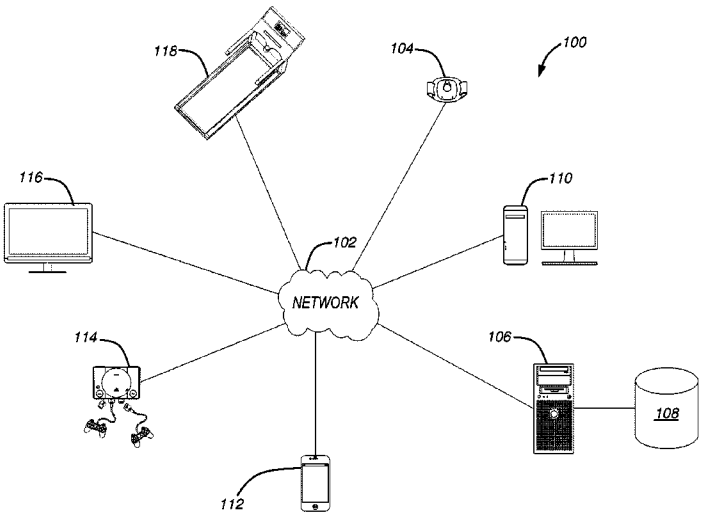
* cited by examiner

Primary Examiner — Timothy A Musselman
(74) *Attorney, Agent, or Firm* — Maschoff Brennan

(57) **ABSTRACT**

A system incentivizes people to engage in physical activity. A person's physical activity may be monitored over a period of time. Such monitoring may occur by using a sensing device carried or worn by the user. In the system, one or more thresholds for physical activity are established. Information tracked using the sensing device can be compared to the thresholds. A percentage of physical activity relative to the threshold can be translated to a reward established for the physical activity, and the percentage may be used to determine a reward value for an electronic device relative to a full available value. Rewards may include times or amounts. Time values may indicate durations during which particular activities or devices may be used. Amount values may indicate an amount of a battery charge, a number of communications, a currency value, or other values relative to use of an electronic device.

13 Claims, 9 Drawing Sheets



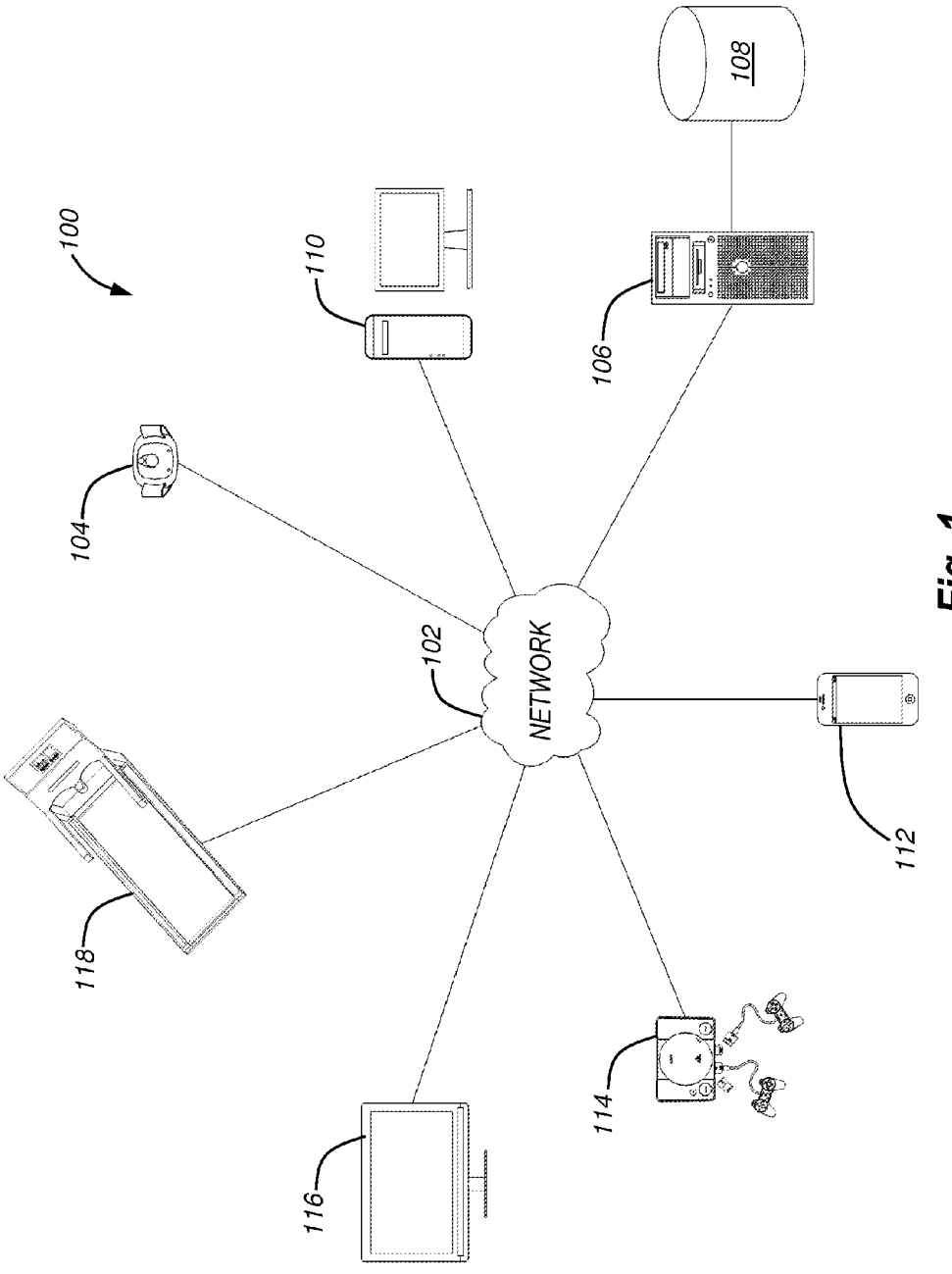


Fig. 1

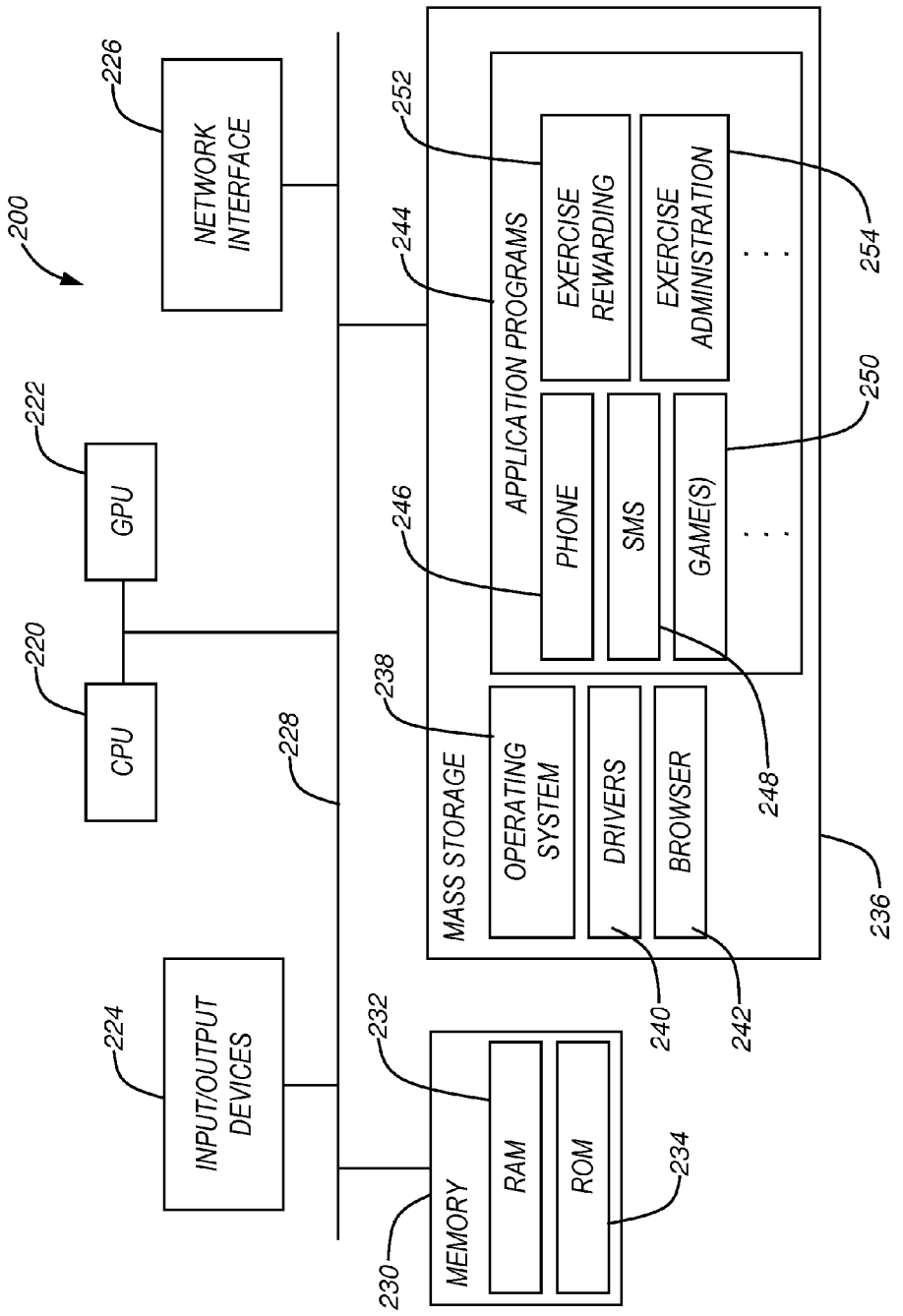

200
NETWORK INTERFACE
226
GPU
222
CPU
220
228
INPUT/OUTPUT DEVICES
224
MEMORY
230
RAM
232
ROM
234
MASS STORAGE
238
OPERATING SYSTEM
240
DRIVERS
242
BROWSER
248
236
APPLICATION PROGRAMS
244
PHONE
246
SMS
GAME(S)
250
EXERCISE REWARDING
252
EXERCISE ADMINISTRATION
254

Fig. 2

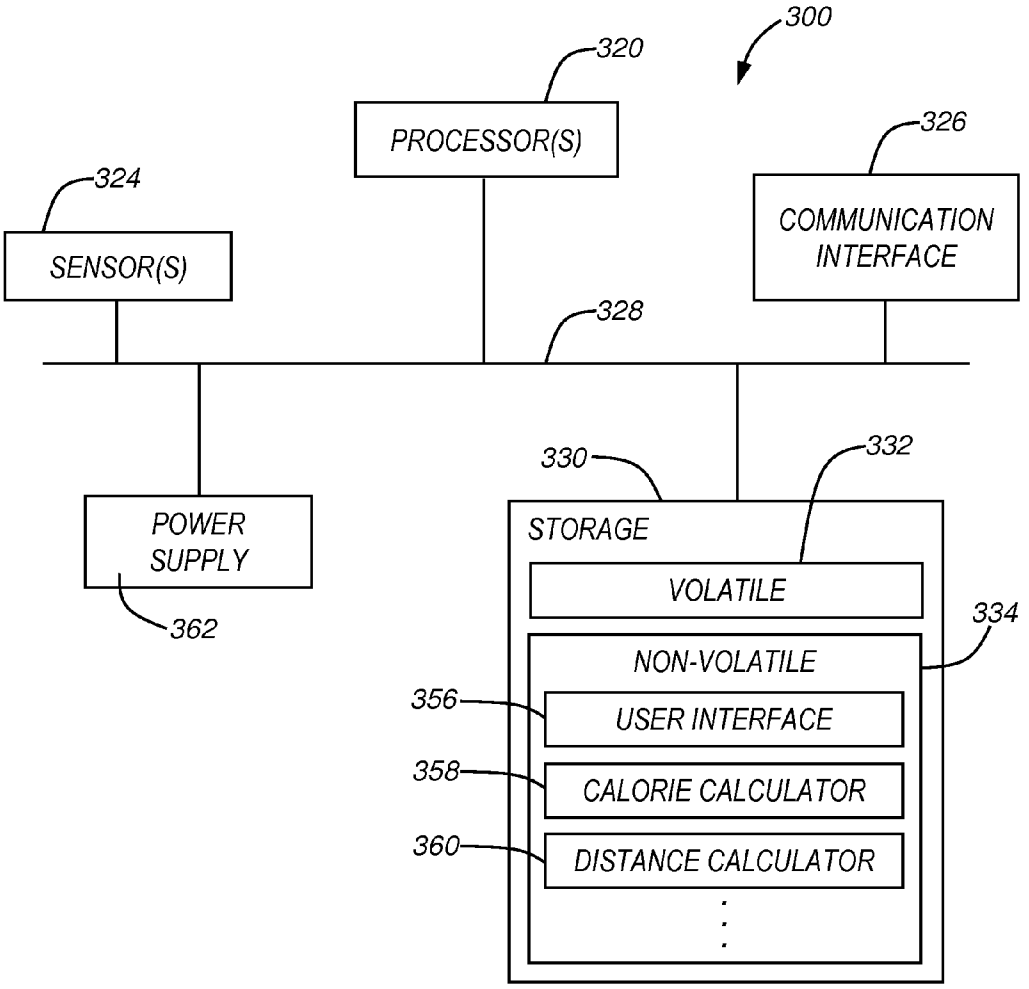

300
320
PROCESSOR(S)
326
COMMUNICATION INTERFACE
324
SENSOR(S)
328
330
332
POWER SUPPLY
362
STORAGE
VOLATILE
334
NON-VOLATILE
356
USER INTERFACE
358
CALORIE CALCULATOR
360
DISTANCE CALCULATOR

Fig. 3

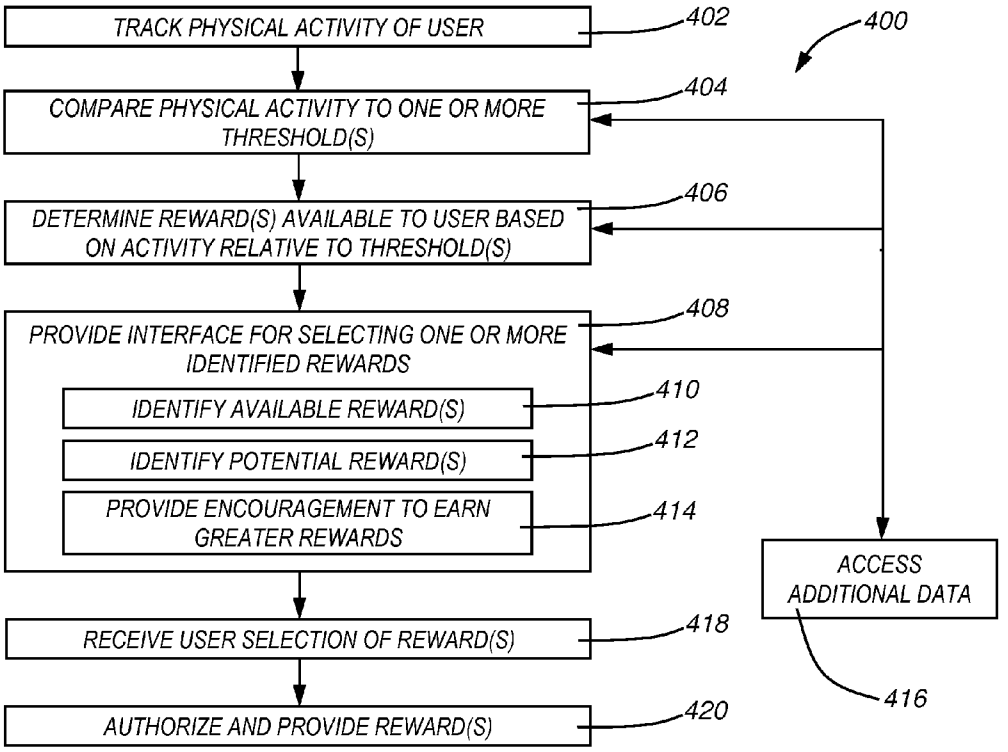

TRACK PHYSICAL ACTIVITY OF USER
402
400
COMPARE PHYSICAL ACTIVITY TO ONE OR MORE THRESHOLD(S)
404
DETERMINE REWARD(S) AVAILABLE TO USER BASED ON ACTIVITY RELATIVE TO THRESHOLD(S)
406
PROVIDE INTERFACE FOR SELECTING ONE OR MORE IDENTIFIED REWARDS
408
IDENTIFY AVAILABLE REWARD(S)
410
IDENTIFY POTENTIAL REWARD(S)
412
PROVIDE ENCOURAGEMENT TO EARN GREATER REWARDS
414
ACCESS ADDITIONAL DATA
416
RECEIVE USER SELECTION OF REWARD(S)
418
AUTHORIZE AND PROVIDE REWARD(S)
420

Fig. 4

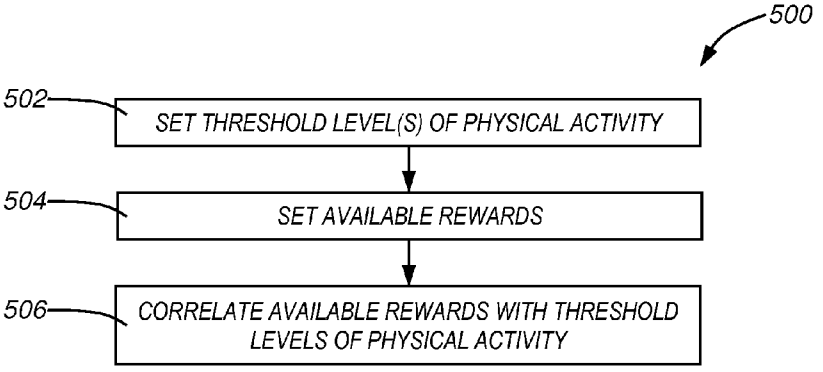

500
502
SET THRESHOLD LEVEL(S) OF PHYSICAL ACTIVITY
504
SET AVAILABLE REWARDS
506
CORRELATE AVAILABLE REWARDS WITH THRESHOLD LEVELS OF PHYSICAL ACTIVITY

Fig. 5

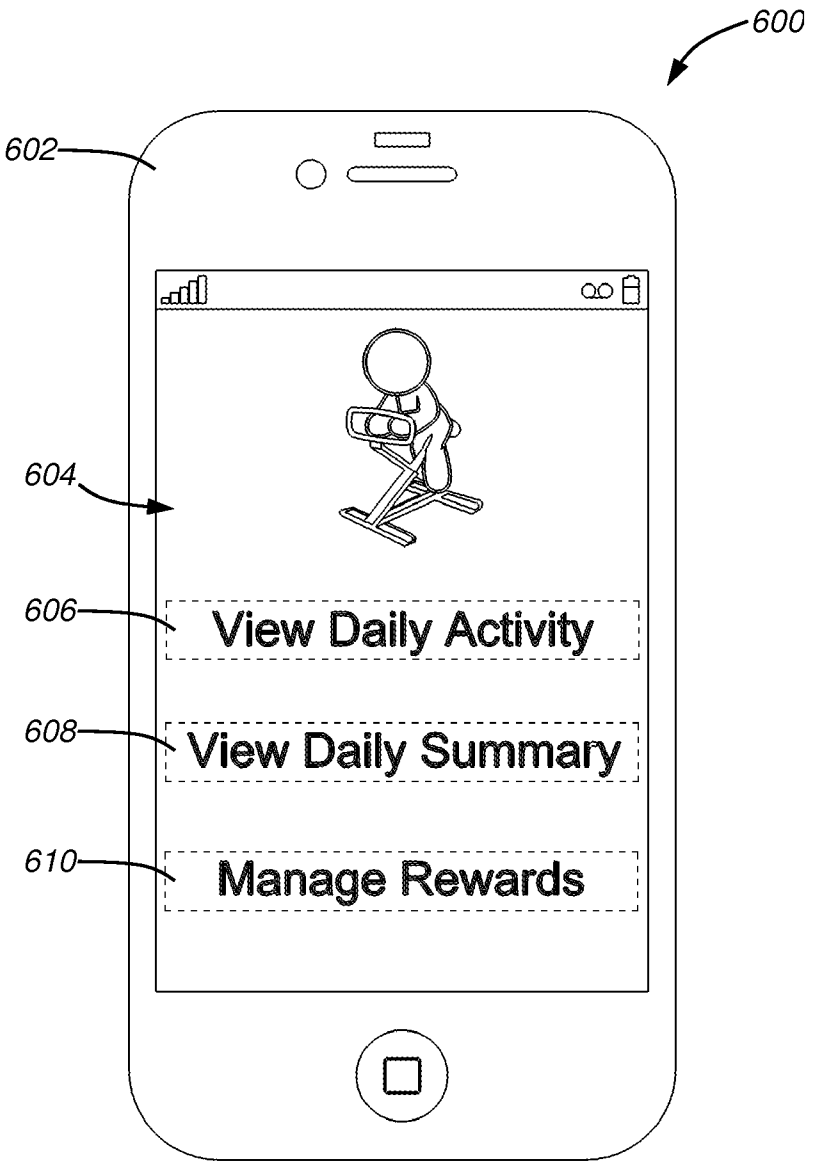

600
602
604
606
View Daily Activity
608
View Daily Summary
610
Manage Rewards

Fig. 6A

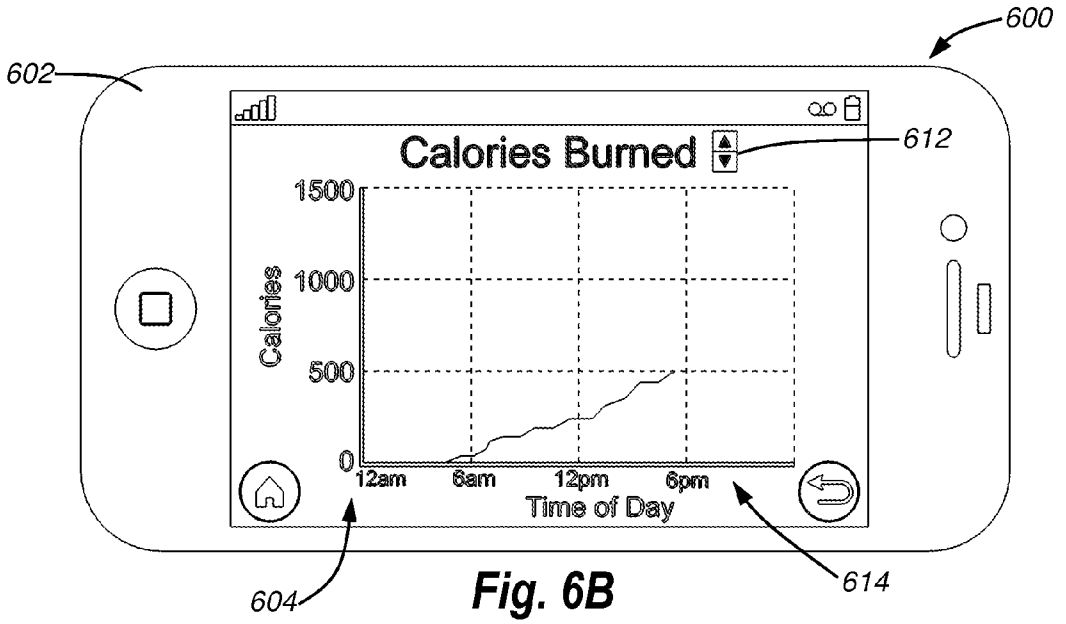

600
602
Calories Burned
612
1500
1000
500
0
Calories
12am
6am
12pm
6pm
Time of Day
604
614

Fig. 6B

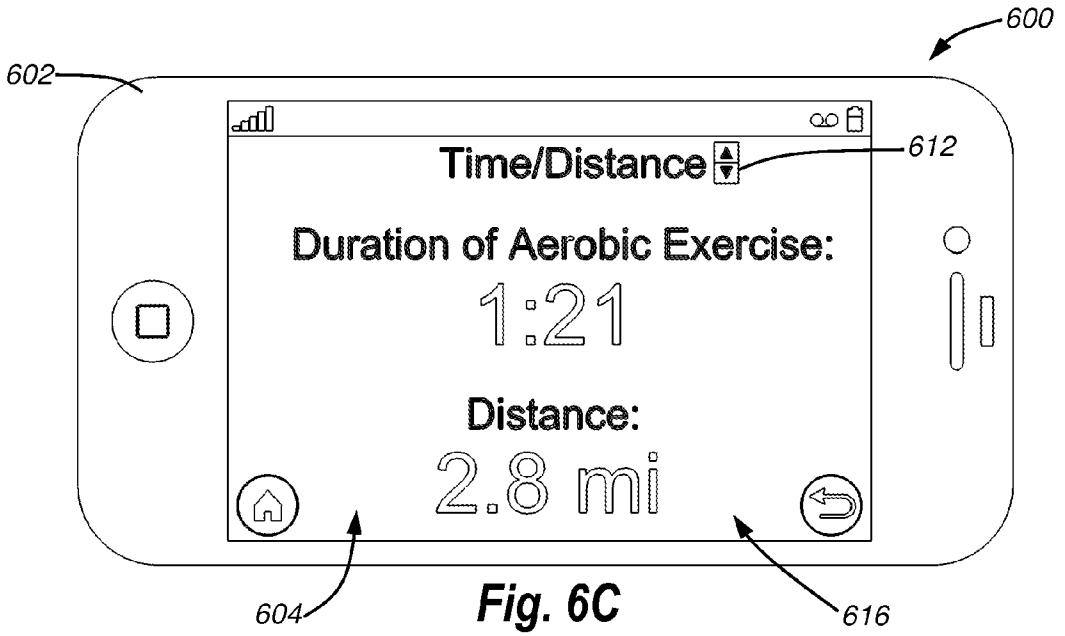

600
602
Time/Distance
612
Duration of Aerobic Exercise:
1:21
Distance:
2.8 mi
604
616

Fig. 6C

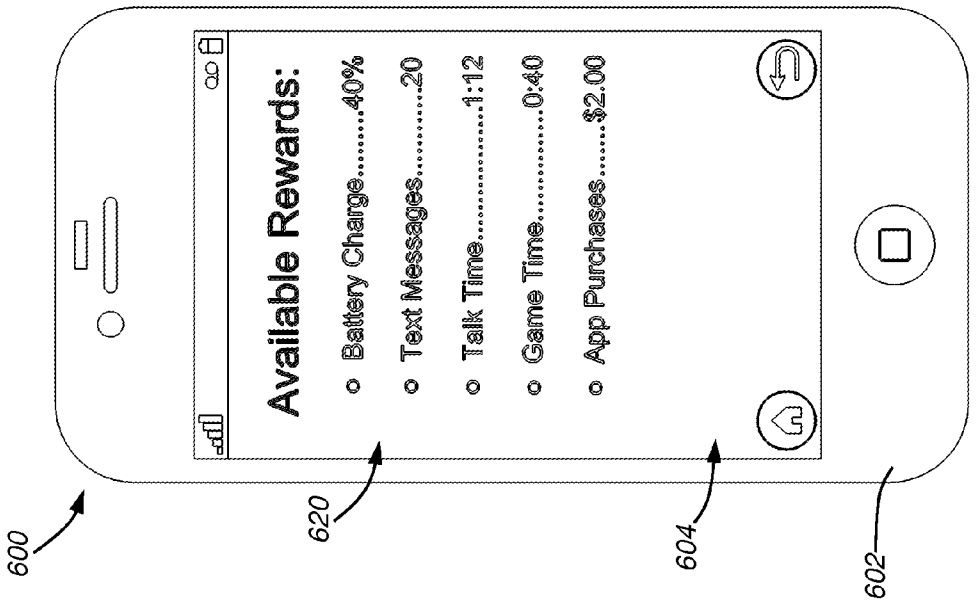

600
620
604
602
Available Rewards:
Battery Charge.....40%
Text Messages.....20
Talk Time.....1:12
Game Time.....0:40
App Purchases.....$2.00

Fig. 6E

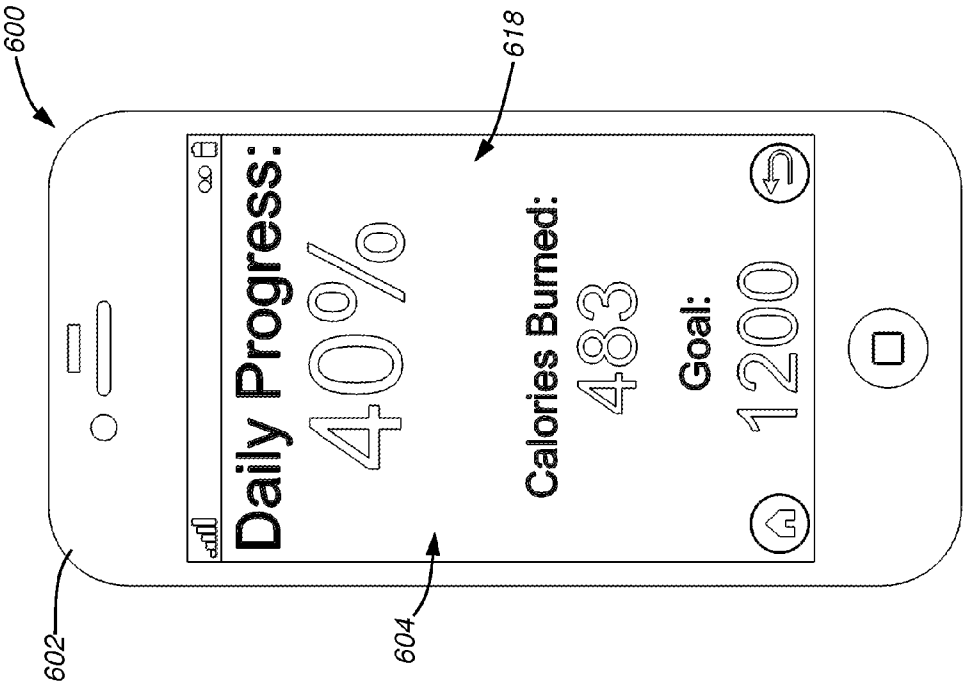

600
618
602
604
Daily Progress:
40%
Calories Burned:
483
Goal:
1200

Fig. 6D

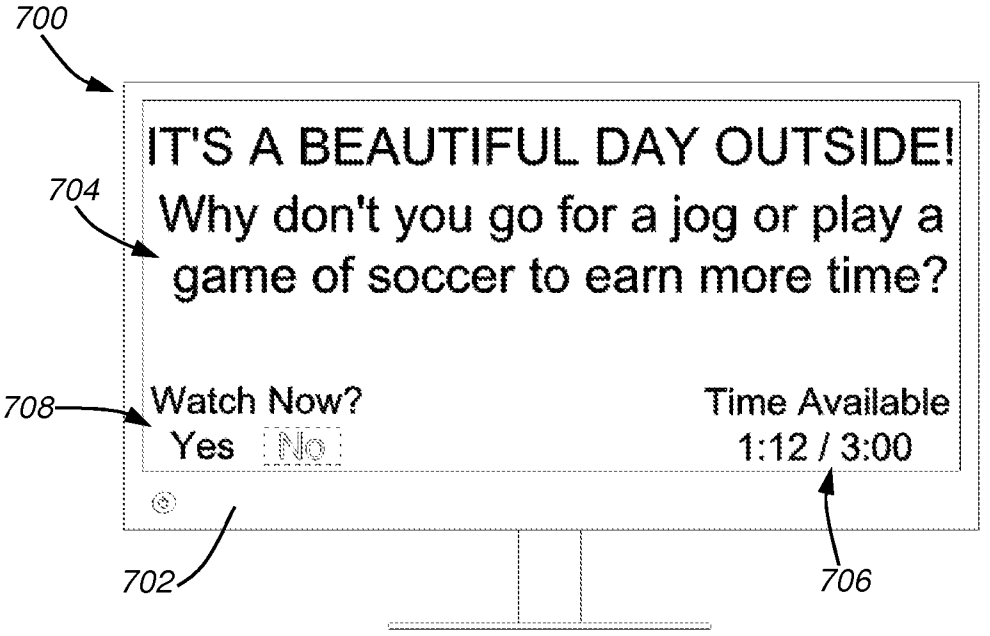

700
IT'S A BEAUTIFUL DAY OUTSIDE!
704
Why don't you go for a jog or play a game of soccer to earn more time?
708
Watch Now?
Yes No
Time Available
1:12 / 3:00
702
706

Fig. 7

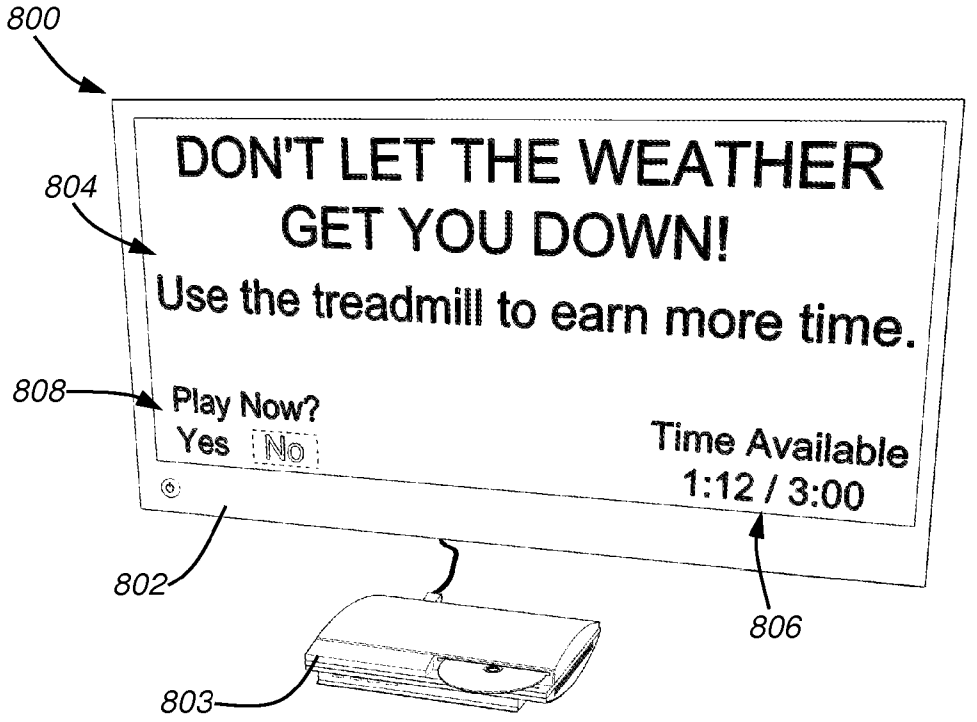

800
DON'T LET THE WEATHER GET YOU DOWN!
804
Use the treadmill to earn more time.
808
Play Now?
Yes No
Time Available
1:12 / 3:00
802
806
803

Fig. 8

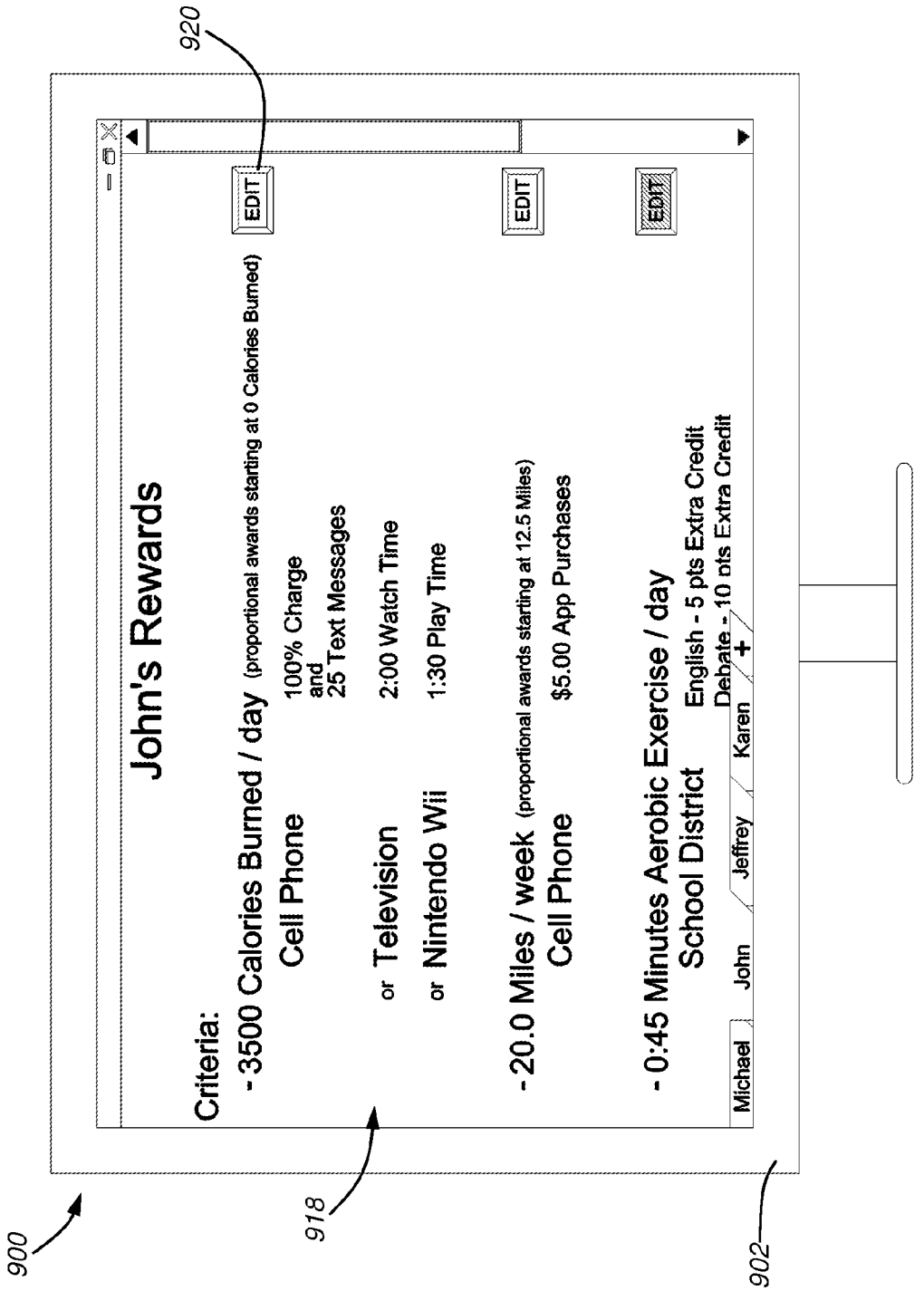

900
902
918
920
John's Rewards
Criteria:
- 3500 Calories Burned / day (proportional awards starting at 0 Calories Burned)
Cell Phone
100% Charge
and
25 Text Messages
or Television
2:00 Watch Time
or Nintendo Wii
1:30 Play Time
- 20.0 Miles / week (proportional awards starting at 12.5 Miles)
Cell Phone
$5.00 App Purchases
- 0:45 Minutes Aerobic Exercise / day
School District
English - 5 pts Extra Credit
Debate - 10 pts Extra Credit
EDIT
EDIT
EDIT
Michael
John
Jeffrey
Karen
+

Fig. 9

SYSTEM AND METHOD FOR REWARDING PHYSICAL ACTIVITY

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to and the benefit of U.S. Patent Application Ser. No. 61/656,768 filed on Jun. 7, 2012 and entitled "SYSTEM AND METHOD FOR REWARDING PHYSICAL ACTIVITY."

TECHNICAL FIELD

The present disclosure relates generally to systems and methods for exercising. More particularly, the present disclosure relates to systems and methods for encouraging exercise. More particularly still, the present disclosure relates to systems and methods for encouraging exercise by providing rewards based on physical activity levels.

BACKGROUND

Regular exercise is important for a number of reasons, including comprehensive health, weight control, muscle toning, and the correction and avoidance of cardiovascular conditions. Indeed, there are well-known correlations between the amount of exercise a person engages in and the individual's physical as well as mental health. Estimates indicate that over two million people die prematurely each year in the United States as a result of causes that are attributable to a lack of sufficient physical exercise.

Despite the well-known importance of exercise, motivating people to exercise continues to be a significant challenge. Indeed, boredom is often cited as the primary obstacle to exercise. To help combat the boredom, and maintain a person's motivation level to exercise, portable music devices have often been used in connection with performance of an exercise program. Example portable music devices have in the past included portable radios, portable cassette and compact disk players, and more recently have included mp3 players and other similar devices that store digital copies of audio files. As a person exercises, the person can play music or other audio information to increase the person's interest in continuing interest.

While music has often been helpful for some people to avoid or mitigate boredom during exercise, it often does not itself provide a significant incentive to exercise. Indeed, modern devices such as smart phones, portable media players (e.g., the IPOD TOUCH® available from Apple Inc.), laptops, e-readers, tablet computing devices, and the like allow music to be available almost anywhere, whether stored directly on the device or streamed over a wireless network. A person simply doesn't need to exercise to listen to music as they may listen to music while doing other, less strenuous activities. Further, the same devices that often allow music to be available anywhere often are integrated with other capabilities. Such capabilities may include video, communication (e.g., video chat, instant messaging, text messaging, telephone, etc.), video game, and other capabilities. Teenagers and even younger children now often carry such devices, and can find entertainment with such devices that not only provides little incentive to exercise, but distracts them from exercising.

An example of a system for incentivizing people to exercise, and particularly for incentivizing children to exercise, is found in U.S. Patent Publication No. 2006/0025282, in which an exercise computer monitors the exercise performed by a child. The exercise computer may be portable and wearable. When the child performs well on certain exercises, or exercises regularly, the child may be rewarded. Example rewards include video games, cartoons, music, and merchant coupons. Additionally, the exercise computer may monitor the child's progress and skills and provide motivation and advice.

In addition, other related exercise systems, devices and methods for motivating people to exercise include those in U.S. Pat. Nos. 5,456,648, 7,955,219, U.S. Patent Publication No. 2008/0027673, U.S. Patent Publication No. 2008/0147502, U.S. Patent Publication No. 2009/0118100, and U.S. Patent Publication No. 2011/0275483.

SUMMARY OF THE DISCLOSURE

In one aspect of the present disclosure, a method for incentivizing physical activity includes tracking a person's physical activity over a period of time. The tracked physical activity may be compared to a threshold. A reward is identified for meeting the threshold. If the tracked physical activity is less than the threshold, a reward that is provided or authorized may be scaled to be proportional to the reward identified for meeting the threshold.

Another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include performing a method for incentivizing physical activity using a computing system having one or more processors.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include tracking a person's physical activity using a sensing device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include using a sensing device carried or worn by a person.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include tracking physical activity that includes a number of calories burned.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include comparing a number of calories burned to a threshold number of calories burned.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include a threshold and/or tracked physical activity that includes distance or duration information.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include comparing physical activity to multiple thresholds.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include comparing physical activity to multiple thresholds, the multiple thresholds being associated with the same reward.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include comparing physical activity to multiple thresholds, at least some of the thresholds corresponding to different rewards.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include comparing physical activity to a maximum threshold.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include providing a reward associated with use of an electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include a reward for use of an electronic device including a battery charge of the electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include authorizing or providing a reward that is less than a full battery charge of an electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include restricting charging of a battery based on a proportion of a person's physical activity relative to a threshold.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include authorizing or providing a reward for use of an electronic device that includes talk time, text messaging, email messaging, or video game playing time.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include authorizing or providing a reward that includes educational credit.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include identifying multiple rewards corresponding to a threshold.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include identifying multiple rewards for a threshold, the various rewards corresponding to multiple electronic devices.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include authorizing multiple rewards redeemable on different electronic devices, where redeemable rewards are collectively proportional to tracked physical activity relative to a threshold.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include computer-readable media storing instructions that can be executed by one or more processors to cause a computing system or device to perform a method for incentivizing physical activity.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include receiving a request to use an electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include accessing information about a reward based on physical activity of a person, and the reward being associated with restricted use of the electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include displaying a portion of a reward available for redemption on an electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include monitoring use of an electronic device relative to a reward.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include sending a message to an administrator computing device that indicated what portion of a reward is redeemed at an electronic device.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include providing encouragement to a person to engage in additional physical activity to increase an available reward.

Yet another aspect of the disclosure that may be included in any combination with other aspects disclosed herein may include using current information to provide encouragement.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate various embodiments of the present systems and methods and are a part of the specification. The illustrated embodiments are merely examples of the present systems and methods and do not limit the scope thereof. Throughout the drawings, the same reference number designates similar, but not necessarily identical, elements.

FIG. **1** schematically illustrates an example system that includes a sensing device and one or more computing devices communicating over a network, in accordance with one embodiment of the present disclosure;

FIG. **2** schematically illustrates an example computing device usable in the system of FIG. **1**, according to one embodiment of the present disclosure;

FIG. **3** schematically illustrates a sensing device usable in the system of FIG. **1**, according to an embodiment of the present disclosure;

FIG. **4** illustrates a method for rewarding a person for engaging in physical exercise, in accordance with one embodiment of the present disclosure;

FIG. **5** illustrates a method for administrating exercise criteria and rewards for exercise according to an embodiment of the present disclosure;

FIG. **6**A illustrates an example computing device with a user interface providing a view for viewing exercise progress and managing rewards associated with performed exercise;

FIG. **6**B illustrates the example computing device and user interface of FIG. **6**A, while providing a view for graphically viewing performed exercise in terms of calories burned;

FIG. **6**C illustrates the example computing device and user interface of FIG. **6**A, while providing a view for viewing the duration and/or distance associated with performed exercise;

FIG. **6**D illustrates the example computing device and user interface of FIG. **6**A, while providing a view for viewing progress towards an exercise goal;

FIG. **6**E illustrates the example computing device and user interface of FIG. **6**A, while providing a view for viewing and/or selecting rewards that are available for exercise that has been performed;

FIG. **7** illustrates an example television with a user interface providing a view for redeeming rewards associated with performance of physical exercise;

FIG. **8** illustrates an example video game system providing a view for redeeming rewards associated with performance of physical exercise; and

FIG. **9** illustrates an example display device including a user interface for an administrator of a system for incentivizing physical activity and exercise.

DETAILED DESCRIPTION

A system for incentivizing people to exercise is disclosed herein. Specifically, embodiments of the present disclosure

include a system that may monitor exercise that a person performs over a given time period (e.g., daily, weekly, monthly, etc.). The exercise system may use a sensing device that detects the exercise done. Information logged by the sensing device can be correlated with rewards available for meeting exercise or health-related criteria. If the criteria is met, full rewards may be obtained. If the criteria is not met, no rewards or partial rewards may be provided. In some embodiments, the system may be managed by an administrator, such as a parent or educator. The system may monitor the exercise performed by a child or dependent, and incentives can relate to use of electronic devices available to the child or dependent, or to educational credit.

In FIG. **1** illustrates an example system **100** that may include multiple devices or components for managing exercise incentives in accordance with embodiments of the present disclosure. As part of the system **100**, a network **102** may be provided to facilitate communication between one or more devices or components (e.g., devices **104-118**). The network **102** may be any suitable network, and may include a wireless network, a wired network, or some combination thereof. In some embodiments, the network **102** may include multiple networks. For instance, the network **102** may include the Internet, a local access network, a wide access network, a CDMA network, a GSM network, an LTE network, a Wi-Fi network (e.g., 802.11 communication network), or other types of local or even global networks, or any combination of the foregoing. It should be appreciated in view of the disclosure herein that some devices **104-116** may communicate using different networks or protocols, but that using the combined network **102**, any device **104-118** may potentially have such communicates relayed to any other device **104-118**.

The illustrated system **100** includes various devices **104-118** that may communicate through the network **102**. By way of illustration, the system **100** of FIG. **1** includes an example sensing device **104** and computing device **106**. In some embodiments the computing device **106** may be a server, although the computing device **106** may instead by a personal computing device or satisfy some other purpose.

The sensing device **104** may generally be utilized to sense and track physical activity of a user. In some embodiments, for instance, the sensing device **104** may include one or more sensors to track movement, heart rate, metabolism or other items related to exercise or a user's health and well being. In addition to or in lieu of such sensors, the sensing device **104** may also include input components. For instance, the sensing device **104** may include a user interface to allow a user to input information. Information that is input may include information related to exercise (e.g., start/end times, distance, workout type, etc.), food consumption (e.g., calories consumed), or the like.

The sensing device **104** device may be used in any number of different manners by a user. For instance, in one embodiment the sensing device **104** may be worn by the user. An example sensing device **104** could be worn on the wrist or ankle, around the chest, or in another manner. In such an embodiment, the sensing device **104** could potentially obtain information related to the heart rate of the user (e.g., by measuring a pulse), perspiration levels, and the like. In other embodiments, the sensing device **104** may be worn or used in other manners. An example sensing device **104** could, for instance, be placed in a user's pocket. The sensing device **104** may include suitable sensors or components to determine information such as the number of steps taken, the distance moved, the altitude climbed, change in physical location, and the like. In some embodiments, a sensing device **104** may be integrated into another component or device (e.g., a telephone or portable media player), although it may also be a separate device.

In accordance with one aspect of the present disclosure, the sensing device **104** is worn, carried, or otherwise used by a person throughout the day. While with the person, the sensing device **104** tracks the physical activity of the person. Information related to the physical activity may then be used in a manner that may be learned by a review of the disclosure herein.

Information from the sensing device **104** may also be communicated through the network **102**, or by other means, to other devices or components **106-118** of the system **100**. In one example, information obtained, calculated or otherwise accessed by the sensing device **104** may be communicated to the computing device **106**. The computing device **106** may act as a server that collects such information on behalf of the user of the sensing device **104**, and potentially on behalf of a number of different people. For instance, the computing device **106** may be within a home and each member of a family may have a corresponding sensing device **104** for obtaining information communicated to the computing device **106**. On a larger scale, the computing device **106** may operate in connection with a service in which people at remote locations dispersed across a country or even the world can have information from corresponding sensing devices **104** stored at or accessible to the computing device **106**. The computing device **106** may actually be a collection of multiple devices and need not be a single device.

Optionally, the computing device **106** may be used to determine a correlation between physical activity as reported by the sensing device **104** and rewards available to a user of the sensing device. More particularly, in one embodiment of the present disclosure the computing device **106** may store information related to rewards available to a user and the goals that may be met to satisfy the requirements for such rewards. As further discussed herein, in some cases the computing device may store information for determining partial rewards when a goal is not completely satisfied but progress towards the goal is made.

Although such information may be stored by the computing device **106**, in other embodiments the computing device **106** may store the information remotely or in other locations, or access the information from other sources. In FIG. **1**, for instance, a data store **108** is shown as being accessible to the computing device **106**. According to one embodiment, the computing device **106** may be a server and the data store **108** may be a dedicated database accessible by the server. In other embodiments, the data store **108** may be integrated within the computing device **106** or accessible by, or even integrated within, other components of the system **100**.

The system **100** may also include a variety of additional components. For instance, the system **100** is shown as including an additional computing device **110** in communication with the network **100**. The computing device **110** is illustrative of a personal computer, office computer, laptop, tablet, or other computing device that a person may access. As shown in FIG. **1**, the computing device **110** may communicate through the network with other devices, potentially including the sensing device **104** and/or the computing device **106**. Thus, information obtained by the sensing device **104** about a person's physical activity, or information about rewards associated with the physical activity, may be accessible to the personal computer **110**.

As discussed herein, an aspect of the present disclosure includes providing rewards to people who engage in physical activity, and thereby incentivizing them to continue exercising. According to one embodiment, rewards may be obtained in the form of access to electronic devices, or access to applications or programs on electronic devices. Thus, in one embodiment, the personal computer **110** may be a device to which access is at least partially based on rewards in an exercise incentive system such as system **100**. For instance, if a threshold level of exercise is satisfied for a day, a user may be allowed to login to and use the computing device **110**, or to play video games on, or otherwise use applications and programs on the computing device **110**. If the user has not satisfied the threshold level of exercise, access to the computing device **110**, or portions thereof, may be unavailable, or may be limited.

Other electronic devices that may be subject to limitations based on physical activity include portable electronic device **112**, gaming system **114**, and television **116**. It should be appreciated in view of the disclosure herein that any number of additional devices could have been included and may also be subjected to limitations based on physical exercise.

The portable electronic device **112** is generally representative of a mobile device such as a mobile telephone, a portable media player, an e-reader, a tablet computing device, or any number of other computing or electronic devices that can be easily transported from one location to the next. In some cases, the portable electronic device **112** may be a so-called "smart phone" which includes not only telephone capabilities, but also other communication capabilities such as email, instant messaging, text messaging, video conferencing, and the like. Further or other applications of the portable electronic device **112** may include gaming programs, productivity applications, audio or video programs, and the like.

Gaming system **114** and television **116** may each also be devices that can be operated in connection with an exercise incentive system as described herein. Each device **114**, **116** may communicate through the network (e.g., with computing device **106** or sensing device **104**) to obtain information on a user's exercise. Based on the exercise performed, the user may or may not be granted access to play video games or watch television, or the time or available programs may be limited as desired. A greater explanation of manners of using devices **106-116** in connection with an exercise incentive program is provided below with respect to FIG. **2**.

Also illustrated in FIG. **1** is an example exercise device **118**. The exercise device **118** can take any of a number of different forms. The illustrated device **118**, for instance, is a treadmill-type device, although other devices may include stationary bicycles, elliptical machines, steppers, rowers, weight systems, and the like. The exercise machine **118** may also optionally be connected to the network **102** to communicate with one or more other devices **104-116**. In some cases the exercise device **118** may operate in addition to, or instead of, the sensing device **104** to provide information about a user's physical activity. For instance, a user may begin a workout using the exercise device **118**. During the workout, or upon completion thereof, information about the workout (e.g., duration, distance, intensity, calories burned, average heart rate, etc.) may be communicated over the network **102**. The information may be used by the computing system **106** to identify rewards available to the user, and such rewards may optionally be available for redemption on the computing devices **110-116**. In other embodiments, the information from the exercise device **118** may be communicated to the devices **110-116**. For instance, if a user wants to play a game using the gaming system **114**, the gaming system **114** may request exercise information from the exercise device **118** (or computing device **106**). The gaming system **114** may then determine if access should be provided, what type of access may be provided, how long to provide access, and the like.

While FIG. **1** illustrates a system in which each of numerous devices **104-118** may communicate through the network **102**, the system **100** is illustrative only, and may be modified in any number of different manners. For instance, nothing in system **100** requires that all of the devices **104-118** maintain a connection with the network **102** at all times, or even that a particular type of communication system be used. Instead, devices **104-118** may selectively communicate through the network **102**. Alternatively, some of the devices **104-118** may communicate with other of the devices **104-118** out-of-band relative to the network **102**. For instance, the sensing device **104** may track physical activity. When a user wishes to provide information on his or her exercise to the system, or to obtain rewards for the activity, the user may use a physical cable to directly connect the sensing device **104** to a suitable device (e.g., computing system **110**, portable electronic device **112**, gaming system **114**, or television **116**), or use some other connection mechanism. Alternatively, a memory component (e.g., an SD card) of the sensing device **104** may be removed and connected to a desired device.

Turning now to FIG. **2**, an example computing system **200** is schematically illustrated in greater detail. The computing system **200** of FIG. **2** generally represents a number of different devices that may be used in connection with the system **100** of FIG. **1**, as well as devices that may be used to manage rewards and incentives on account of physical activity, or to provide activities that are restricted or awarded depending on physical activity. For instance, the computing system **200** of FIG. **2** may be used as the computing device **106** of FIG. **1**, which device may access and/or store information related to the physical activity of one or more users. The computing system **200** may then be used to identify what rewards are available based on the activity and provide information to corresponding devices or systems so that rewards can be redeemed. Alternatively, the computing system **200** could instead be used as the portable electronic device **112** of FIG. **1**, which device may obtain information from another source (e.g., sensing device **104** or computing device **106**) to determine whether the user has redeemed rewards that relate to the use of the computing system. For instance, the computing system **200** may determine that based on a user's physical activity, the user has access to a certain amount of talk time, a certain number of emails or text messages, one or more games or other applications, application download programs, or even power capabilities. For instance, based on an available reward, the user may be given the ability to charge the portable electronic device **112** to a particular power level. As will be appreciated in view of the disclosure herein, other incentives are also available, including when the computing system **200** represents a gaming system, television, or other device.

In FIG. **2**, the computing system **200** includes multiple components that may interact together over one or more communication channels. In this embodiment, for instance, the system **200** may include multiple processors. More particularly, the illustrated processors include a central processing unit (CPU) **220** and a graphics processing unit (GPU) **222**. The CPU **220** may generally be a multi-purpose processor for use in carrying out instructions of computer programs of the system **200**, including basic arithmetical,

logical, input/output (I/O) operations, or the like. In contrast, the GPU **222** may be primarily dedicated to processing of visual or graphical information. In one example embodiment, the GPU **222** may be primarily dedicated to display of images and the like, and may be heavily used in video games. In other embodiments, a single processor or multiple different types of processors may be used other than, or in addition to, those illustrated in FIG. **2**.

The CPU **220**, GPU **222** or other processors may interact or communicate with one or more input/output (I/O) devices **224**, a network interface **226**, memory **230** and/or a mass storage device **236**. One manner in which communication may occur is using a communication bus **228**, although multiple communication busses or one or more other communication channels or interfaces may be used.

The CPU **220** and/or GPU **222** may generally include one or more processing components capable of executing computer-executable instructions received or stored by the system **200**. For instance, the CPU **220** or GPU **222** may communicate with the input/output devices **224** using the communication bus **228**. The input/output devices **224** may include ports, keyboards, a mouse, scanners, printers, display elements, touch screens, microphones or other audio input devices, speakers or other audio output devices, global positioning system (GPS) units, audio mixing devices, cameras, sensors, power supplies, other components, or any combination of the foregoing, at least some of which may provide input for processing by the CPU **220** or GPU **222**, or which may receive information output from the processors **220**, **222**. Similarly, the network interface **226** may receive communications via a network (e.g., network **102** in FIG. **1**). Received data may be transmitted over the bus **228** and processed in whole or in part by the processors **220**, **222**. Alternatively, data processed by the processors **220**, **222** may be transmitted using the bus **228** or other system components to the network interface **226** for communication to another device or component connected over a network or other communication channel. The other device or component may be local or may be remote relative to the system **200** illustrated in FIG. **2**.

The system **200** may also include memory **230** and mass storage **236**. In general, the memory **230** may include both persistent and non-persistent storage, and in the illustrated embodiment the memory **230** is shown as including random access memory **232** and read only memory **234**. Other types of memory or storage may also be included in memory **230**. The mass storage **236** may generally be comprised of persistent storage in a number of different forms. Such forms may include a hard drive, flash-based storage, optical storage devices, magnetic storage devices, or other forms which are either permanently or removably coupled to the system **200**, or in any combination of the foregoing. In some embodiments, an operating system **238** defining the general operating functions of the computing system **200**, and which may be executed by the CPU **220**, may be stored in the mass storage **236**. Other example components stored in the mass storage **236** may include drivers **240**, a browser **242** and application programs **244**.

The term "drivers" is intended to broadly represent any number of programs, code, or other modules including Kernel extensions, extensions, libraries, or sockets. In general, the drivers **240** may be programs or include instructions that allow the computing system **200** to communicate with other components either within or peripheral to the computing system **200**. For instance, in an embodiment where the I/O devices **224** include a display unit, the drivers **240** may store or access communication instructions indicating a manner in which data may be formatted to be displayed on the display unit. The browser **242** may be a program generally capable of interacting with the processors **220**, **222**, as well as the network interface **226** to browse programs or applications on the computing system **200** or to access resources available from a remote source. Such a remote source may optionally be available through a network or other communication channel. A browser **242** may generally be considered a type of application within applications **244**, or may be considered a separate component as illustrated in FIG. **2**. An example browser may be an Internet or web browser for accessing pages of resources available over the Internet or another global or other network.

The application programs **244** may include other programs or applications that may be used in the operation of the computing system **200**. Examples of application programs **244** may include a telephone application **246**, a text messaging application **248**, one or more gaming applications **250**, or virtually any other type of application. As will be appreciated by one of skill in the art in view of the disclosure herein, other types of applications **244** may provide other functions or capabilities, and may include email applications, calendar applications, productivity applications, music or video applications, map applications, and the like.

In at least one embodiment, the application programs **244** include an exercise rewarding application **252**. The exercise rewarding program **252** may generally perform a number of different functions related to using exercise information to obtain rewards. For instance, the exercise rewarding program **252** may access exercise-related information and/or reward information. In some cases, the exercise rewarding program **252** may also provide information on the available rewards. More particularly, information may be provided to a user to know what rewards are available, or information may be provided to other systems or components to allow rewards to be redeemed. In one embodiment, for instance, the system **200** may use exercise information to determine that a reward is available for another device (e.g., a television) and then send a message to the other device to allow the other device to then provide the reward. Alternatively, the system **200** may be the device where the reward is redeemed in which case the system **200** may receive a message for providing the reward. In some cases, the device which determines what rewards are available is the same electronic device on which the reward is redeemed.

The exercise redeeming program **252** may also perform other functions. For instance, rewards may vary based on whether exercise meets certain goals or thresholds. If exercise is below a threshold, the exercise rewarding program **252** may provide information to a user to allow the user to know that additional exercise may be required for a reward, or that additional exercise may increase the available rewards. In other embodiments, third party information, such as weather, may be accessed to make suggestions to the user on what physical activities to engage in.

As an illustration, the exercise rewarding program **252** may determine that by engaging in some additional exercise the user may be able to increase his or her reward. Using the network interface **226**, the exercise rewarding program **252** may access a third party data source that includes weather information. If the weather information indicates that the weather is suitable for outdoor activity, the exercise rewarding program **252** may provide a message indicating that an outdoor exercise activity would be available for some additional exercise. If the weather was not suitable for outdoor activity, a different message may suggest indoor weight lifting, yoga, treadmill, or other exercises.

As also shown in FIG. **2**, the system **200** may additionally or alternatively include an exercise administration program **254**. The exercise administration program **254** may generally be used to administer an incentive exercise incentive program. For instance, in some embodiments the exercise administration program **254** may be used to identify exercise goals or thresholds for a particular person, group of people, and the like. The exercise administration program **254** may further specify what rewards are available. Certain rewards may be associated with particular exercise activities or goals, and the correlation may be specified in the exercise administration program **254**.

While the exercise administration program **254** and exercise rewarding program **252** are shown as being included on the same computing system **200**, this is merely illustrative. In other embodiments, certain devices may include only one of the exercise administration program **254** or the exercise rewarding program **252**. A gaming system, television, portable electronic device, or other electronic device, for instance, may have access thereto granted or limited based on rewards. Such a device may include only the exercise rewarding application **252** to govern how rewards are redeemed. The exercise rewarding application **252** may communicate with or use information from the exercise administration application **254**; however, the exercise administration program **254** may reside elsewhere.

With reference now to FIG. **3**, an example sensing device **300** is shown in additional detail. The sensing device **300** generally represents a personal device that may be worn or carried by a user to track exercise or fitness information; however, the sensing device **300** may be more broadly embodied in aspects of other devices, including exercise equipment and personal electronic devices.

The example sensing device **300** includes one or more processors **320** usable to process data or instructions and perform basic arithmetical, logical, input/output (I/O) operations, or the like. Information used by the processors **320** may be obtained from one or more sensors **324**, from a communication interface **326**, or from a memory component **330**. The information may be obtained using a communication bus **328** connecting any or all of the processors **320**, sensors **324**, communication interface **326** or memory **330**.

As shown in FIG. **3**, the illustrated embodiment of a sensing device **300** contemplates the use of one or more sensors **324**. The sensors **324** may be of any number of different types and can obtain a variety of different types of information. For instance, one example sensor of the sensors **324** may include a pedometer. A pedometer is a sensor that can count the steps taken by a person, and often includes detecting motion of a person's hips. Another type of sensor may include an accelerometer. An accelerometer can measure acceleration along a single axis or along multiple axes. In general, such measurements can be used to measure motion and vibrations. Different movement profiles may be produced for different activities. For instance, an accelerometer on a person who is walking or running may produce different readings than for a person who is lifting weights or swimming. The accelerometer may nonetheless measure the movement during any of these physical activities, and potentially can determine the type of activity producing the results.

Another type of sensor that may be provided in the sensors **324** may include an altimeter or a GPS unit. An altimeter measures changes in altitude, which may be helpful for activities such as hiking or climbing stairs. The altimeter can measure the elevation change so that the type or results of the activity can be identified. A GPS unit, in contrast, identifies location. Using satellite communication, the location of a person can be pinpointed, along with the change in position. A person who is walking, running, cycling or otherwise moving may thus have their location monitored to determine distance covered, speed, pace, and the like.

Still another type of sensor that may be used in the system **300** includes a heart rate monitor. The heart rate monitor can measure a pulse to determine how frequently a heart is beating. Such a measurement may indicate how strenuously a person is exercising, or may provide an indication as to a health condition. Another sensor usable in the system **300** may include a perspiration monitor and/or thermometer. Such sensors may be used to determine how much a person is sweating or the person's skin temperature, which can also be correlated with physical activity levels.

As discussed herein, information about a person's exercise or other physical activity may be provided to various components in a communication system. Optionally, the information that is obtained from the sensors **324** may be processed by the processors **320** and/or stored in memory **330**. The memory **330** may include any of a number of different types, including both volatile memory **332** and non-volatile memory **334**. The volatile memory **332** may generally be used to temporarily store information obtained by the sensors **324**, processed by the processors **320**, or communicated using the communication interface **326**, or for other purposes. Other information stored more persistently may be stored on the non-volatile memory **334**.

Information stored on the non-volatile memory **334** may include a user interface module **334**. In some embodiments, the sensing device **330** may allow a user to input information not otherwise available from the sensors **324**. The user interface **356** may, for instance, allow a user to identify a type of exercise being performed. The user interface component **356** may also allow a user to input other information, such as the type and/or quantity of food eaten, the user's size (e.g., height and weight), and other information.

Also stored in the non-volatile memory **334** of the sensing device **300** of FIG. **3** is a calorie calculation component **358**. According to one example embodiment, the sensors **324** may obtain information about a person's physical activity. Information about the user's movement, heart rate, and the like may thus indicate when a person is exercising, how long they exercise for, and how strenuous the exercise is. The calorie calculation component **358** may use such information to determine how many calories a person burned during the exercise.

The calorie calculation component **358** may employ any of a number of different algorithms to provide an indication of the number of calories burned. Indeed, the number of calories burned during a given period of time can be dramatically different depending on the type of activity being performed, the size of the person performing the activity, and the intensity level with which the activity is performed. Thus, according to one embodiment, the calorie calculation component **358** uses each of multiple different algorithms to calculate calories burned.

By way of illustration, if the sensors **324** determine that a person is most likely walking or running, the calorie calculation component **358** may choose to use an algorithm such as the following:

$$C = \frac{w \cdot t}{19.658 - 0.993v}$$

In the above formula, C represents the number of calories burned, while w represents weight in pounds, t represents duration of exercise in minutes, and v represents the velocity. Other types of exercises may use other algorithms to estimate heart rate.

The calorie calculation component **358** may thus use different algorithms for different exercises. In other embodiments however, one algorithm may be used for all exercises or for multiple different types of exercises (e.g., for any exercise not having its own equation). Some examples of such algorithms may include a formula using a metabolic equivalent (MET). In other embodiments, indirect calorimetry (e.g., measuring differences in oxygen and carbon dioxide respiration to estimate heat generation) or predictive energy expenditure equations (e.g., Mifflin-St. Jeor, Harris-Benedict calculations) may be used to estimate the number of calories burned.

In addition to calculating calories burned, or as an alternative thereto, other calculations could be performed. FIG. **3**, for instance, illustrates non-volatile memory **334** that includes a distance calculator **360**. The distance calculator **360** may calculate the distance of travel for any of different exercises, and may do so based on information obtained from the sensors **324**. As an example, if the sensors **324** include a pedometer, the number of steps taken along with calibration information for the user may be used to estimate the distance traveled over a period of time. Alternatively, the sensors **324** may include an accelerometer which can be used to measure speed, distance or direction of travel. In some cases, the sensors **324** may use a GPS device to obtain information that can be used by the distance calculator **360** to determine distance traveled.

Although not specifically illustrated in FIG. **3**, the sensing device **300** may be used to determine a variety of other types of information. For instance, calculations may be performed to determine an average heart rate, a duration of a particular exercise or activity, or other information that can be directly or indirectly determined from the information gathered by the sensors **324**.

As will be appreciated in view of the disclosure herein, information obtained using the sensors **324** and user interface **356** may thus be communicated to other components of the sensing system **300** (e.g., using the communication bus **328**). The same information may also be communicated to other components outside of the sensing device **300**, either in the same form as obtained, or in a processed form. By way of illustration, rather than passing information directly received by the sensors **324**, the information may be processed using the processors **320** based on the calorie calculator **358**, distance calculation **360**, or some other module, and then communicated to another device or system using the communication interface **326**. Moreover, raw or processed information may be communicated according to any of a number of different protocols. For instance, the communication interface **326** may use a wired connection (e.g., Ethernet) or wireless connection (e.g., Bluetooth, 802.11, etc.) to transfer information. In other embodiments, all or a portion of the storage **330** is removable (e.g., an SD card), so that information that is sensed or calculated can be stored and removed. The removed storage may then be connected to another device for use.

In some embodiments, the sensing device **300** is a portable device that may be worn or carried by a user. For instance, the sensing device **300** may have the form of a chip or watch so as to move with a user as they move from place to place and activity to activity. As a result, the activities throughout an entire day may be monitored and the calorie, distance, heart rate, or other information over that time may be monitored and aggregated. In such an embodiment, the sensing device **300** may include a power supply **362**. The power supply **362** is optionally rechargeable or replaceable (e.g. a battery) that can power components such as the processors **320** and sensors **324** to enable operation of the sensing system **326**.

In other embodiments, the sensing device **300** may be integrated into other equipment, such as a treadmill, exercise bicycle, or other type of indoor or outdoor exercise equipment, or in a portable electronic device (e.g., a smart phone). For such a device, there may continue to be a power supply **362**. Optionally, the power supply **362** for such a device may be dedicated to the sensing components; however, the power supply **362** may also be a general power component providing power to any number of different components, including for display screens, input devices, motors, and the like.

Turning now to FIG. **4**, an example method **400** for rewarding a user for engaging in physical activity is described in additional detail. To provide an understanding of one example embodiment of how the method **400** may be performed, the method **400** will be described with reference to certain components of the devices and systems of FIGS. **1-3**, although other systems, devices and components may also be used in performing the method **400** of FIG. **4**.

According to one aspect of the present disclosure, the method **400** includes an act **402** of tracing the physical activity of a user. As discussed herein, tracking the physical activity of a user in act **402** may occur using any number of manners. In accordance with at least one embodiment, for instance, a user may wear or carry a sensing device (e.g., sensing device **104** or **300**). The sensing device may then be used to track the user's movements or other activity during the day. Example sensing devices may therefore track information such as the number of steps taken, distance traveled, speed, type of exercise, heart rate, exercise duration (e.g., duration of exercise above a certain heart rate), or the like. According to at least some embodiments, information that is tracked may be used to calculate or determine other information. For instance, information about the speed, heart rate, type of exercise and the like may be used to calculate the number of calories the user of the sending device is estimated to have burned during an activity or over a period of time. Of course, other methods of tracking the activity of a user in act **402** may also be used. For instance, a user may manually enter exercise information into a logging program or may use an exercise device which can track and potentially transmit such information to a logging program.

Regardless of the particular manner in which physical activity of a user is tracked in act **402**, the tracked information may be used to determine rewards for the user as discussed herein. In accordance with one embodiment, rewards are determined by, at least in part, comparing the physical activity that is tracked to one or more thresholds. The thresholds that are set may correspond to physical activity information that is tracked, whether directly by a sensor, calculated from sensed information, or otherwise input or obtained. As an example, a threshold may be the number of calories that should be burned during a day. A sensing device used in tracking the user's physical activity in act **402** may estimate a number of calories burned, or provide information to another system component that can determine the calories burned information for a user. The number of calories burned according to the tracked physical activity information may be compared to the threshold value for calories burned in act **404**. Based on the comparison, the

method **400** may be used to then determine if the user's activity met the threshold (i.e., by meeting or exceeding the threshold), or how close the user came to meeting the threshold (e.g., determining that the calories burned was some percentage of the threshold). Of course, a similar comparison may be done for thresholds set for other physical activity information such as distance, number of steps, duration of exercise, and the like.

While the above description describes a comparison to a single threshold, there may be multiple thresholds to which the physical activity is compared in act **404**. For instance, there may be multiple thresholds for a single physical activity category, such as calories burned, or thresholds may be in different physical activity categories.

The method **400** may further include determining what reward or rewards are available to a user base don their activity relative to the one or more thresholds, as shown in act **406** of method **400**. As discussed herein, there are a number of different types of rewards that are available, and the manner of providing the rewards based on the threshold levels of physical activity may vary based on the type of reward, or may be applied for all types of rewards. For instance, continuing with the example of tracking calories burned and comparing the calories burned relative to a threshold value, the method **400** may determine that the user has exceeded the threshold. In that case, a full reward of a given type may be available to the user. By way of illustration, for meeting the threshold number of calories burned in a twenty-four hour period, a user may be allowed to fully charge his or her cellular phone, portable media player, or other portable electronic device. Additional or alternative rewards that may be available include a certain amount of talk time on a cellular phone, a particular number of text messages, a duration of time to watch television or play computer games, a specified cash value for downloading applications for a portable computing device, or the like.

In contrast, if the user does not meet the threshold level for calories burned, the rewards as determined in act **406** may be different than the maximum available rewards. As an illustration, if during one day a user burns only seventy-five percent of the threshold value of calories, the user may receive no rewards. Alternatively, a user burning seventy-five percent of the threshold value of calories may receive a reduced reward relative to the full reward. In one embodiment, determining the rewards available in act **406** may provide rewards proportional to the full reward. Thus, if a reward is for a full charge of a portable electronic device when the threshold is satisfied, a charge of seventy-five percent may provided as a reward when the user reaches seventy-five percent of the threshold. In other embodiments, other schemes may be provided for reducing the reward by an amount corresponding to the difference between the user's activity and the threshold.

For instance, as noted above, there may be multiple thresholds used in act **404** and compared against the user's physical activity. In one example there may be a minimum and maximum threshold. If the user does not meet the minimum threshold, then no reward may be provided. In contrast, the maximum threshold may correspond to a maximum reward so that once the maximum threshold is exceeded no additional rewards are provided. Anything between the minimum threshold and maximum threshold may correspond to a reward that is less than the full reward. The reward may be allocated proportionally, in a tiered manner, or in another format.

For instance, there may be tiers which corresponding to different thresholds, and a user may obtain rewards only upon meeting the additional thresholds to move from tier to tier. By way of example, if calories burned is the threshold criteria used and a maximum threshold is 2500 calories burned, there may be additional thresholds at 1000 calories burned, 1500 calories burned, and 2000 calories burned. Anything below 1000 calories burned may not provide any reward to the user. If the user burns between 1000 and 1500 calories, the user may receive twenty-five percent of a maximum reward. If the user burns between 1500 and 2000 calories, the user may receive fifty percent of the maximum reward. If the user burns between 2000 and 2500 calories, the user may receive seventy-five percent of the maximum reward, and the user can receive the full reward by exceeding 2500 calories.

The rewards available to the user as determined in act **406** may also be redeemed by the user. One manner of redeeming the rewards may include providing an interface through which the rewards can be selected, as provided in step **408**. The interface may provide information on a single reward, or may allow a user to view multiple different reward options. As an illustration, if a television is connected in an exercise incentivizing system, the user may turn on the television, and potentially identify himself or herself. Upon doing so, the television may access information about the user's exercise activity and/or the rewards available based on exercise activity. When the rewards are determined, the user interface can identify the rewards that are available for redemption on the television, as shown in act **410**. For instance, the television may indicate that based on the user's activity a certain amount of television watching time is available. The time may be tracked cumulatively, so that if a user previously redeemed a portion of the reward, the television may also display the time remaining for a redeemed reward.

Of course, for other devices subject to rewards, other options may be displayed. A gaming system, for instance, may indicate how much time is available for game play. A telephone may indicate how much talk time a person can redeem, how many text messages can be sent/received, or what portion of a full charge may be provided to the telephone, or what portion of a reward remains from an earlier redemption. Thus, each time a user accesses a system that may be operated in connection with an exercise incentivizing system, the user can be notified whether or not they have any time or other benefit remaining, or what rewards they can collect or redeem for use of the device. Often, the identification of the available rewards in act **410** may occur through a visual display; however, in other embodiments an audio or other display may be provided to indicate what reward is left. For instance, during a phone conversation an audio cue may play to indicate that a certain amount of time (e.g., 5 minutes) remains.

In accordance with some embodiments, the reward that is available may be less than a maximum reward. At least some embodiments contemplate advising the user that there are greater rewards available. Thus, in act **412** of step **408**, a user may be notified that additional rewards are available and/or what the potential rewards may be. For instance, if a user is only receiving half of the maximum benefit, an audio or visual cue may identify the available reward as a percentage of the maximum, or may identify the maximum available reward. In some cases, the method **400** may also include providing encouragement to the user to earn greater rewards as shown in act **414**. For instance, a message may be played or displayed that suggests to the user to continue exercising before redeeming the reward so that they can get a larger reward. If the user has earned a maximum reward, the

encouragement provided in act **414** may be omitted, or may instead be congratulatory or encourage continued physical exercise in the future.

As shown in FIG. **4**, the method **400** for rewarding a user that engages in physical activity can include accessing additional data in act **416**. The act **416** can be performed in at virtually any stage of the method **400**, and can include accessing data from different sources. For instance, when comparing physical activity of users to a threshold in act **404**, the act **416** may be used to access the physical activity data, to access the thresholds, to obtain algorithms or functions for converting physical activity data to a value that can be compared to the thresholds, or the like. Similarly, to determine available rewards in act **406** additional data may be accessed in act **416** to determine what rewards are available. Additional data may also be accessed in act **416** during the step **408** for providing an interface for selecting rewards. The additional data may include what rewards are available or what maximum or other potential rewards are available. Messages to provide as encouragement in act **414** may also be available in act **416**.

In some embodiments, the additional data accessed in act **416** may be keyed to certain criteria. For instance, to provide encouragement to a user to earn greater rewards in act **414**, a system implementing the method **400** may provide contextually relevant information. Contextually relevant information may include such information as the weather, types of exercise the user enjoys or regularly engages in, and the like. As an illustration, the additional data accessed in act **416** may include information about the current weather conditions at the user's location. If the weather is suitable for outdoor activity, additional information may include what outdoor activities the user performs. If the weather is not suitable for outdoor activity, additional information may include what indoor activities the user regularly performs, or what nearby locations (e.g., a gym) the user can visit to continue exercising. Thus, on a sunny, warm day, a user who regularly jogs may be encouraged to go outside for a short jog to earn more rewards. On a cold, rainy day, a user who owns a treadmill may be encouraged to use the treadmill, or a user who is a member at a nearby gym may be encouraged to visit the gym to gain additional or greater rewards.

Optionally, the user interface includes a selection component through which the user can select to redeem a reward. In the method **400**, user selection of a reward can be received as an instruction or message as shown by act **418** in which user selection of a reward is received. Following selection of a reward, the reward can be authorized and provided in act **420**.

The selection and provision of rewards may be performed in various manners. For instance, a user may select a reward using an input/output component of a computing or other electronic device. A user interface may display a single reward or multiple rewards and the input/output component can be used in the selection. Upon receiving indication of the selection, the reward can be provided directly on the device where the selection is made, or a message may be sent. For instance, a message may be transmitted to a server or other computing system to account for rewards that are redeemed. In some embodiments selection of a reward may be automatic. For instance, by plugging in a telephone to charge, the telephone may automatically access information about what rewards are available and charge the device to the maximum allowed based on the rewards determined to be available in act **406**.

As shown in FIG. **4**, the method **400** can include the use of one or more thresholds to determine the rewards that are available to a user. The thresholds and rewards may be set in a number of manners. For instance, the thresholds may be programmatically determined and set by an author or provider of a computing program that executes all or a portion of the method **400** of FIG. **4**. In other embodiments, thresholds may be dynamic based on research from medical or educational sources. In still other embodiments, an administrator may exercise some control over the thresholds as well as over the rewards.

FIG. **5** illustrates an example method **500** for administrating exercise criteria and rewards for exercise according to an embodiment of the present disclosure. In the method **500**, one or more threshold levels of physical activity may be set in act **502**. The threshold levels that are set may include any threshold as discussed or contemplated herein. Thus, a threshold may be set for categories such as exercise distance or duration, caloric expenditure (e.g., calories burned or a difference between calories consumed and burned), or the like. Moreover, multiple different thresholds can optionally be set, whether for categories of physical activity, or as multiple thresholds for the same physical activity. Further still, such thresholds may have different time constraints. As an illustration, some thresholds may be set for a particular period of time (e.g., a day, week month) while other thresholds may be for a different period of time. Indeed, the thresholds set in act **502** may even be varied day to day or month to month. For instance, one threshold may be set for weekdays while a different threshold is set for weekends.

One or more available rewards may also be set in act **504** of the method **500** of FIG. **5**. Setting available rewards in act **504** may include identifying rewards that will be provided to a person satisfying all or portions of the physical activity thresholds identified in act **502**. Such rewards may include identification of a device on which rewards can be redeemed as well as a value. For instance, a device may be a smart phone while a value may be a value for talk time, a number of text messages, an amount of charge to the battery, or the like.

In one embodiment, an administrator may know that a person whose physical activity is being tracked has access to a cellular phone, a gaming system, a desktop computer, a television, or other devices. If the administrator wants to control access to any or all such devices based on an exercise and incentive program, the administrator can specify rewards that correspond to each device. As discussed herein, rewards for a cell phone optionally relate to communication (e.g., talk time, text messaging, email availability, video conferencing, etc.), entertainment (e.g., music or game downloads or play), power supply, and the like. Similar rewards may be provided for other devices, and time available to play video games or watching television may thus also be set in act **504**.

The thresholds set in act **502** and the rewards set in act **504** may also be correlated in an act **506**. Such an act **506** may include indicating and/or storing a reward that is to be associated with a particular threshold. For instance, if a threshold of a particular number of calories burned is specified, that threshold can be associated with a particular reward for a cell phone, for example. The same threshold may also be correlated in act **504** with multiple different rewards. Thus, the same threshold for calories burned could be associated with a television viewing reward, a game play reward, or the like. Moreover, such rewards may be cumulative or exclusive. More particularly, if multiple rewards are associated with the same threshold, an administrator may be able to set whether the rewards are each available if the

threshold is met (or based on what work towards the threshold is met), or whether the user may choose only one or less than all of the available rewards. Consequently, a user may be able to earn a reward for a certain amount of time for television viewing, video game playing, or talking on a cell phone; however, the user may not be able to redeem all of the rewards, but instead may only be able to redeem one reward, for example. In other embodiments, a user may be able to allocate the reward among different rewards. For instance, rather than redeeming a full amount of one reward, the user may redeem a portion of each of multiple rewards (e.g., 50% of the reward towards cell phone use, 25% towards television viewing and 25% towards video gaming).

Turning now to FIGS. **6A-9**, example embodiments of devices and interfaces for use in the performance of methods **400** and **500** of FIGS. **4** and **5** are illustrated in greater detail. In particular, FIGS. **6A-8** illustrate example devices and user interfaces at which physical activity and reward information may be provided and potentially selected, while FIG. **9** illustrates an example user interface for use by an administer of an exercise incentivizing system.

More particularly, FIGS. **6A-6E** illustrate various views of an exercise and reward tracking system **600** in which a user interface **604** is displayed on an electronic device **602**. In the illustrated embodiment, the electronic device **602** has the form of a portable electronic device such as a portable media player or smart phone; however, the electronic device **602** may include other devices, including laptops, desktop computing devices, gaming systems, televisions, tablet computing devices, and the like.

As shown in FIG. **6A**, the user interface **604** may provide a user with various options to view information regarding the physical activity of a user, and potentially the rewards available to a user on account of physical activity of the user. The user interface **604** may be executed by a processor of the computing device **602** and can use information stored on the exercise device **602** and/or information obtained over a communication network from one or more remote sources. For instance, information stored on a server or sensing device may be accessed via wired or wireless communication connections and used by an application on the exercise device **602** to display the user interface **604**.

In the illustrated embodiment, the menu view of the user interface **604** provides a user with multiple options. The illustrative options illustrated include an option **606** to view daily activity, an option **608** to view a daily summary, and an option **610** to manage rewards that may be available to the user of the device **602**. Each of options **606-610** may be selected by the user to obtain a different view within the user interface **604**. Of course, additional or different options may also be provided, including the option to manage or administer rewards as discussed herein.

FIG. **6B** illustrates an example view **614** of the user interface **604** that may be obtained to view a person's daily physical activity. In particular, the view **614** provides an option to view the number of calories burned by a person during a twenty-four hour period. In this embodiment, a graphical illustration depicts the number of calories burned using a graph to show an increase in calories burned during the day; however, other illustrations may also be used. For instance, a textual description of a number of calories burned may be provided. Other types of charts, graphs, descriptions and the like may also be provided.

A sensing device worn or carried by the user may obtain movement information that can be translated by the sensing device, the electrical device **602** or another device into the calories burned information. Other information may similarly be obtained by the sensing device and transferred within a communication network to the device **602**. In one embodiment, a selector **612** within the user interface **604** allows a user to change the type of physical activity information is displayed. Thus, while a user may select to view calories burned, other information such as distance, average heart rate, steps taken, and the like may also be displayed. A sensing device may thus be able to track any number of different types of information related to physical activity, and the different types of information may be available to view on the device **602**. Moreover, while a view **614** of the user interface **604** may display a single type of information, other embodiments contemplate multiple types of physical activity information in a single view.

FIG. **6C**, for instance, illustrates an alternative view **616** in the user interface in which the selector **612** has been used to show distance and duration information. More particularly, in this view **616** a duration component is displayed to describe the amount of time during a given period a user has engaged in aerobic exercise. In this case, the use engaged in one hour and twenty-one minutes of aerobic exercise. Such a determination may be based on heart rate to indicate how long during the day the user's heart rate was elevated beyond a particular rate.

The same view **616** of the user interface **604** may also display information such as distance. The distance information may correspond to the total distance a person traveled during a day, the distance traveled during a particular type of exercise (e.g., jogging or cycling), the distance traveled during aerobic exercise specified above, or it may represent any other distance that may be tracked directly by a sensing device, or indirectly using information obtained from a sensing or input device. Thus, while a single distance is displayed in the view **616**, in other embodiments multiple distances may also be displayed.

The user interface **604** of FIGS. **6B** and **6C** may thus provide information obtained from a sensing device or other input device to allow a user to monitor his or her physical activity. As discussed herein, another aspect of monitoring a person's physical activity is the ability to obtain rewards based on the physical activity relative to a threshold. FIG. **6D**, for instance, illustrates an example embodiment of a view **618** of the user interface **604**, which view **618** provides a summary of activity relative to a particular threshold or goal. More particularly, the user of a sensing device may set a goal, or have a goal set for him or her. In this embodiment, the goal is to burn 1200 calories over a specified period of time. In the view **618** of FIG. **6D**, the goal is displayed along with an indication of the number of calories burned thus far, which is in this case 483 calories. The user is thus about forty percent of the way towards completing the goal as is further specified in the view **618** of FIG. **6D**. If there are multiple thresholds or levels set, a user may be able to move between various views to obtain a progress summary towards each goal. Alternatively, a single summary may provide information to track progress towards each of multiple fitness-related goals.

As described herein, a user may receive different rewards depending on whether the user has met a threshold or goal, or based upon the extent to which the user is nearing the goal. FIG. **6E** illustrates an example embodiment of a view **620** of a user interface **604** which displays various rewards that may be available based on the progress a user has made towards a goal as shown in FIG. **6D**.

More particularly, as shown in FIG. **6E**, the user may be able to redeem various rewards. Some or all of the rewards may be redeemed directly for use of the electronic device

602, although other rewards may be redeemed for use with other devices or to provide other rewards. As shown in FIG. 6E, for instance, based on a comparison of the exercise performed to a threshold level desired, the user may be able to do a forty percent charge of the battery of the exercise device 602. Additionally, the user may be able to send and/or receive twenty text messages, talk for an hour and twelve minutes, play video games for forty minutes, or purchase up to two dollars worth of applications on the device 602. In some embodiments, the rewards are selectable so by selecting the particular reward (e.g., using a touch-screen or cursor-based input device) the user can redeem the reward. If, for instance, a user selects to redeem the reward to charge the battery, the user can connect the electronic device 602 to a power source and an application executing on the device 602 will monitor the power charge. When the charge has reached forty percent, or potentially been increased by forty percent, the application may cause the battery to stop charging.

Similarly, if a user selects to redeem a reward for text messages, the application on the electronic device 620 may monitor incoming and outgoing text messages. Once a message total reaches twenty it may disable the text messaging application. Gaming applications, phone systems and application purchasing systems on the device 602 may be subjected to similar controls. The various rewards may be cumulative so that the user can redeem each of the rewards; however, in other embodiments the user may select only one or less than all rewards. For instance, a user may be able to select to use the phone functions of the electronic device 602 or the game playing functions, but not both. In other embodiments, the user can allocate rewards among multiple devices. As an example, rather than redeeming the full one hour twelve minutes of talk time, the user may use thirty-six minutes. By using only half the available talk time, the user could then potentially select to play games for twenty minutes, or half the available gaming time. Thus, some embodiments may also contemplate automatic redemption of rewards. In such embodiments, the user interface 604 or the application executing the user interface could cause a reward to be redeemed by a user using the device in a particular manner (e.g., by using the telephone functions) rather than selecting a particular reward beforehand. In such an embodiment, the user interface 604 could optionally display the time remaining for the reward or for other rewards where a reward can be allocated among multiple redemption possibilities.

FIG. 7 illustrates another example of a system 700 in which rewards can be redeemed as a result of physical activity. In the illustrated embodiment, the system 700 includes a television 700. The television 700 may have an application or other program executing thereon which controls the availability of access to the television. Optionally, the application can execute or display a user interface 704 to provide the user with information about his or her rewards.

In FIG. 7, for instance, the user interface 704 may be displayed when a user turns on the television 704. Once turned on, the television 704 may be used to determine whether the user requesting to view television has performed sufficient exercise or has any rewards left to allow television viewing to continue. The television 704 may thus communicate with a sensing device, a server, another computing device, or some other component. Information that is obtained can then be used to display information about rewards. In FIG. 7, for instance, a reward 706 is displayed. The illustrated reward 706 indicates that the user has one hour and twelve minutes of a maximum three hours television viewing time available. The user may then use a selection mechanism 708 to begin watching television to start redeeming the reward. If the user stops watching television 702, the application on the television 702 (or on a set-top-box or controller connected to the television 702) may stop the time from running so that the next time the user turns on the television the time available and/or maximum time available may be decreased to show how much time is left and how much more could potentially be earned.

More specifically, as described herein, rewards for exercise may not only be established for meeting a particular threshold or goal, but for progress towards a goal. Thus, upon reaching or exceeding the threshold, the user may obtain the full reward. If, however, the user has only progressed partially towards the threshold, less than the full reward may be available, whether in a stepped, tiered, or other allocation scheme. For instance, if a user has made forty percent progress towards a goal, the user could receive forty percent of the reward, which in this embodiment may be time for television watching.

According to one embodiment of the present disclosure, although a user may redeem a partial reward, systems contemplated may nonetheless continue to encourage a person to continue exercising to maximize his or her rewards. The user interface 704 of FIG. 7, for instance, includes an encouragement to play soccer or go for a jog to earn more time. The encouragement may be tailored to the person and/or other factors. For instance, the encouragement also indicates that there is beautiful weather outdoors. As discussed herein, systems and methods of the present disclosure contemplate accessing external resources to obtain certain information. The application on the television 702 may, for instance, access a weather system database to determine what weather conditions are like. If there is suitable weather, the user can be encouraged to exercise outdoors, similar to the manner suggested in FIG. 7. Further information stored on the television 702 or accessible thereto may also indicate that the user enjoys or regularly engages in jogging or soccer. Consequently, the user interface 704 may recommend activities the user enjoys. Alternatively, other activities may also be suggested to try and expand the types of activities the user participates in, although in some embodiments encouragement may be provided without recommending a particular activity.

A similar exercise incentivizing system is illustrated in FIG. 8 in the context of a gaming system 800. In this embodiment, the system includes a display 802 connected to a gaming unit 803. The gaming unit 803 may also be executing or have access to an application which is used to control the function of the gaming unit 803 based on rewards offered to a user. As discussed herein, such rewards may be provided based on the physical activity of a user wanting to use the gaming system 800.

In the illustrated embodiment, the application used by the gaming unit 803 may produce a user interface 804 for the display 802. The user interface 804 may display various types of information, including information about rewards available. In this case, a reward 806 is indicated as an amount of time available for game playing, and the reward 806 optionally includes information about the maximum time that could be earned.

The user interface 804 may also encourage the user to continue exercising. Where, as here, the user has not maximized his or her reward, the user interface 804 may display a message telling the user to continue exercising. In this particular embodiment, weather information may be accessed to determine that poor weather exists in the area.

As a result, the user is encouraged to exercise indoors, such as by using a treadmill. If the user decides to earn more time, the user can select the "No" option on the selection mechanism **808**; however, the user can begin redeeming the rewarded play time using the alternative "Yes" option.

FIG. **9** illustrates an alternative embodiment of a system **900** that may be used to incentivize people to exercise and be physically active. Whereas systems **600**-**800** of FIGS. **6**A-**8** generally correspond to end-user systems that may be used to view and redeem rewards, the system **900** of FIG. **9** instead illustrates an example system that may be used to administer a rewards system.

In particular, the illustrated embodiment includes a user interface **918** that may be displayed on a display device **902**. As will be appreciated in view of the disclosure herein, the example user interface **918** may be produced by using a computing system connected to the display device **902**. In some embodiments the application may be a local application, although the application may also be distributed. For instance, the application used to produce the user interface **918** may implemented in a cloud-based system so that a browser application may be used to access information processed primarily remote from the display device **902**.

As discussed herein, incentives to exercise may be provided by a parent, guardian, educator, or other person or entity capable of administering an incentive program. For instance, a parent may exercise some control over the various different electronic devices used by his or her children, and can use a reward system as described herein to grant or deny access to one or more devices, to limit the use of such devices, and the like. FIG. **9**, for instance, illustrates an embodiment similar to what may be viewed or provided to a parent. In this embodiment, there may be four children. Using an exercise administration application, the parent may establish different thresholds or goals that the children must meet for certain usage privileges.

The system **900** of FIG. **9** contemplates that one of the children is John, and that John may have access to various electronic devices, including a cell phone, television, and a gaming system. The parent or other administrator has, in this embodiment, set-up thresholds for use in providing various different rewards. More particularly, if the user is able to burn 3500 calories in a day, the user may obtain cell phone, television, or gaming system access. In particular, in this embodiment, the system is set-up to provide a full charge and twenty-five text messages for the cell phone if the calorie burned threshold is satisfied. As alternative rewards, John could instead earn two hours of television watching time, or an hour and a half of game playing time.

As also shown in the user interface **918** of FIG. **9**, the rewards may be proportionally applied. In this particular embodiment, a proportional reward is allowed starting at zero calories all the way up to 3500 calories. Thus, if John was to burn 2800 calories, he could earn eighty percent of the identified rewards. As also shown in FIG. **9**, a control **920** may be provided to allow the administrator to edit the criteria, rewards, or allocation of the rewards at any time.

Multiple criteria or thresholds may also be set for a single person, as shown in FIG. **9**. For instance, in the illustrated embodiment, an administrator may be able to set a daily threshold for burned calories, as well as a weekly threshold for distance run or otherwise covered during exercise. If John satisfies the threshold, additional rewards may be earned, which in this case may be a monetary amount towards the purchase of applications for John's cell phone. The rewards may be proportionally applied only after reaching a certain level, although other allocation schemes may also be offered. Of course, the illustrated rewards and criteria are merely illustrative and other rewards may also be available.

For instance, as shown in FIG. **9**, additional rewards may be available to benefit John's in school. In the illustrated embodiment, for instance, if John satisfies a requirement for exercising forty-five minutes a day, the user interface **918** may notify the school district of his performance. As a result of such notification, extra credit may be obtained in various classes. In some cases, the parent or administrator controlling access to electronic devices may not be able to also specify the rewards for entities, such as a school. In FIG. **9**, for instance, the option to edit the scholastic rewards has been grayed out. Thus, an administrator is optionally notified of rewards available to the same person being monitored even if the administrator cannot modify those rewards. In other embodiments, the administrator may not have any access to the reward information from other entities.

While FIG. **9** illustrates the reward and threshold values and criteria for one person (i.e., John), the same user interface **918** may be used to administer a reward system for multiple users. In particular, in tabs shown in FIG. **9**, three other users may have reward systems set-up, and the option to add still other participants is included. Each participant may have different rewards, different thresholds, or a combination thereof. Alternatively, each participant may have the same general rewards and/or thresholds.

Embodiments of the present disclosure may generally be performed by a computing device, and more particularly performed in response to instructions provided by an application executing on the computing device or system, including systems that are distributed with both local and remote resources. Therefore, embodiments of the present disclosure may run on general purpose or special purpose computing devices once a suitable application is installed. In other embodiments, a cloud-based or software-as-a-service system, or hardware, firmware, software, or any combination of the foregoing may be used in directing the operation of a computing device or system.

Embodiments of the present disclosure may thus comprise or utilize a special purpose or general-purpose computer including computer hardware, such as, for example, one or more processors and system memory, as discussed in greater detail herein. Embodiments within the scope of the present disclosure also include physical and other computer-readable media for carrying or storing computer-executable instructions and/or data structures, including applications, tables, or other modules used to execute particular functions or direct selection or execution of other modules. Such computer-readable media can be any available media that can be accessed by a general purpose or special purpose computer system. Computer-readable media that store computer-executable instructions are physical storage media. Computer-readable media that carry computer-executable instructions are transmission media. Thus, by way of example, and not limitation, embodiments of the disclosure can comprise at least two distinctly different kinds of computer-readable media, including at least computer storage media and/or transmission media.

Examples of computer storage media include RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transmission medium which can be used to store desired program code means in the form of computer-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer.

When information is transferred or provided over a communication network or another communications connection (either hardwired, wireless, or a combination of hardwired or wireless) to a computing device, the computing device properly views the connection as a transmission medium. Transmissions media can include a communication network and/or data links, carrier waves, wireless signals, and the like, which can be used to carry desired program or template code means or instructions in the form of computer-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer. Combinations of physical storage media and transmission media should also be included within the scope of computer-readable media. Further, upon reaching various computer system components, program code means in the form of computer-executable instructions or data structures can be transferred automatically from transmission media to computer storage media (or vice versa). Thus, it should be understood that computer storage media can be included in computer system components that also (or even primarily) utilize transmission media.

Computer-executable instructions comprise, for example, instructions and data which, when executed at a processor, cause a general purpose computer, special purpose computer, or special purpose processing device to perform a certain function or group of functions. The computer executable instructions may be, for example, binaries, intermediate format instructions such as assembly language, or source code. Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the described features or acts described above, nor performance of the described acts or steps by the components described above. Rather, the described features and acts are disclosed as example forms of implementing the claims.

Those skilled in the art will appreciate that the embodiments may be practiced in network computing environments with many types of computer system configurations, including, personal computers, desktop computers, laptop computers, message processors, hand-held devices, programmable logic machines, multi-processor systems, microprocessor-based or programmable consumer electronics, network PCs, tablet computing devices, minicomputers, mainframe computers, mobile telephones, PDAs, servers, watches, portable chips, and the like.

INDUSTRIAL APPLICABILITY

In general, the exercise incentivizing systems, devices and methods of the present disclosure relate to monitoring physical activity performed by a person and providing rewards based on the extent of such physical activity. Specifically, a person may go throughout the day engaging in various types of activities, which activities may have varying levels of physical strain. A sensing device worn or carried by the user may detect how much the person moves, the user's heart rate, and other factors related to physical activity. Based on such information, a profile of the person may be obtained with information that includes the activities engaged in, the number of calories burned, the duration of exercise, distance traveled during one or more types of exercise, and the like.

A parent or guardian may be particularly interested in monitoring the exercise and physical activity of children. For instance, a parent may use the physical activity information gathered by a sensing device to determine whether a child will be allowed to use another device. An automated system may therefore be provided to allow a child to watch television, play video games, use a cell phone, and the like only if the child engages in a suitable amount of physical activity. The parent or guardian may specify what level of activity is required, and can do so over a period of time with a user-defined granularity. Thus, a user may want to incentivize exercise during a particular time of day, over a full day, week, month, or the like.

If the user is able to reach the defined threshold of physical activity, the user can receive the rewards set-up by the parent or guardian. For instance, a parent may limit use of a cell phone, television, or gaming system. If a reward is earned, additional time may be provided to use those devices or systems. Other rewards may also be provided, including monetary rewards. In another example, a portable device may have its power capacity limited. For instance, if a child doesn't satisfy an exercise threshold, the child may be unable to charge his or her cell phone. The rewards provided may be cumulative, although in some cases they are awarded on a time-limited basis so that if not used during a particular period they are lost. Parents, for example, may want to limit television watching and grant awards on a daily basis so a child cannot save rewards to watch no television one day and an excessive amount the next.

By comparing actual physical activity to a threshold, the entitlement of child to a reward may be determined. Additional aspects contemplate providing rewards even when the threshold is not met. For instance, as a user progresses towards a threshold, rewards may be provided in proportion to the user's progress. Thus, if a user is half way to reaching the threshold, the rewards may be available but cut in half.

Embodiments also contemplate allowing parents and other administrators to ensure that the applications and programs used in an exercise incentivizing program are operating correctly and efficiently. In some embodiments, rewards may relate to use of electronic devices, and control of those electronic devices may be monitored by an application executing on the device. Monitoring systems on an administrative-side system may from time-to-time evaluate performance of the applications, and may ensure that such applications remain installed and have not been tampered with to avoid controls established by the administrator. If the application ceases operation or is disabled, the administrator can be notified to take corrective action.

Where a reward relates to the charge or use of a communication device, override capabilities may also be enforced. For instance, if a child has used all of the talk time on a cellular phone, a parent may nevertheless be able to override the system to get in contact with the child or allow the child to contact the parents. Exceptions may be provided to ensure that communication with the parents or certain others may occur uninterrupted regardless of the rewards and device usage limits. In a similar manner, if a cell phone or other device is provided a limited charge, a portion of that charge, or an additional charge, may be held in reserve to allow operation of the device to get in contact with the parents or others. In some cases, a reward for a limited charge may not actually limit the amount of charge provided to the phone or other device. Instead, an application may monitor the charge on a battery. When the battery charge has reduced by a certain amount (e.g., if battery power drops from 100% to 50% and a user has a 50% battery charge reward), an application may disable certain functions of the device.

While parents may be administrators to control rewards and define physical activity thresholds for the rewards, others may also act as administrators. For instance, insur-

ance companies, cell-phone providers, or employers may allow people to opt-in to monitoring systems and provide benefits associated with wellness programs they administer. Additionally, schools may allow students to enroll in systems monitoring physical activity. As has been reported by authors of various studies, there is a significant and positive correlation between physical activity and scholastic performance. A review of fourteen such studies was conducted and produced in the January 2012 volume of the Archives of Pediatrics & Adolescent Medicine. As highlighted in the publication, children who are more physically active have improved academic performance, which is likely the result of improved cognition, decreased stress and increased nerve cell creation and support of synaptic plasticity. With the positive correlation between physical activity and academic performance, schools may administer a program whereby extra credit or other incentives can be provided based on the physical activities of enrolled children.

Systems and methods of the present disclosure are also contemplated for use with existing systems and across multiple platforms. For instance, a person may track his or her activity online. For instance, the WWW.IFIT.COM website allows users to track workouts and nutritional information. Embodiments contemplated herein may interface with the WWW.IFIT.COM or other websites to automatically update such websites with information, or to access information from such websites. As an example, a workout tracking website may maintain fitness information such as weight, height, and the like. A sensing device may access the website to obtain such physical information to calculate the number of calories burned over a period of exercise, or can even provide the workout information to the website so the website can calculate the calories burned information.

Further still, different systems may concurrently monitor a person's physical activity and provide different rewards. For instance, as discussed herein, a parent may monitor a child's activity and a school may monitor the same activity. Different rewards may be provided for the same activity by each administrator. A fitness tracking website, employer, or other person or entity may also track such information to provide still additional rewards. Each administrator may have access to only his or her information—or may be able to view other information for the same person being tracked—but each user can potentially monitor the rewards available from all program administrators. Such monitoring may be on a single application or interface or on multiple applications and interfaces.

What is claimed is:

1. A method for incentivizing physical activity, comprising:

in a computing system that includes one or more processors;

tracking a person's physical activity over a period of time;

comparing the person's physical activity to a threshold for the period of time;

identifying a reward corresponding to the threshold, the reward comprising use of an electronic device; and

determining that the person's physical activity is less than the threshold and, in response, authorizing a proportional amount of the reward, the proportional amount being scaled based on the person's physical activity relative to the threshold;

wherein authorizing the proportional amount of the reward comprises authorizing a battery charge of the electronic device, the authorized battery charge being less than a full charge of the battery.

2. The method recited in claim **1**, wherein tracking person's physical activity includes obtaining data from a sensing device carried or worn by the person.

3. The method recited in claim **1**, wherein comparing the person's physical activity to a threshold includes comparing a number of calories burned to a threshold number of calories burned.

4. The method recited in claim **1**, wherein the threshold includes one or more of a distance or duration.

5. The method recited in claim **1**, wherein comparing the person's physical activity to a threshold includes comparing the person's physical activity to a plurality of thresholds.

6. The method recited in claim **5**, wherein the plurality of thresholds correspond to a same reward.

7. The method recited in claim **5**, wherein the plurality of thresholds correspond to different rewards.

8. The method recited in claim **1**, further comprising:

restricting the battery charge based on a proportion of the person's physical activity relative to the threshold.

9. The method recited in claim **1**, wherein the reward includes one or more of:

talk time;

text messaging;

email messages; or

video game playing time.

10. The method recited in claim **1**, wherein identifying a reward corresponding to the threshold includes identifying a plurality of rewards corresponding to the threshold.

11. The method recited in claim **10**, wherein authorizing the reward includes authorizing the plurality of rewards, the plurality of rewards collectively being proportional to the person's physical activity relative to the threshold.

12. A system for incentivizing physical activity of a user, the system comprising:

a sensing device that tracks physical activity of a user; and

a computing device with one or more processors that receives information from the sensing device regarding the physical activity of the user, the computing device comparing the physical activity of the user with a threshold, the computing device identifying a reward based upon comparing the physical activity of the user with the threshold, the reward comprising a limited amount of power to power an electronic device, the computing device determining the limited amount of power to power the electronic device based upon a proportional amount of the physical activity of the user relative to the threshold.

13. The system recited in claim **12**, wherein the limited amount of power to power the electronic device comprises authorizing a battery charge of the electronic device.

* * * * *

APPENDIX I

US009403053B2

(12) **United States Patent**
Kaiser et al.

(10) **Patent No.: US 9,403,053 B2**
(45) **Date of Patent: Aug. 2, 2016**

(54) **EXERCISE PROMOTION, MEASUREMENT, AND MONITORING SYSTEM**

(75) Inventors: **William J. Kaiser**, Los Angeles, CA (US); **Lawrence Au**, Los Angeles, CA (US); **Maxim A. Batalin**, San Diego, CA (US); **Alexander A. Bui**, Los Angeles, CA (US); **Bruce H. Dobkin**, Los Angeles, CA (US); **Xiaoyu Xu**, Los Angeles, CA (US); **Brett Jordan**, Los Angeles, CA (US); **Seth Thomas**, Los Angeles, CA (US)

(73) Assignee: **THE REGENTS OF THE UNIVERSITY OF CALIFORNIA**, Oakland, CA (US)

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(2), (4) Date: **Feb. 20, 2014**

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(52) **U.S. Cl.**
CPC ***A63B 22/0605*** (2013.01); ***A63B 21/015*** (2013.01); ***A63B 22/0007*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC A63B 22/0605; A63B 22/0694; A63B 22/0007; A63B 2220/34; A63B 2220/54; A63B 2220/89; A63B 21/00069; A63B 21/015; A63B 2225/50; A63B 71/0622; A63B 24/00; A63B 24/0062
See application file for complete search history.

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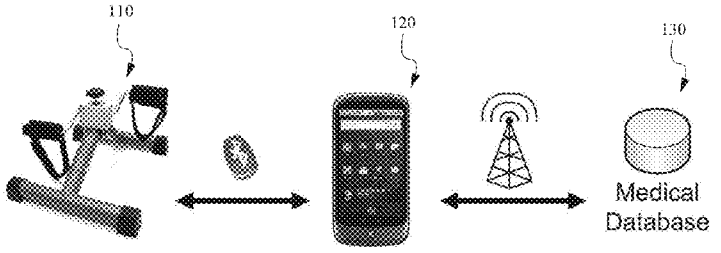
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Primary Examiner — Glenn Richman
(74) *Attorney, Agent, or Firm* — Haverstock and Owens LLP

(57) **ABSTRACT**

An exercise system comprising: an exercise cycle comprising a crank, wherein the crank is configured to be rotated by a user; and a sensing unit coupled to the exercise cycle, wherein the sensing unit is configured to sense information related to at least one crank measurement and to transmit the information related to the at least one crank measurement to a remote device via wireless communication. In some embodiments, the remote device is a mobile device. In some embodiments, the at least one crank measurement comprises a rotational speed of the crank or a force applied to the crank. The remote device can display information related to use of the exercise cycle based on the information received from the exercise cycle.

19 Claims, 5 Drawing Sheets



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G06F 19/00	(2011.01)
G06Q 50/22	(2012.01)
A63B 21/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A63B22/0694*** (2013.01); ***A63B 24/0062*** (2013.01); ***A63B 71/0622*** (2013.01); ***G06F 19/3481*** (2013.01); ***G06Q 50/22*** (2013.01); *A63B 21/00069* (2013.01); *A63B 2024/0065* (2013.01); *A63B 2071/065* (2013.01); *A63B 2220/34* (2013.01); *A63B 2220/54* (2013.01); *A63B 2220/89* (2013.01); *A63B 2225/20* (2013.01); *A63B 2225/50* (2013.01); *A63B 2230/75* (2013.01)

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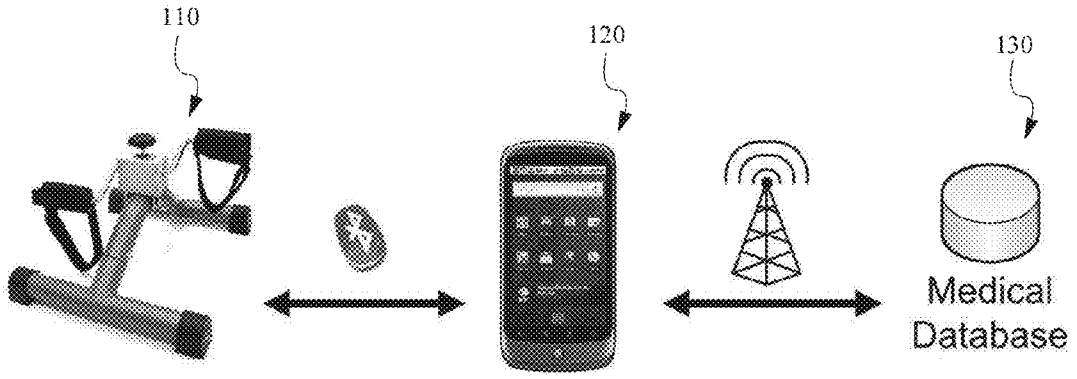


Fig. 1

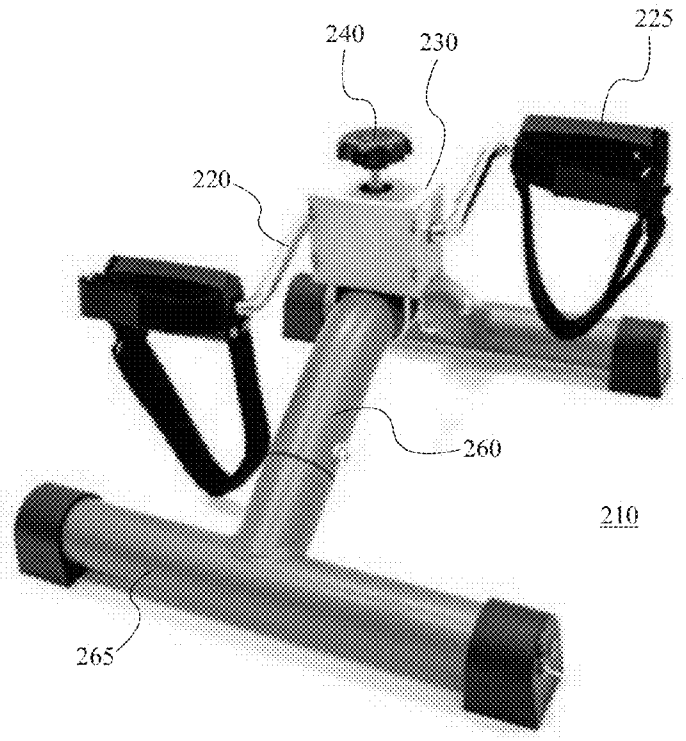


Fig. 2A

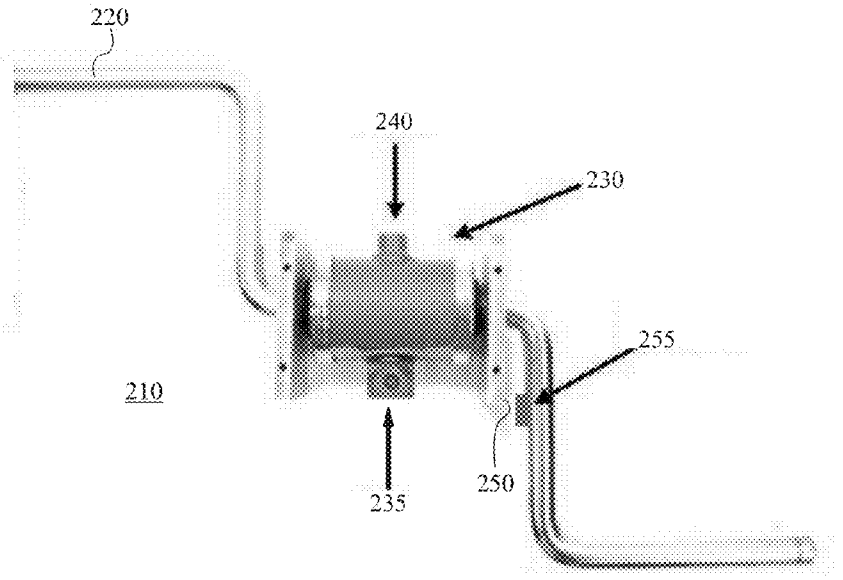


Fig. 2B

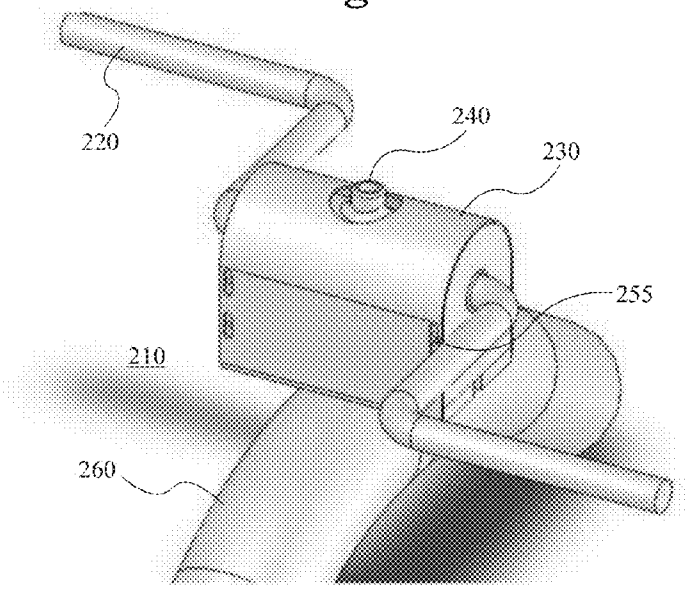


Fig. 2C

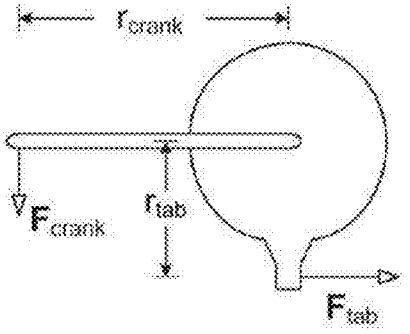


Fig. 2D

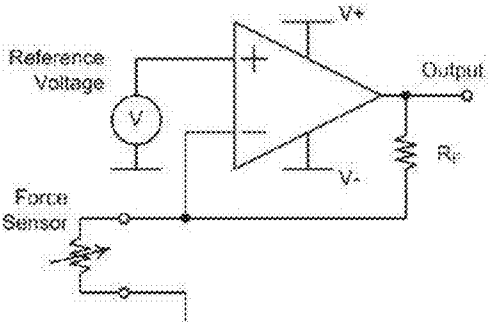


Fig. 2E

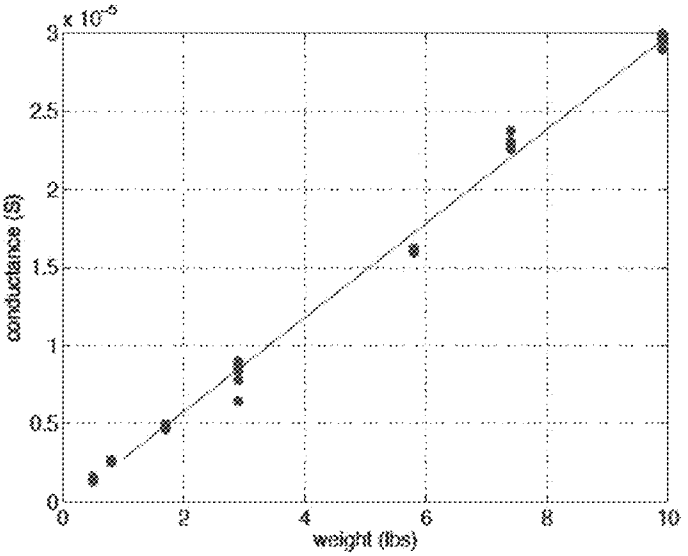

x 10^-5
conductance (S)
weight (lbs)

Fig. 3

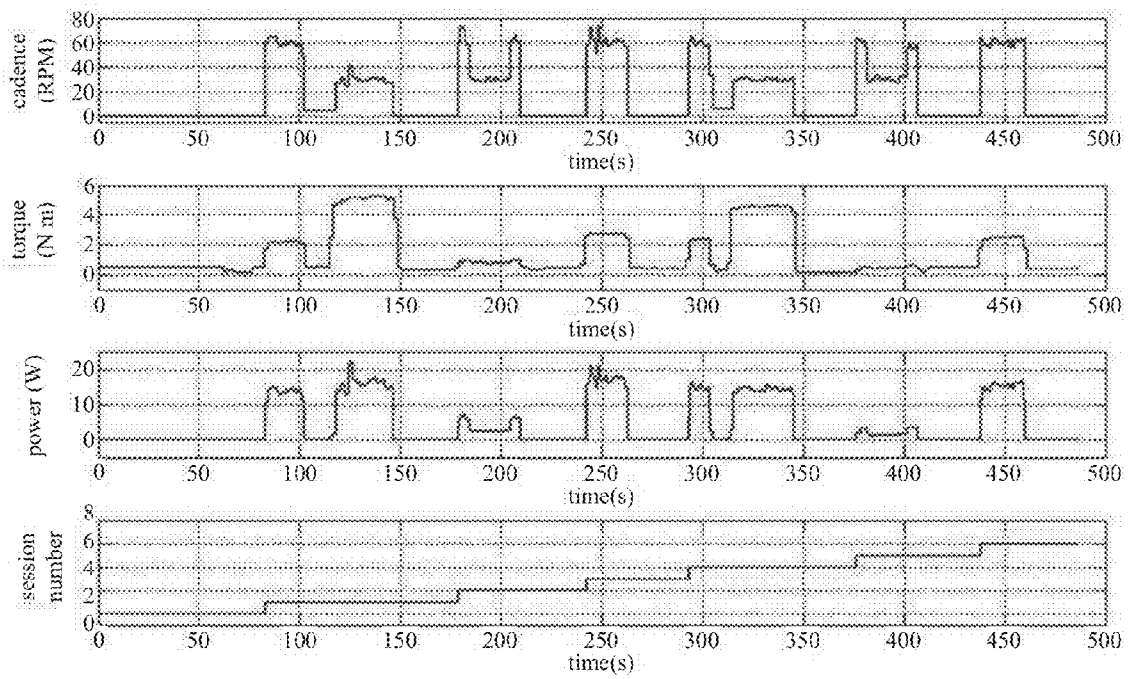

cadence (RPM)
torque (N m)
power (W)
session number
time(s)

Fig. 4



Fig. 5A

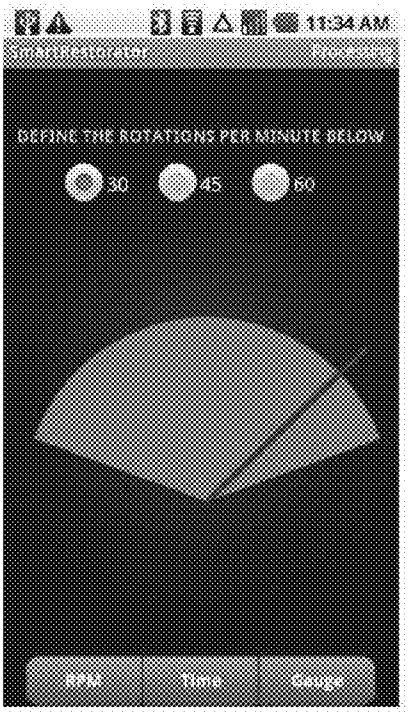


Fig. 5B



Fig. 6A

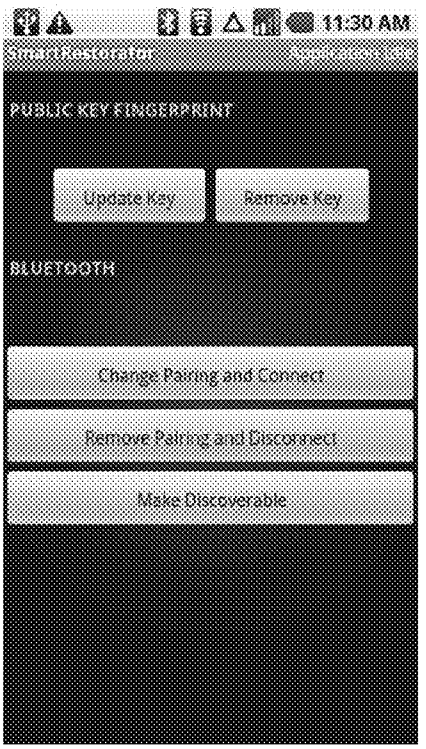


Fig. 6B

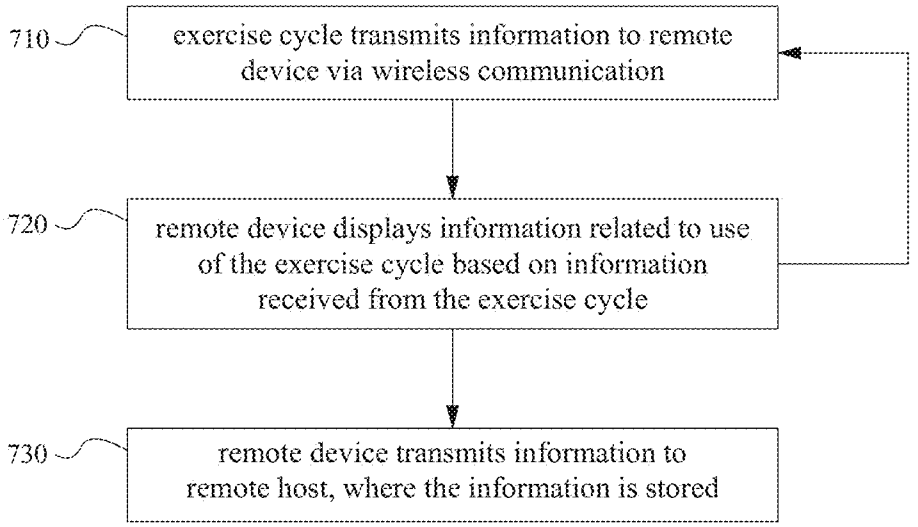

710
exercise cycle transmits information to remote device via wireless communication
720
remote device displays information related to use of the exercise cycle based on information received from the exercise cycle
730
remote device transmits information to remote host, where the information is stored

Fig. 7

EXERCISE PROMOTION, MEASUREMENT, AND MONITORING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Ser. No. 61/490,529, filed May 26, 2011, entitled "EXERCISE PROMOTION, MEASUREMENT, AND MONITORING SYSTEM," which is hereby incorporated by reference in its entirety as if set forth herein.

FIELD OF THE INVENTION

The present invention relates to a system and method of exercise promotion, measurement, and monitoring.

BACKGROUND OF THE INVENTION

Physical rehabilitation has become increasingly important for subjects recovering from treatment in clinics and from disease conditions including stroke. A particularly critical requirement is the support of individuals who suffer from impaired mobility or who may be confined to beds, yet must be provided with an assured fitness promotion regimen.

Stroke is a prominent cause of long-term disability in the United States. According to the American Heart Association (AHA), 800,000 people experience strokes every year. Stroke patients often lose essential sensorimotor skills. Consequently, the main objective of stroke rehabilitation is to re-enable patients' functional skills so they will be able to perform daily tasks. Physical activity, coupled with a regimented program, has been shown to reduce the probability of future strokes and prevent major loss of functional skills. Aerobic exercise has been shown to provide benefits for chronic stroke patients through intervention in both upper and lower extremities, even when the subjects were exercising while sitting. Unfortunately, many stroke survivors suffer from physical deconditioning, which further leads to cardiovascular risk factors and problems. As a result, an immediate solution is needed for stroke patients during rehabilitation. Specifically, physicians need to engage patients in repetitive exercises. With the increasingly prohibitive cost of hospital stay and pressure to discharge patients as soon as possible, a cost-effective solution to stroke rehabilitation is crucial.

Conventional low cost exercise cycle devices provide a means for enabling patient exercise. However, these devices are limited since they do not report energy expenditure that is critical to establishing whether a subject user is meeting a prescribed exercise regimen or has improved or declined. The lack of knowledge of actual workload may result in inadequate or excessive exercise. Conventional low cost exercise cycle devices also do not include the capability for local guidance and remote monitoring. Without these capabilities, it is not possible for a caregiver or healthcare enterprise to monitor all patients to ensure adherence to an exercise protocol.

An urgent need exists for low cost, rapidly deployable systems that enable exercise activity for patients in the clinic, those recovering in the community, the frail elderly, and those disabled.

SUMMARY OF THE INVENTION

The present invention provides a sensor-equipped portable exercise cycle that continuously measures arm and leg cycling activities through a mobile device in real time. Preferably, both cadence and torque, two important parameters for evaluating progress of rehabilitation, can be measured and logged continuously via a wireless interface. Sensor data are stored and relayed to a remote server. This system enables a dramatic cost reduction and increased deployment capability.

In one aspect of the present invention, an exercise system comprises: an exercise cycle comprising a crank, wherein the crank is configured to be rotated by a user; and a sensing unit coupled to the exercise cycle, wherein the sensing unit is configured to sense information related to at least one crank measurement and to transmit the information related to the at least one crank measurement to a remote device via wireless communication.

In some embodiments, the at least one crank measurement comprises a rotational speed of the crank or a force applied to the crank. In some embodiments, the remote device is configured to determine the at least one crank measurement using the transmitted information.

In some embodiments, the exercise cycle further comprises a resistance hub, and the crank comprises a first arm and a second arm, the first arm extending from a first side of the resistance hub and terminating in a first end, and the second arm extending from a second side of the resistance hub opposite the first side and terminating in a second end. In some embodiments, a first pedal is coupled to the first arm at the first end, and a second pedal is coupled to the second arm at the second end.

In some embodiments, the at least one crank measurement comprises a rotational speed of the crank. In some embodiments, the sensing unit is configured to register a trigger event when the crank passes a sampling location. In some embodiments, the sensing unit is configured to measure the rotational speed of the crank by measuring the time between successive trigger events or to register the trigger event with a remote device that is configured to measure the rotational speed of the crank by measuring the time between successive trigger events. In some embodiments, a magnet is coupled to the crank, wherein the magnet produces a magnetic field having a magnitude, and the sensing unit is configured to detect the magnetic field and to produce a voltage that is proportional to the magnitude of the magnetic field. In some embodiments, the sensing unit comprises a Hall-effect sensor. In some embodiments, the sensing unit is configured to measure the rotational speed of the crank by measuring the time between successive voltage peaks or to communicate the produced voltage to a remote device that is configured to measure the rotational speed of the crank by measuring the time between successive voltage peaks.

In some embodiments, the at least one crank measurement comprises the force applied to the crank. In some embodiments, the sensing unit is configured to measure torque of the crank using the applied force measurement or to communicate the applied force to a remote device that is configured to measure torque of the crank using the applied force measurement.

In some embodiments, the exercise cycle further comprises a resistance hub and a tab coupled to the resistance hub, wherein the crank is configured to translate the force that is applied to it to the tab, and the tab is configured to apply the force that is applied to it to the sensing unit. In some embodiments, the sensing unit comprises a polymer force sensor. In some embodiments, the sensing unit comprises a polymer conductive strain sensor.

In some embodiments, the sensing unit is configured to be used to determine the rotational speed of the crank and the force applied to the crank. In some embodiments, the sensing unit is configured to determine the rotational speed of the

crank or to transmit information related to the rotational speed of the crank to a remote device that is configured to determine the rotational speed of the crank using the transmitted information related to the rotational speed of the crank, and the sensing unit is configured to determine the torque of the crank or to transmit information related to the force applied to the crank to a remote device that is configured to determine the torque of the crank using the transmitted information related to the force applied to the crank.

In some embodiments, the exercise cycle further comprises a resistance hub and a resistance control knob coupled to the resistance hub, wherein the resistance control knob is configured to control an amount of resistance to movement of the crank. In some embodiments, the exercise system further comprises plastic friction pads configured to sandwich a portion of the crank with a clamping force, wherein the resistance control knob is configured to adjust the clamping force.

In another aspect of the present invention, a method of monitoring exercise comprises: receiving, by a remote device, information transmitted from an exercise cycle comprising a crank, wherein the information is related to at least one crank measurement; and displaying, by the remote device, information related to use of the exercise cycle based on the information received from the exercise cycle.

In some embodiments, the information related to use of the exercise cycle comprises cadence. In some embodiments, the information related to use of the exercise cycle comprises torque. In some embodiments, the information related to use of the exercise cycle comprises a user's performance on the exercise cycle in relation to a desired measurement.

In yet another aspect of the present invention, a program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of monitoring exercise is provided. The method comprises: receiving information related to at least one crank measurement of an exercise cycle; and displaying information related to use of the exercise cycle based on the received information.

In some embodiments, the information related to use of the exercise cycle comprises cadence. In some embodiments, the information related to use of the exercise cycle comprises torque. In some embodiments, the information related to use of the exercise cycle comprises a user's performance on the exercise cycle in relation to a desired measurement.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an architecture for an exercise promotion, measurement, and monitoring system in accordance with some embodiments of the present invention.

FIG. **2**A illustrates a perspective view of an exercise cycle in accordance with some embodiments of the present invention.

FIG. **2**B illustrates a front view of an exercise cycle in accordance with some embodiments of the present invention.

FIG. **2**C illustrates another perspective view of an exercise cycle in accordance with some embodiments of the present invention.

FIG. **2**D illustrates a side view of a torque measurement system for an exercise cycle in accordance with some embodiments of the present invention.

FIG. **2**E illustrates a parametric circuit for an exercise cycle in accordance with some embodiments of the present invention.

FIG. **3** is a graph illustrating a sample calibration of force sensors in accordance with some embodiments of the present invention.

FIG. **4** is a graph illustrating a test experiment for varying sensor data along with computed power and recorded sessions in accordance with some embodiments of the present invention.

FIG. **5**A illustrates a user interface that shows the real-time display of cadence in accordance with some embodiments of the present invention.

FIG. **5**B illustrates a user interface that shows a patient's adherence to a desired cadence in accordance with some embodiments of the present invention.

FIG. **6**A illustrates a user interface that supports calibration of the exercise system in accordance with some embodiments of the present invention.

FIG. **6**B illustrates a user interface that supports configuration of the exercise system in accordance with some embodiments of the present invention.

FIG. **7** is a flow chart illustrating a method of monitoring exercise in accordance with some embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the described embodiments will be readily apparent to those skilled in the art and the generic principles herein can be applied to other embodiments. Thus, the present invention is not intended to be limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features described herein.

The present invention can be provided as a computer program product that can include a machine-readable medium having stored thereon instructions that can be used to program a computer (or other electronic devices) to perform a process according to the present invention. The machine-readable medium can include, but is not limited to, floppy diskettes, optical disks, CD-ROMs, ROMs, RAMs, magnet or optical cards, or other type of media/machine-readable medium suitable for storing electronic instructions.

Furthermore, it is contemplated that any features from any embodiment can be combined with any features from any other embodiment. In this fashion, hybrid configurations of the disclosed embodiments are well within the scope of the present invention.

Various aspects of the disclosure can be described through the use of flowcharts. Often, a single instance of an aspect of the present disclosure can be shown. As is appreciated by those of ordinary skill in the art, however, the protocols, processes, and procedures described herein can be repeated continuously or as often as necessary to satisfy the needs described herein. Additionally, it is contemplated that method steps can be performed in a different order than the order illustrated in the figures, unless otherwise disclosed explicitly or implicitly.

The present invention provides an exercise system that, in some embodiments, monitors applied force, generated power, and dissipated energy. This data is provided as guidance in real time, as well being archived, processed, and made available to service providers that, in turn, guide patients in a local or remote environment and ensure adherence to a prescribed exercise regimen. Clinical trials of the present invention have shown the benefits of exercise for treatment of many diverse conditions ranging from stroke, to respiratory disorders, to geriatric subjects with multiple diagnoses. Trial results of the present invention also show a reduction in length

of hospital stay resulting from promotion of patient exercise. Guidelines have also been developed for rehabilitative exercise.

FIG. **1** illustrates an architecture for an exercise promotion, measurement, and monitoring system in accordance with some embodiments of the present invention. The present invention provides a compact exercise cycle **110**, which is preferably capable of sensing both cadence (i.e., speed of rotation) and torque generated by subjects for quantitative analyses. In some embodiments, sensor systems are integrated into the mechanical structure of the exercise cycle **110**, minimizing potential hindrance to patients. The present invention takes into consideration the need of caregivers and users for detailed sensor data, and real-time feedback to system users. Preferably, sensor data generated by the exercise cycle **110** is transmitted to a local mobile device **120** and to a remote host **130**, such as a host that comprises a medical database, via the mobile device **120**. In some embodiments, the sensor data is transmitted directly to the remote host **130**. Preferably, feedback to patients is provided by real-time computation of sensor system parameters. The present invention leverages low-cost sensor technology specifically selected to reduce the cost of microelectronic interfaces. It is important to note that its use is widely applicable to many exercise applications for healthy subjects or patient treatment.

In some embodiments, the sensing and local area wireless communication employed by the present invention exploits low power local area networking choices. In some embodiments, Bluetooth technology is employed since it enables convenient access to widely available mobile devices. In some embodiments, this wireless communication is implemented in the exercise cycle of the present invention with the MicroLEAP compact sensing platform (L. Au, W. Wu, M. Batalin, D. Mclntire, and W. Kaiser, "MicroLEAP: Energy-aware Wireless Sensor Platform for Biomedical Sensing Applications," in *Biomedical Circuits and Systems Conference,* 2007. *BIOCAS* 2007.*IEEE*, November 2007, pp. 158-162). MicroLEAP enables real-time energy accounting and management. In some embodiments, it is configured to be placed in low-power modes to conserve battery life, based on real-time application needs. An 8-channel, 16-bit ADC is available for incorporating custom analog sensors in the exercise cycle of the present invention. MicroLEAP supports both an Li-Polymer battery and an AC wall adapter. With continuous wireless data transfer, it can operate for over 24 hours with a fully charged battery. In some embodiments, the Bluetooth interface is controlled through an ASCII-based protocol via Serial Port Profile (SPP). Basic operations, such as selecting sampling frequency and sensor channels, can be accomplished in user-level applications.

In some embodiments, acquiring sensor data from MicroLEAP can be completed with any Bluetooth-enabled mobile device that supports SPP. In some embodiments, sensor data are collected using an Android-based mobile device. In some embodiments, a graphical user interface (GUI) is designed for both data collection and real-time data display. In some embodiments, sensor data in Android, or some other operating system, are logged in successive data files and transmitted to a remote data center through Wi-Fi (802.11) connections or via cellular data or via wireline interfaces. Although reference is made above to specific operating systems and wireless communication technologies, it is contemplated that other operating systems and wireless communication technologies are within the scope of the present invention.

FIG. **2**A-C illustrate the major components of an exercise cycle **210** of the present invention. The exercise cycle **210** comprises a crank **220** that is configured to be rotated by a subject user with hands or feet. In some embodiments, the crank **220** comprises pedals **225** on opposite sides of the crank **220** in order to aid the user in rotating the crank **220**. Preferably, the crank **220** is a one-piece crank. In some embodiments, force exerted on the crank **220** is translated to a customized welded tab **235** underneath a floating resistance control hub **230** on the exercise cycle **210**. The resistance control hub **230** is configured to control pedaling resistance (i.e., resistance to crank rotation). In some embodiments, the required pedaling force can be controlled by adjusting a resistance knob **240** on the top of the hub **230**, which increases the clamping force on two plastic friction pads that sandwich the middle portion of the crank **220**.

In some embodiments, the exercise cycle **210** acquires both force and rotational data through its sensing interface, and relays them to a mobile device (e.g., mobile device **120**) via wireless communication, (e.g., the Bluetooth interface). The caregiver or patient user can decide if real-time display is necessary or if the sensor data should be archived and transferred to a remote location (e.g., remote host **130**) for future analyses in support of guidance. Guidance information can then range from real time feedback based on the user interface, or later feedback based on Web-based data viewing, or via methods that include summary reports provided on a regular schedule (e.g., a daily schedule).

The exercise cycle **210** is designed for structural robustness, low cost, and convenient deployment in a clinic bed or operating as a floor mounted device. In some embodiments, proper enclosure and additional metal support are added to the exercise cycle **210** for both mechanical stability and sensor instrumentation. In some embodiments, the exercise cycle **210** comprises a base stand **260** for aiding in stabilization of the exercise cycle **210**. Preferably, the crank **220** and the resistance hub **230** are coupled to the base stand **260**. In some embodiments, the base stand **260** comprises two legs **265**, preferably disposed on opposite sides of the stand **260**. However, it is contemplated that other configurations are within the scope of the present invention.

Regarding sensor instrumentation, both force and Hall-effect sensors are inexpensive and can be deployed directly. In some embodiments, the sensing platform (e.g., MicroLEAP) is mounted inside tubing of the exercise cycle **210** near an end in order to maintain maximum wireless signal strength. However, it is contemplated that other configurations are within the scope of the present invention.

In some embodiments, cadence, or rotational speed, is measured by introducing a fixed sampling location along the trajectory of the crank **220**. Every time the crank **220** passes the sampling location, the sensing unit of the exercise cycle **210** registers a trigger. In some embodiments, cadence is computed by measuring time difference between two successive triggers. In some embodiments, the fixed sampling location is instrumented with a sensor **250**, such as a Hall-effect sensor (e.g., the Honeywell SS49E), located on one side of the resistance hub **230**, as seen in FIG. **2**B. In some embodiments, a small magnet **255** is attached to the same side of the crank **220**, as seen in FIGS. **2**B-C. As the magnet **255** travels over the sensor **250** via the crank **220**, the sensor **250** detects the corresponding magnetic field and produces an analog voltage proportional to the strength of the field. By computing the time difference, Δt, between two consecutive voltage peaks, the exercise system of the present invention can compute the cadence and corresponding angular frequency, ω, of the cycle:

$$\text{cadence}\,[rpm] = \frac{\Delta t}{f_{sampling}} \cdot (60\ \text{s}) \tag{1}$$

$$\omega[\text{rad/s}] = \frac{2\pi \cdot 60\ \text{s}}{\text{cadence}\,[rpm]} \tag{2}$$

where $f_{sampling}$ corresponds to the sampling frequency of the sensing platform.

In some embodiments, measurement of torque, power, and energy requires measurement of the force exerted on the crank and its rotational speed. In some embodiments, the sensing unit on the exercise cycle **210** measures the torque by measuring the force exerted by the tab **235** under the resistance hub **230**. In some embodiments, both the crank **220** and the tab **235** are connected to a single rigid resistance hub **230**, so force exerted on the crank **220** is measured by the force produced by the tab **235**. In some embodiments, a thin-film polymer force sensor is applied for measurement of force at the tab. It has been found that the use of TekScan's Flexiforce sensor is particularly useful in the present invention due to its availability and high repeatability. This sensor system exhibits both large resistance and large response to force. In some embodiments, the sensing unit uses a polymer conductive strain sensor due to its low cost and large resistance response to strain. This large response enables the implementation of analog microelectronic measurement interfaces at low cost in comparison to alternative conventional solutions based on the conventional metal strain gage.

In some embodiments, torque measurement at time t, $\tau(t)$, requires the knowledge of the applied force, F(t), and the radial length (displacement vector), r(t). In some embodiments, when the tab applies force to the force sensor, the conductance of the sensor changes proportionally.

Consider FIG. **2**D: a net force, $F_{crank}(t)$, is exerted on the resistance hub. Now, $\|\tau(t)\|=\|r(r)\times F(t)\|$, where × denotes the cross product. The welded tab **235** and the crank **220** are connected to the same resistance hub, and thus net torque must remain the same:

$$\tau_{crank}=\tau_{tab} \tag{3}$$

The parametric circuit in FIG. **2**E converts the conductance generated by $\|\tau_{tab}\|$ an output voltage:

$$V_{out}=V_{ref}(1+R_fG) \tag{4}$$

where G is the conductance of the force sensor.

In some embodiments, the average power, P_{avg}, is defined as the average of the product of angular frequency and torque over a time duration T:

$$P_{avg} = \frac{1}{T}\int_0^T \|\tau(t)\| \cdot \omega(t)\, dt \tag{5}$$

Equation (3) describes the translation of the external force applied on the resistance hub to a corresponding force applied on force sensor. In some embodiments, both the force and resulting conductance of the force sensor used in the sensing unit exhibit a linear relationship:

$$G=\alpha \cdot F \tag{6}$$

where α is the proportionality constant determined empirically.

In some embodiments, by design, θ_{tab} is close to 90 degrees at all times. Equation (3) enables computation of external torque by measuring $\|F_{tab}\|$. All of $\|F_{tab}\|$ appears on the force sensor. Substituting Equations (3), (4) and (6) yields the relationship:

$$V = m \cdot F_{tab} + c = \left(\alpha R_f V_{ref} \frac{r_{crank}}{r_{tab}}\right) \cdot F_{tab} + V_{ref} \tag{7}$$

Equations (7) and (8) provide a method for in situ calibration: Place a minimum of two known weights on the resistance hub (F_{tab}) and record the resulting voltages (V_{ref}). Because the relationship is linear, one can estimate m and c by using a linear best-fitting curve. The estimated slope and offset from the calibration should match up closely to the predicted slope and offset:

$$m = \alpha R_f V_{ref} \frac{r_{crank}}{r_{tab}} \tag{8}$$

$$c = V_{ref} \tag{9}$$

It is contemplated that the computations and determinations of crank measurements discussed above (e.g., cadence, torque, and power) can be performed by the sensing unit on the exercise cycle **210** or on a remote device, such as a mobile device or a remote host.

FIG. **3** shows a sample calibration of force sensors using three different weights, with the conductance of the sensor being plotted in relationship to different weights. As expected, the empirical calibration function closely matches up with the expected function.

FIG. **4** illustrates a test experiment for varying cadence and resistance values. The cadence-time characteristic captures the speed in a cycle-by-cycle fashion. As a result, the cadence-time characteristic exhibits a step-wise waveform. Similarly, FIG. **4** shows a torque-time characteristic, a power-time characteristic, and a session-number-time characteristic. When the sensing unit does not detect a new trigger from the sensor within a certain time limit, it assumes the present session has concluded. The next trigger automatically indicates the beginning of a new session. The time limit can be set by a subject user or caregiver for automatically computing the number of sessions completed by the patient. In FIG. **4**, the time limit is 20 seconds. Therefore, the sensing unit infers that there are 6 episodes, as reflected by the session-number-time characteristic.

In some embodiments, resistances are monitored and reported as continuous values or divided into levels that may denote standard values of: low, medium, and high. In some embodiments, the resistance knob **240** on the exercise cycle **210** controls the pedal force resistance that the patient experiences, and the torque-time characteristic illustrates the generated torque resulting from this setting and the user applied force. In some embodiments, the measured torque exhibits a non-zero offset value for zero applied torque. This is recorded and removed in the data processing. The power-time characteristic is the product of the speed and torque values. Finally, energy developed by a subject over a session of usage is the time integral of generated power. It is contemplated that these analyses, computations, and inferences discussed above with respect to FIG. **4** can be performed by the sensing unit on the exercise cycle or by a remote device, such as a mobile device or a remote host.

In some embodiments, the present invention provides a user interface on a remote device, preferably a mobile device.

The user interface is configured to display information related to a patient's use of the exercise cycle (i.e., rotation of the crank). Such information includes, but is not limited to, cadence, torque, power, and number of sessions. In some embodiments, this information is updated on a cycle-to-cycle basis. In some embodiments, the user interface employs an Android-based operating system. However, it is contemplated that the use of other operating systems are within the scope of the present invention. FIG. **5**A shows the real-time display of cadence (RPM) while the patient is using the exercise cycle.

In some embodiments, the user interface is also configured to show the patient's performance in relation to a certain standard. For example, in some embodiments, the user interface enables a user to set a desired cadence or torque or power using the user interface, and then displays the user's performance in relation to this desired measurement, such as how close the user is to the desired measurement or whether the user has met, exceeded, or fell short of the desired measurement. FIG. **5**B shows a patient's adherence to a 30 rotations-per-minute standard. In particular, the needle in the gauge indicates if the patient is adhering to the desired cadence (needle in the center), performing too slow (needle to the left), or performing too fast (needle to the right). In FIG. **5**B, since the user's cadence is at 39 RPM, the patient is exceeding the 30 rotations-per-minute desired cadence, and thus the needle is positioned on the right portion of the gauge.

In some embodiments, the user interface enables a user to calibrate and configure a remote device with the exercise cycle. FIGS. **6**A-B show interfaces that support calibration and configuration of the discovery and authentication that pairs a handheld device with the exercise cycle of the present invention. In FIG. **6**A, the user interface provides instructions to the user for calibrating the system with different weights. The user places a certain weight on each pedal of the exercise cycle, and then activates a corresponding button displayed on the handheld device. This step can be repeated for different weights until proper calibration is achieved. In some embodiments, the user interface provides the user with the option of selecting default calibration values. In FIG. **6**B, the user interface provides the user with options related to authenticating the handheld device and the exercise cycle.

FIG. **7** is a flow chart illustrating a method of monitoring exercise in accordance with some embodiments of the present invention. At step **710**, a user rotates the crank of an exercise cycle, such as exercise cycle **210** discussed above, and the exercise cycle transmits information to a remote device via wireless communication, such as Bluetooth. In some embodiments, the remote device is a mobile device, such as a mobile phone. The transmitted information s related to at least one crank measurement. Such information can include, but is not limited to, voltage and/or time measurements obtained by the sensing unit of the exercise cycle. Such information can also include more advanced information, including, but not limited to, cadence, torque, power, energy, and session numbers. At step **720**, the remote device displays information related to use of the exercise cycle based on the information received from the exercise cycle. Such displayed information can include, but is not limited to, any of the information discussed above with respect to FIGS. **5**A-B. The method repeats until the user stops using the exercise cycle for a certain amount of time. In some embodiments, at step **730**, the remote device transmits information to a remote host, such as a medical database, where the information is stored. This transmitted information is related to the user's use of the exercise cycle and can comprise any of the previously discussed information (i.e., cadence, torque, etc.). Preferably, the information stored in the remote host is accessible to users, such as patients, caregivers, nurses, and physicians.

The present invention provides a sensor-equipped portable exercise cycle developed to provide a low cost, rapidly-deployable, and remotely-monitored system for promoting general wellness and exercise-prescribed treatment, including rehabilitation. It measures cadence, torque, and power, the critical parameters for evaluating a patient's progress. The present invention provides a cost-effective solution by providing a real-time sensing and monitoring capability through a selection of sensor technology that is inherently low cost. The exercise cycle is preferably portable allowing caregivers and the clinic to monitor and deploy this system both during and after a hospital stay, and in residential, assisted living, and nursing home environments. The present invention's sensing systems are available for local handheld devices providing guidance, display devices integrated into the exercise cycle, and remote monitoring, data processing, archiving, and data display via remote Web services.

The present invention provides a portable, cost-effective solution for physical rehabilitation. By incorporating wireless sensing technology into an exercise cycle, along with data transport and data archiving, patients, caregivers, nurses, and physicians can analyze the progress of patient activity and rehabilitation in real time. The graphic user interface also provides a method for motivating patients to adhere to their regimented exercise routines and tracking their daily progress.

The present invention has been described in terms of specific embodiments incorporating details to facilitate the understanding of principles of construction and operation of the invention. Such reference herein to specific embodiments and details thereof is not intended to limit the scope of the claims appended hereto. It will be readily apparent to one skilled in the art that other various modifications can be made in the embodiment chosen for illustration without departing from the spirit and scope of the invention as defined by the claims.

What is claimed is:

1. An exercise system comprising:

an exercise cycle comprising a crank, wherein the crank is configured to be rotated by a user; and

a sensing unit coupled to the exercise cycle, wherein the sensing unit is configured to sense information related to at least one crank measurement and to transmit the information related to the at least one crank measurement to a remote device via wireless communication, wherein the at least one crank measurement comprises the force applied to the crank, wherein the exercise cycle further comprises a resistance hub and a tab coupled to the resistance hub, wherein the crank is configured to translate the force that is applied to it to the tab, and the tab is configured to apply the force that is applied to it to the sensing unit.

2. The exercise system of claim **1**, wherein the remote device is a mobile device.

3. The exercise system of claim **1**, wherein the at least one crank measurement comprises a rotational speed of the crank or a force applied to the crank.

4. The exercise system of claim **1**, wherein the remote device is configured to determine the at least one crank measurement using the transmitted information.

5. The exercise system of claim **1**, wherein:

the exercise cycle further comprises a resistance hub; and

the crank comprises a first arm and a second arm, the first arm extending from a first side of the resistance hub and terminating in a first end, and the second arm extending

from a second side of the resistance hub opposite the first side and terminating in a second end.

6. The exercise system of claim **5**, wherein a first pedal is coupled to the first arm at the first end, and a second pedal is coupled to the second arm at the second end.

7. The exercise system of claim **1**, wherein the at least one crank measurement comprises a rotational speed of the crank.

8. The exercise system of claim **7**, wherein the sensing unit is configured to register a trigger event when the crank passes a sampling location.

9. The exercise system of claim **8**, wherein the sensing unit is configured to measure the rotational speed of the crank by measuring the time between successive trigger events or to register the trigger event with a remote device that is configured to measure the rotational speed of the crank by measuring the time between successive trigger events.

10. The exercise system of claim **7**, wherein:

a magnet is coupled to the crank, wherein the magnet produces a magnetic field having a magnitude; and

the sensing unit is configured to detect the magnetic field and to produce a voltage that is proportional to the magnitude of the magnetic field.

11. The exercise system of claim **10**, wherein the sensing unit comprises a Hall-effect sensor.

12. The exercise system of claim **10**, wherein the sensing unit is configured to measure the rotational speed of the crank by measuring the time between successive voltage peaks or to communicate the produced voltage to a remote device that is configured to measure the rotational speed of the crank by measuring the time between successive voltage peaks.

13. The exercise system of claim **1**, wherein the sensing unit is configured to measure torque of the crank using the applied force measurement or to communicate the applied force to a remote device that is configured to measure torque of the crank using the applied force measurement.

14. The exercise system of claim **1**, wherein the sensing unit comprises a polymer force sensor.

15. The exercise system of claim **1**, wherein the sensing unit comprises a polymer conductive strain sensor.

16. The exercise system of claim **1**, wherein the sensing unit is configured to be used to determine the rotational speed of the crank and the force applied to the crank.

17. The exercise system of claim **16**, wherein:

the sensing unit is configured to determine the rotational speed of the crank or to transmit information related to the rotational speed of the crank to a remote device that is configured to determine the rotational speed of the crank using the transmitted information related to the rotational speed of the crank; and

the sensing unit is configured to determine the torque of the crank or to transmit information related to the force applied to the crank to a remote device that is configured to determine the torque of the crank using the transmitted information related to the force applied to the crank.

18. The exercise system of claim **1**, wherein the exercise cycle further comprises a resistance hub and a resistance control knob coupled to the resistance hub, wherein the resistance control knob is configured to control an amount of resistance to movement of the crank.

19. The exercise system of claim **18**, further comprising plastic friction pads configured to sandwich a portion of the crank with a clamping force, wherein the resistance control knob is configured to adjust the clamping force.

* * * * *

APPENDIX J

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(54) **HEALTH MANAGEMENT FEEDBACK METHOD USING FITNESS EQUIPMENTS**

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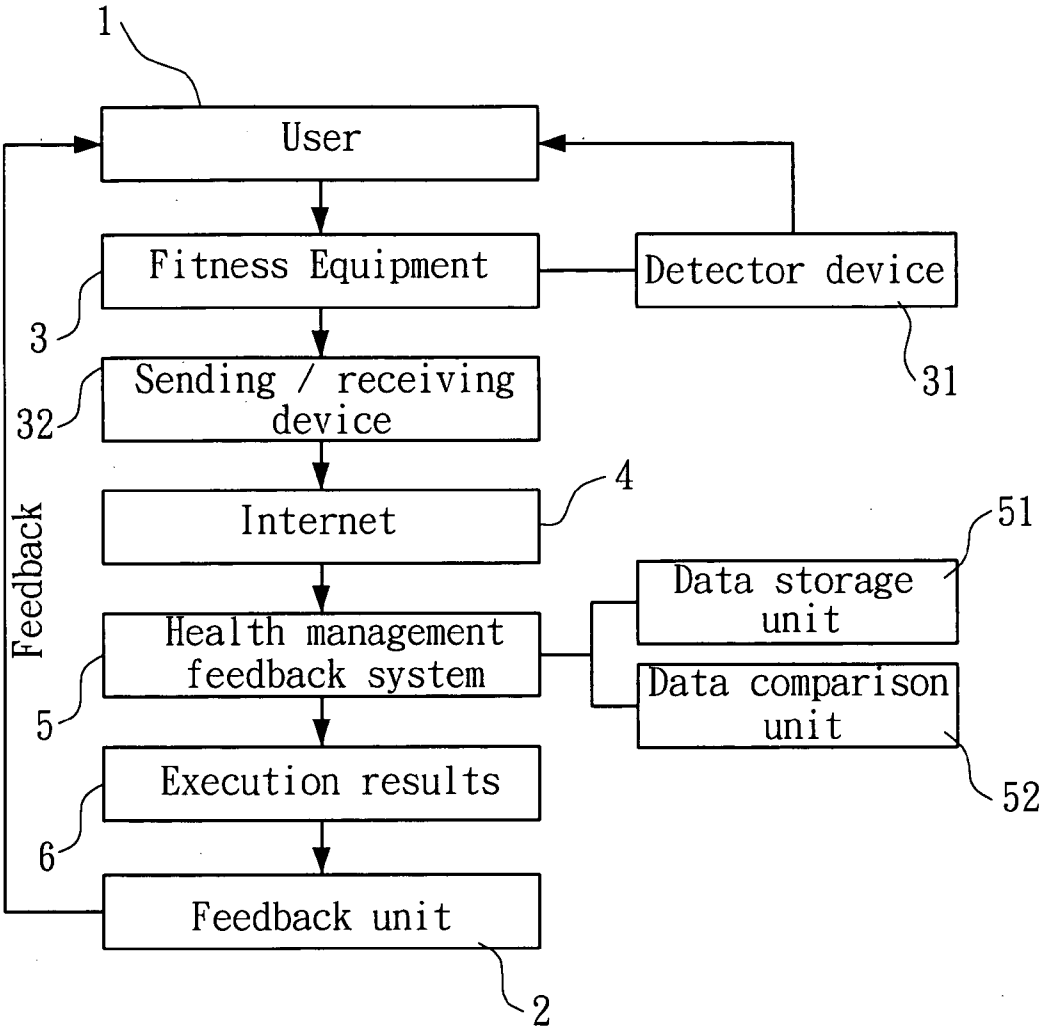
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(57) **ABSTRACT**

A health management feedback method by using fitness equipments comprises that a feedback unit proposes at least one seductive health management feedback plan for feedback to user and the health management feedback plan including the matching fitness equipment and a feedback plan for setting the execution result to realize seductive factors, wherein once user using fitness equipment being confirmed for self-use achieves the execution result predefined by health management feedback system, feedback unit is through feedback of the resource obtained by user to realize seductive factors, and the predefined objective of the feedback plan proposed by feedback unit is achieved through the execution result done by user.



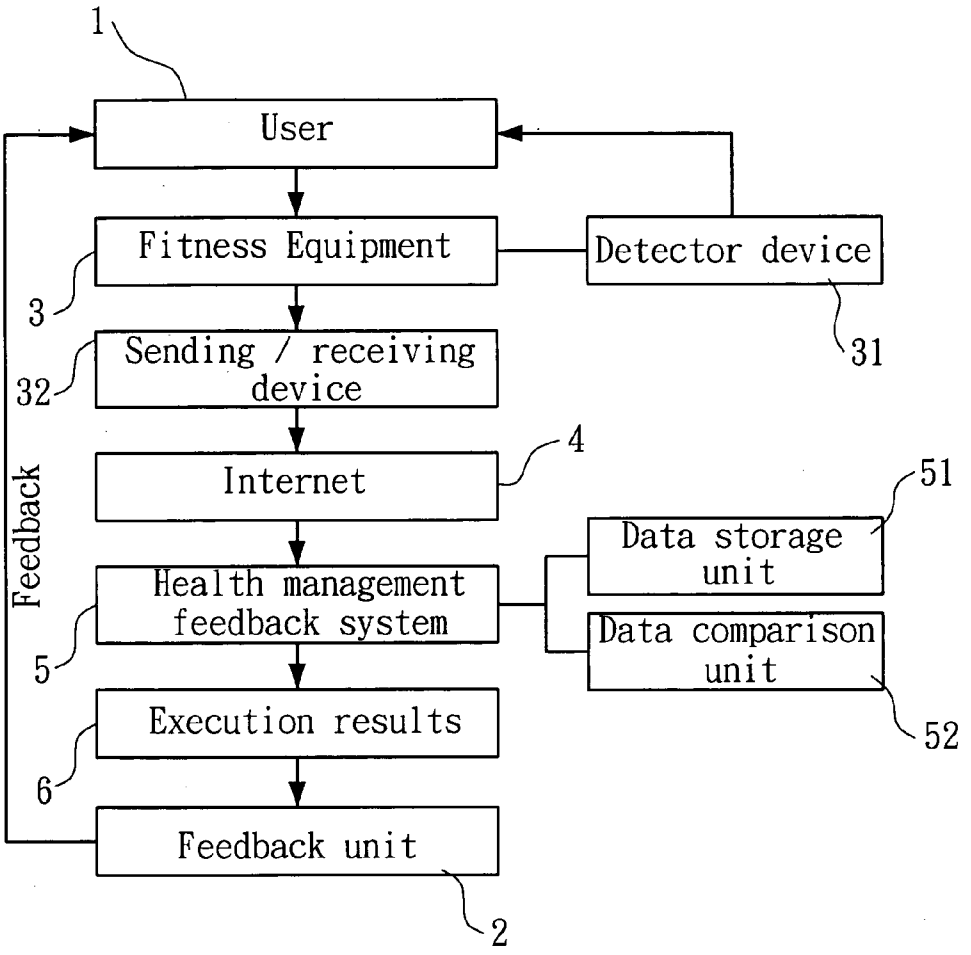

1
User
Fitness Equipment
Detector device
3
31
Sending / receiving device
32
Internet
4
51
Data storage unit
Feedback
Health management feedback system
Data comparison unit
5
52
Execution results
6
Feedback unit
2

FIG. 1

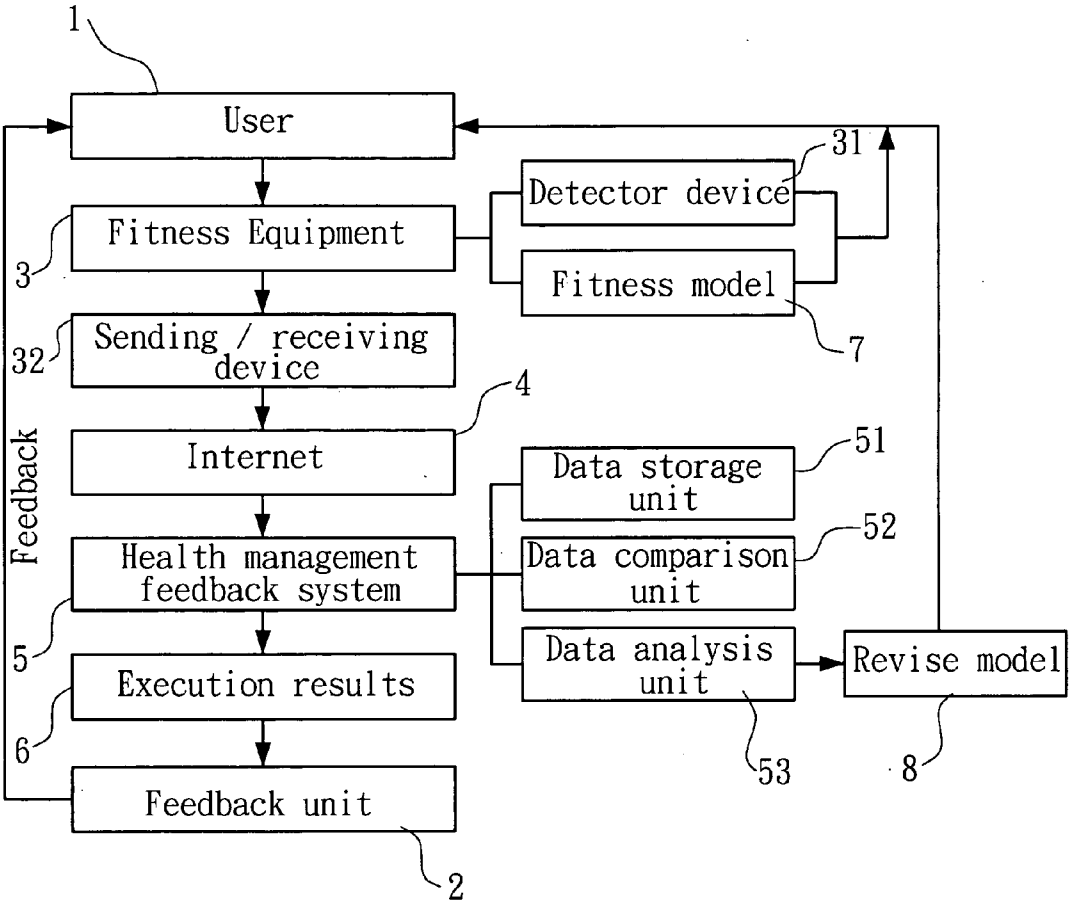

1
User
31
Detector device
Fitness Equipment
3
Fitness model
7
32
Sending / receiving device
4
Internet
51
Data storage unit
52
Data comparison unit
Feedback
Health management feedback system
5
Data analysis unit
Revise model
Execution results
6
53
8
Feedback unit
2

FIG. 2

HEALTH MANAGEMENT FEEDBACK METHOD USING FITNESS EQUIPMENTS

BACKGROUND OF THE INVENTION

[0001] (a) Field of the Invention

[0002] The invention is related to a health management feedback method using fitness equipments, more particularly to a health management feedback system to allow users to obtain feedback by using fitness equipments.

[0003] (b) Description of the Prior Art

[0004] As modern people are pursuing for body health, more and more people value the importance of exercises, and many people has the habits to use fitness equipments. However, it is often found that many people are unable to maintain using the fitness equipments persistently, i.e. users usually stop using the fitness equipments due to laziness or lack of time.

[0005] Regarding present market trend, there are many health management relevant institutions, wherein insurance companies are the most obvious. Usually, policyholder purchases insurance policy from the insurance company for basic insurance protection, however, the insurance premium is usually dependent on health conditions of the policyholder, and the insurance company pays insurance compensation to the policyholder only when conditions of the policyholder conform to the contents of insurance policy. Therefore, it is only a passive insurance for policyholder without more active benefits to the actual heath of policyholder.

[0006] Nevertheless, there are insurance companies who are cooperating with gym centers, wherein the policyholder goes to the gym center cooperated with the insurance company for exercise, and the gym center seals presence records as the proof to obtain insurance compensation feedback. Further, there are insurance companies who establish interactive platforms on the internet, wherein the policyholder signs in to the individually independent account and enters the website platform to input his/her basic physical data during exercise period, while the physical data before and after the exercise are compared as the proof for insurance compensation feedback.

[0007] For both methods of the above described cooperation between insurance company and gym center or the internet website platform established by insurance company to interact with policyholder, it is necessary to confirm policyholder's identification to prevent cheating, i.e. the policyholder may find somebody else for substitution to go gym center for exercise, or fake his/her basic physical data to obtain insurance compensation feedback.

[0008] Hence, how to solve above said problems is the main emphasis by the invention.

SUMMARY OF THE INVENTION

[0009] The main purpose of the invention is to disclose a health management feedback method using fitness equipments, wherein through the use of the fitness equipment matched with feedback plan by user and further through the integration by health management feedback system, when the execution result by user conforms to the one predefined by feedback unit, the seductive factor is realized by feedback unit to user, thereby to allow user not only to maintain a long term exercise habit, but also to obtain the feedback from the feedback unit, and the feedback plan objective of the feedback unit can also be achieved through the execution result by user **1**.

[0010] To achieve above purpose, the invention includes that a feedback unit proposes at least one seductive health management feedback plan for feedback to user and the health feedback plan having an fitness equipment to match with the predefined objectives of the health management feedback plan is through internet to be online with a health feedback system for realizing results of the predefined seductive factors predefined by the feedback unit, wherein the execution result by the user using the fitness equipment being confirmed for self-use by the anti-cheating mechanism of health management feedback system during the feedback plan period is transmitted back to the feedback unit through the health management feedback system after the feedback plan is completed, once execution result conforms to the one predefined by the feedback unit, the seductive factors are then realized by the feedback unit **2** through feedback to the resource obtained by user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a schematic view showing the feedback flow in the first embodiment of the invention.

[0012] FIG. **2** is a schematic view showing the feedback flow in the second embodiment of the invention.

DETAIL DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Referring to FIG. **1**, wherein a selected embodiment of the invention is shown for description only, and is not intended to limit the scope of patent application.

[0014] A health management feedback method by using fitness equipments is disclosed in the embodiment which comprises that: a feedback unit **2** proposes at least one seductive health management feedback plan for feedback to user **1** and the health feedback plan having an fitness equipment **3** to match with the predefined objectives of the health management feedback plan is through internet **4** to be online with a health management feedback system **5** for realizing results of the predefined seductive factors predefined by the feedback unit **2**, wherein, the execution result **6** by user **1** using fitness equipment **3** being confirmed for self-use by the anti-cheating mechanism of health management feedback system **5** during feedback plan period is transmitted back to feedback unit **2** through health management feedback system **5** after the feedback plan is completed, once execution result conforms to the one predefined by the feedback unit **2**, the seductive factors are then realized by feedback unit **2** through feedback to the resource obtained by user **1**.

[0015] In the embodiment, the fitness equipment **3** having a detector device **31** for detecting fitness data of user **1** during exercise is transmitted to health management feedback system **5** through a sending/receiving device **32** being online with internet **4**, wherein health management system **5** can be managed by a specially assigned company, and it can also be monitored by a software or the internet unquestionably. The system **5** includes a data storage unit **51** for storing fitness data of user **1**, and a data comparison unit **52** for comparing fitness data of user **1** and for matching with the anti-cheating mechanism, whereby fitness data of user **1** is stored and compared by the system **5** during feedback plan period to produce the execution result **6** after feedback plan period is over.

[0016] The fitness data of user **1** when using the fitness equipment for exercise is obtained and tracked by the health management feedback system **5** for comparison and analysis wherein the fitness data includes not only the basic physical data such as weight, oxygen level in the blood, heat beats, blood pressure, etc. detected by the fitness equipment **3**, but it also can be exercise parameters when the fitness equipment **3** is used by user **1** (such as running speed detected by a speed detector, running time detected by a timer, or running mileage detected by an odometer, etc. when a running machine is used by user **1**).

[0017] In case that the fitness data of user **1** in exercise is pulse, wherein each time the pulse of user **1** using the fitness equipment **3** being detected by detector device **31** to draw the pulse wave and being stored in data storage unit **51** is accessed by the anti-cheating mechanism of health management feedback system **5** for comparing with the pulse wave of user **1** through data comparison system **52**, thereby to confirm the self-use of user **1** with fitness equipment **3**.

[0018] Storage unit **51** setting value cannot be revised after initial setting is done. The sending/receiving device **32** is a computer system which is through a storage interface (such as USB disk or SD memory card, etc) to access fitness data of user **1** from fitness equipment **3** and save it back to the sending/receiving device **32** for transmission to health management feedback system **5** through internet **4** for analysis and comparison. Further, sending/receiving device **32** can be directly mounted in fitness equipment **3** and online with internet **4** to directly transmit fitness data of user **1** to health management feedback system **5** for analysis and comparison.

[0019] For instance, if feedback unit **2** is an insurance company for communication with health management feedback system **5** through internet **4**, the feedback plan is an insurance policy which is either a new one to be joined by user **1**, or an existing one for obtaining feedback, the resource obtained by insurance company is the insurance premium paid by user **1**, wherein the seductive factor proposed by insurance company is to provide a premium discount to user **1** when the execution result **6** defined by the feedback plan is reached by using fitness equipment **3**. If the feedback plan period is one year and fitness equipment **3** is an electrical running machine, pre-defined result of feedback unit **2** is that user **1** is required to maintain exercise in five days per week and minimum one hour per day within the one year period, wherein pulse of user **1** in exercise using fitness equipment **3** is detected by a detector device **31** installed thereon to obtain a pulse wave shape, whereby physical data of user **1** is further through sending/receiving device **32** to be directly or indirectly transmitted back to health management feedback system **5** through internet **4** for access by data storage unit **51** of system **5** to compare with the pulse wave shape of user **1** for self-use in the exercise. After the one-year feedback period is over, the execution result **6** of five days per week and minimum one hour per day exercise is transmitted back to feedback unit **2** through health management feedback system **5**, and if execution result **6** conform to the one predefined by feedback unit **2**, the feedback unit **2** then provide premium discount feedback to user **1** due to realization of the seductive factor. Regarding fitness equipment **3**, besides the electrical running machine used for exercise by user **1** in the embodiment, the fitness equipment can also be a detector for detecting the basic physical data of user **1** such as a pedometer, a blood pressure monitor, or a blood sugar machine, etc., wherein basic physical data of user **1** can be transmitted by a transmission interface (such as USB) to health management feedback system **5**.

[0020] Therefore, through the use of fitness equipment **3** matched with feedback plan by user **1** and further through the integration by health management feedback system **5**, when execution result **6** by user **1** conforms to the one predefined by feedback unit **2**, the seductive factor is realized by feedback unit **2** to user **1**, thereby to allow user **1** not only to maintain a long term exercise habit, but also to obtain the feedback from the feedback unit, and the feedback plan objective of the feedback unit can also be achieved through the execution result **6** by user **1**. Of course, as pulse of user **1** is confirmed by anti-cheating mechanism of the invention, the self-use of fitness equipment **3** by user **1** can be ensured to prevent any possibilities of faking identity of user **1** to obtain feedback.

[0021] Of course, there exist many examples of the invention with only detail variations. The second embodiment of the invention is shown in FIG. **2**, wherein health management feedback system **5** is further installed with a data analysis unit **53** for analyzing the fitness data of user **1** which is obtained by health management feedback system **5** to define a fitness model **7** on the fitness equipment **3**, so that physical data of user **1** under fitness model **7** is routinely tracked by health management feedback system **5** is compared and analyzed by health management feedback system **5** to produce execution result **6** after the feedback plan period is over.

[0022] The fitness model **7** is the setting model for fitness equipment use by user **1** defined at initial feedback period, such as the applicable parameters setting for the fitness equipment according to user's health condition in the initial use.

[0023] During the exercise period of user **1** under fitness model **7**, fitness data of user **1** in exercise is analyzed and compared by the health management feedback system **5** and is further routinely provided with a feedback by modification model **8**, wherein fitness data of user **1** in exercise is analyzed and compared with the predefined healthy physical data (analysis of physical data changes such as weight, oxygen level in blood, heart beat, blood pressure, etc.) through data analysis unit **53** and data comparison unit **52** to produce the routine modification model **8** thus allowing user **1** to modify the initial fitness mode **7** of fitness equipment **3** for advance use. Such as that fitness data of user **1** after exercise for three months shall be better than the initial one, therefore, the original fitness model **7** is revised to the more difficult modification model **8**. The modification model **8** is transmitted back to fitness equipment **3** through internet **4** to modify the initial fitness model **7**.

[0024] As can be seen in the embodiment, besides that long term exercise habits of user **1** in first embodiment can be achieved, it can also provide challenging or different degree of pleasure of user **1** in using fitness equipment **3** through the revision of fitness model **7** during feedback period.

[0025] Of course, feedback unit **2** referred by the invention is not limited to insurance company only, such as that it can be an fitness equipment supplier company for communication with health management feedback system **5** through internet **4**, wherein the resource obtained by fitness equipment supplier company is the price for user **1** to buy fitness equipment **3**, while the seductive factor of health management feedback plan proposed by fitness equipment supplier company is the feedback money given to user **1** when the execution result **6** defined by feedback plan is achieved by using fitness equipment **3**.

I claim:

1. A health management feedback method by using fitness equipments comprises that a feedback unit proposes at least one seductive health management feedback plan for feedback to user and the health feedback plan having an fitness equipment to match with the predefined objectives of health management feedback plan is through internet to be online with a health management feedback system for realizing results of the predefined seductive factors predefined by feedback unit, wherein, the execution result by user using fitness equipment being confirmed for self-use by the anti-cheating mechanism of health management feedback system during feedback plan period is transmitted back to feedback unit through health management feedback system after feedback plan is completed, once execution result conforms to the one predefined by feedback unit, the seductive factors are then realized by feedback unit through feedback to the resource obtained by user and the predefined objective of the feedback plan proposed by feedback unit is achieved through the execution result done by user.

2. The health management feedback method using fitness equipments as claimed in claim **1**, wherein fitness equipment has a detector device to obtain the physical data of user for transmission to the health management feedback system through a sending/receiving device online with internet, wherein health management feedback system further includes a storage unit for saving fitness data of user and a data comparison unit matched with anti-cheating mechanism for comparing fitness data of user, thereby fitness data of user is stored and compared during the feedback plan period to produce execution result after plan period is over.

3. The health management feedback method using fitness equipments as claimed in claim **2**, wherein fitness data is the detected basic physical data of user in using fitness equipment.

4. The health management feedback method using fitness equipments as claimed in claim **3**, wherein basic physical data of user in exercise is the pulse, wherein each time the pulse of user using fitness equipment being detected by detector device to draw the pulse wave and being stored in data storage unit is accessed by the anti-cheating mechanism of health management feedback system for comparing with the pulse wave of user through data comparison system, thereby to confirm the self-use of user with fitness equipment.

5. The health management feedback method using fitness equipments as claimed in claim **2**, wherein storage unit setting value cannot be revised after initial setting is done.

6. The health management feedback method using fitness equipments as claimed in claim **1**, wherein fitness data of user is obtained by health management feedback system, and physical data of user in exercise is tracked, compared and analyzed by health management feedback system to produce execution result after the feedback plan period is over.

7. The health management feedback method using fitness equipments as claimed in claim **1**, wherein fitness equipment having a detector device for detecting fitness data of user during exercise is transmitted to health management feedback system through a sending/receiving device being online with internet, health management feedback system further includes a data storage unit for storing fitness data of user, and a data comparison unit for comparing fitness data of user and for matching with the anti-cheating mechanism, as well as a data analysis unit for analyzing fitness data of user, whereby fitness data of user is stored, compared and analyzed by system during feedback plan period to produce execution result after feedback plan period is over.

8. The health management feedback method using fitness equipments as claimed in claim **7**, wherein basic physical data of user in exercise is the pulse, wherein each time the pulse of user using fitness equipment being detected by detector device to draw the pulse wave and being stored in data storage unit is accessed by the anti-cheating mechanism of health management feedback system for comparing with the pulse wave of user through data comparison system, thereby to confirm the self-use of user with fitness equipment.

9. The health management feedback method using fitness equipments as claimed in claim **7**, wherein storage unit setting value can not be revised after initial setting is done.

10. The health management feedback method using fitness equipments as claimed in claim **7**, wherein fitness data of user is obtained by health management feedback system to define a fitness model for exercise of user on fitness equipment, and physical data of user in exercise under fitness model is routinely tracked, compared and analyzed by health management feedback system to produce execution result after the feedback plan period is over.

11. The health management feedback method using fitness equipments as claimed in claim **10**, wherein fitness model is the initial setting model for fitness equipment use by user, while fitness data of user in exercise is analyzed and compared with predefined healthy physical data by health management feedback system to routinely produce a short time modification model during feedback plan period for modifying the initial fitness model of fitness equipment thereby allowing user to exercise under the modified model.

12. The health management feedback method using fitness equipments as claimed in claim **11**, modification model is transmitted by health management feedback system back to fitness equipment through internet to modify the initial fitness model.

13. The health management feedback method using fitness equipments as claimed in claim **7**, wherein fitness data of user is analyzed and compared with predefined healthy physical data through data analysis unit and data comparison unit to produce the routine modification model for advance use of user on fitness equipment.

14. The health management feedback method using fitness equipments as claimed in claim **1**, wherein feedback unit is an insurance company, and feedback plan is an insurance policy which is either a new one to be joined by user, or an existing one for obtaining feedback, while resource obtained by insurance company is the insurance premium paid by user, the seductive factor proposed by insurance company is to provide a premium discount to user when the execution result defined by feedback plan is reached by using fitness equipment.

15. The health management feedback method using fitness equipments as claimed in claim **1**, wherein execution result by user is transmitted by health management feedback system to the feedback unit through internet.

* * * * *

APPENDIX K

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(19) **United States**

(12) **Patent Application Publication**

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(43) **Pub. Date: Apr. 7, 2011**

(54) **EXERCISE COMMUNITY SYSTEM**

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Publication Classification

(51) **Int. Cl.**
A63B 71/00 (2006.01)

(52) **U.S. Cl.** **482/8**

(57) **ABSTRACT**

An exercise system provides incentives for individuals by providing either a collective exercise goal or a sponsored exercise reward.

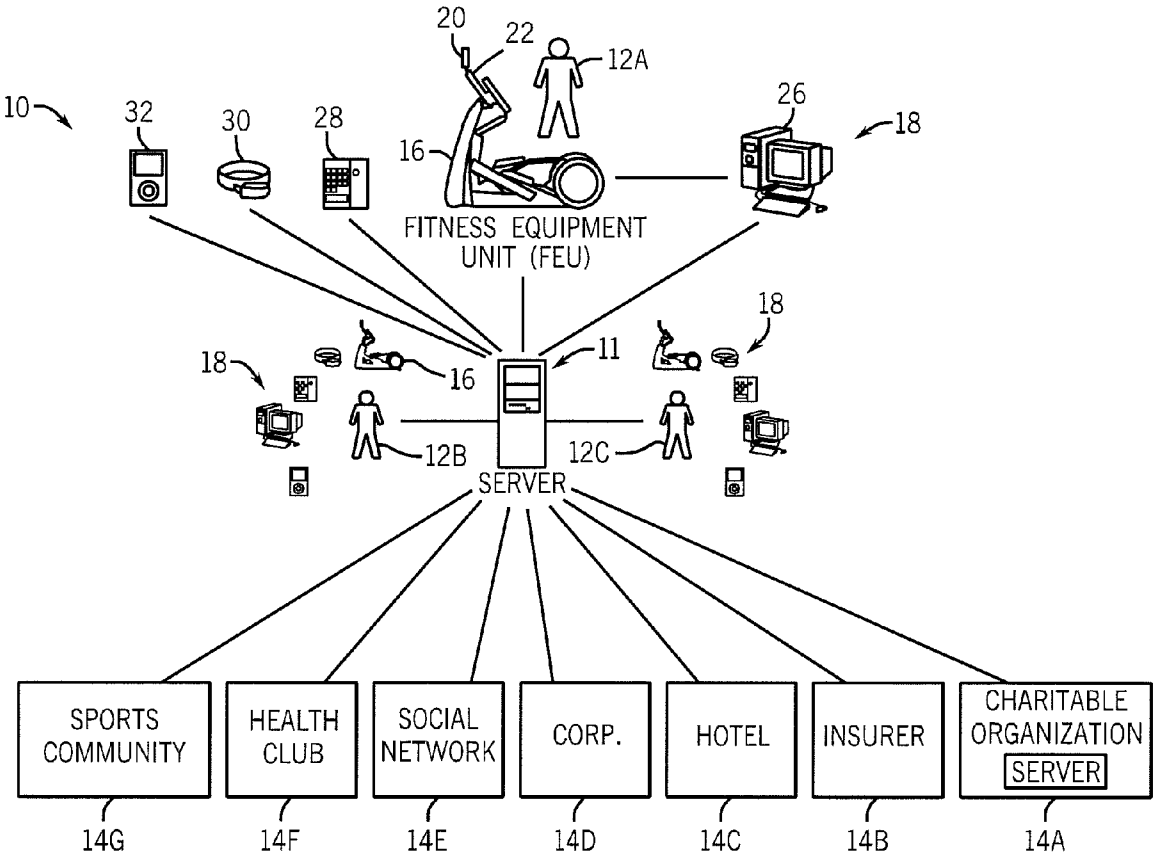
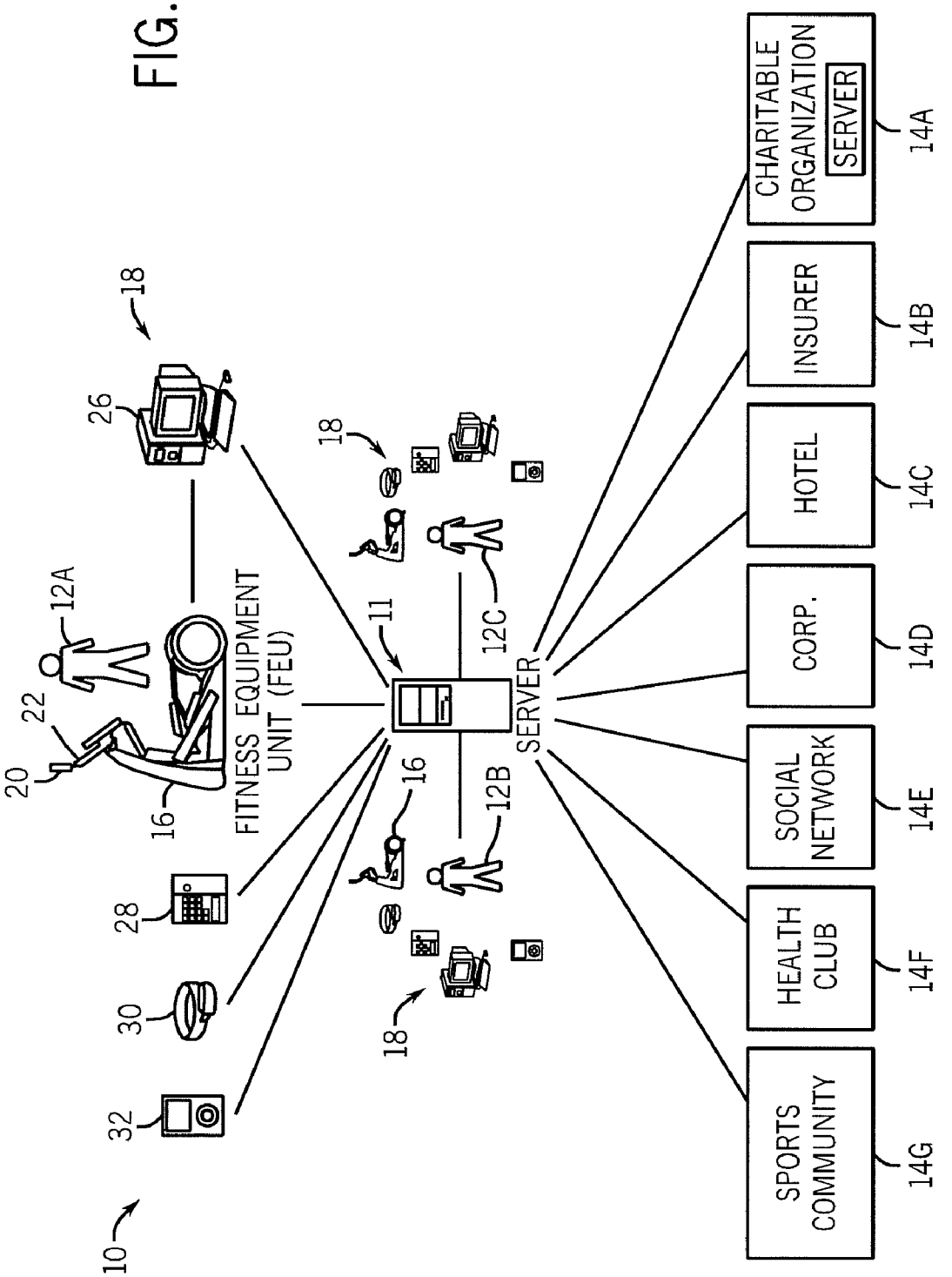


FIG. 1


10
32
30
28
16
20
22
12A
FITNESS EQUIPMENT UNIT (FEU)
26
18
11
SERVER
12C
12B
16
18
18
CHARITABLE ORGANIZATION SERVER
14A
INSURER
14B
HOTEL
14C
CORP.
14D
SOCIAL NETWORK
14E
HEALTH CLUB
14F
SPORTS COMMUNITY
14G

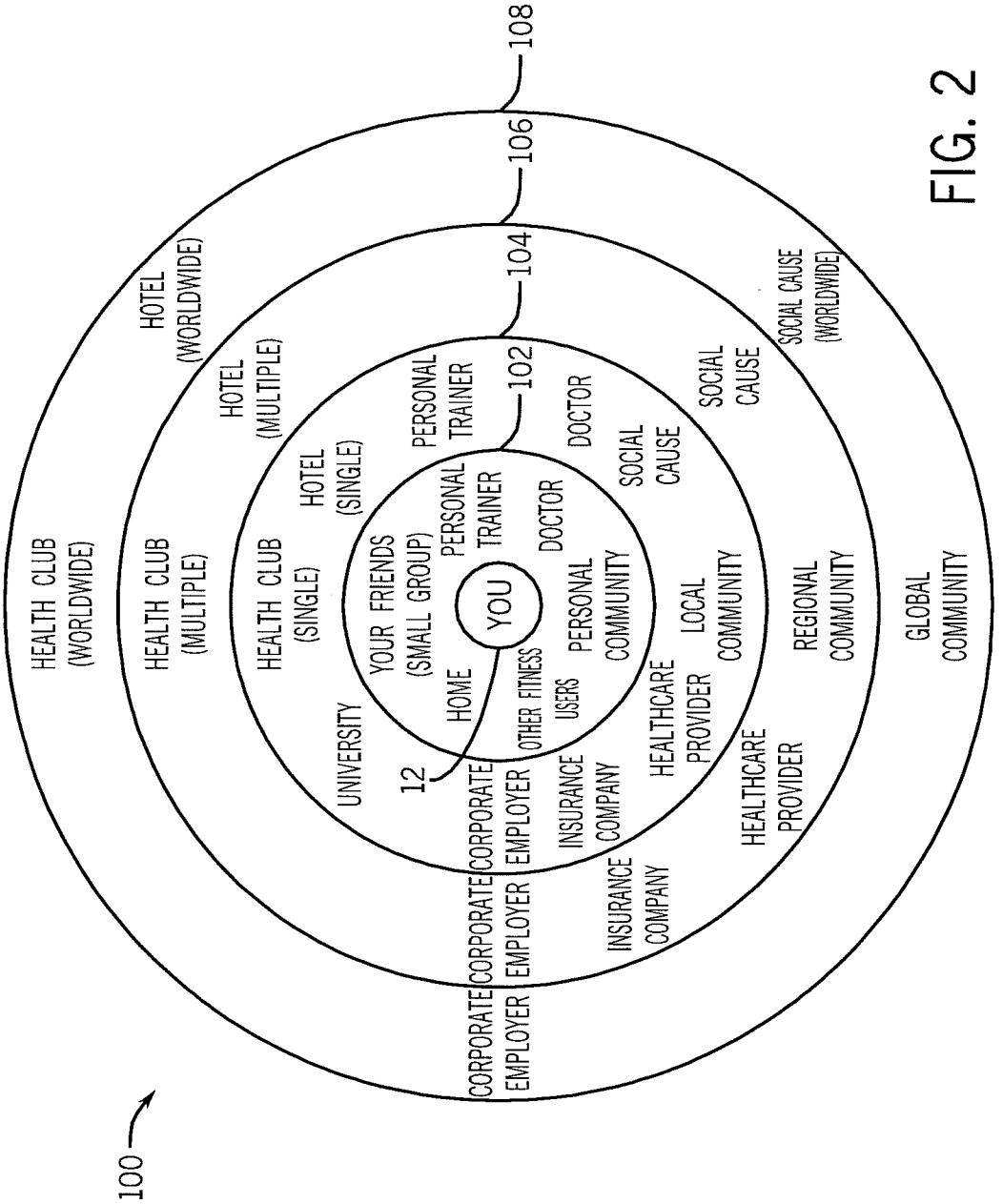

100
108
106
104
102
12
YOU
HOME
OTHER FITNESS USERS
PERSONAL COMMUNITY
YOUR FRIENDS (SMALL GROUP)
PERSONAL TRAINER
DOCTOR
SOCIAL CAUSE
UNIVERSITY
HEALTH CLUB (SINGLE)
HOTEL (SINGLE)
CORPORATE EMPLOYER
INSURANCE COMPANY
HEALTHCARE PROVIDER
LOCAL COMMUNITY
HOTEL (MULTIPLE)
HEALTH CLUB (MULTIPLE)
REGIONAL COMMUNITY
HOTEL (WORLDWIDE)
HEALTH CLUB (WORLDWIDE)
GLOBAL COMMUNITY
SOCIAL CAUSE (WORLDWIDE)

FIG. 2

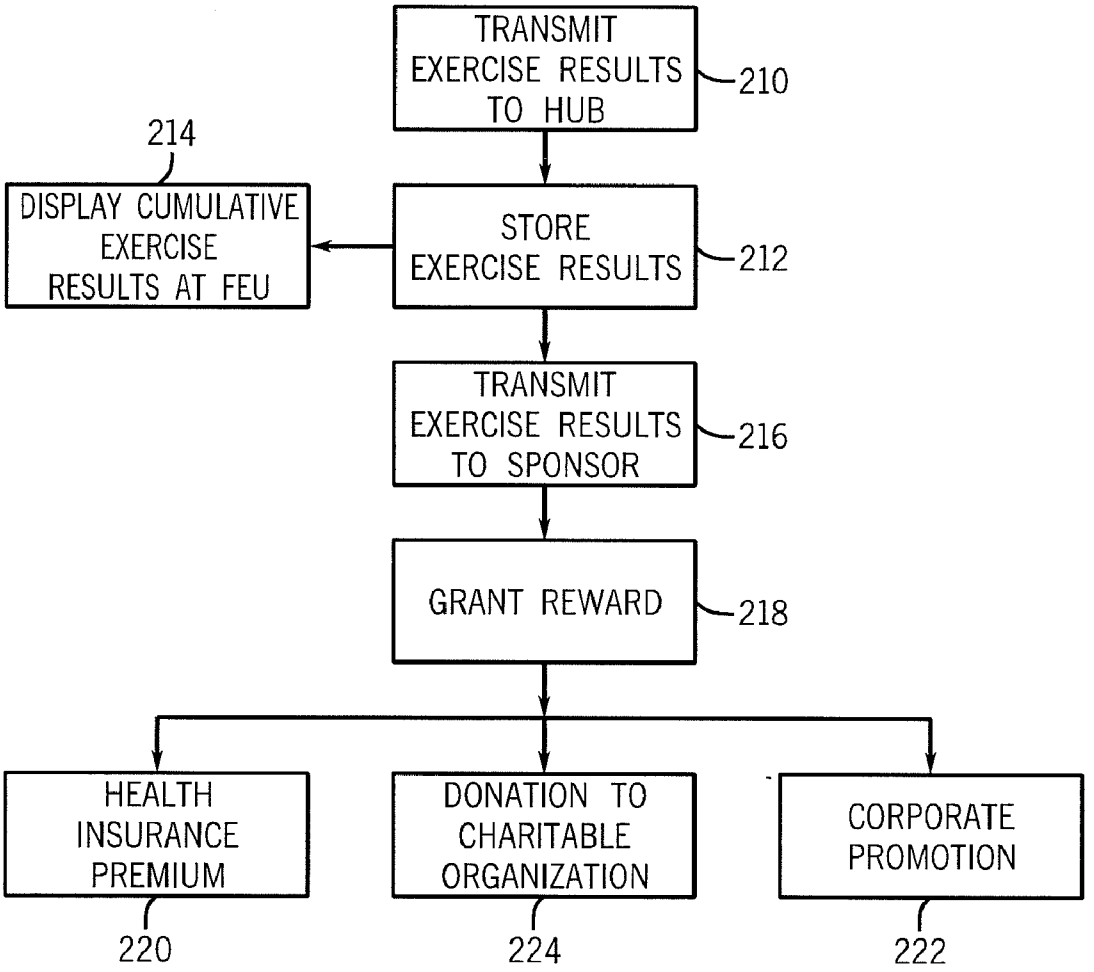

TRANSMIT EXERCISE RESULTS TO HUB
210
214
DISPLAY CUMULATIVE EXERCISE RESULTS AT FEU
STORE EXERCISE RESULTS
212
TRANSMIT EXERCISE RESULTS TO SPONSOR
216
GRANT REWARD
218
HEALTH INSURANCE PREMIUM
220
DONATION TO CHARITABLE ORGANIZATION
224
CORPORATE PROMOTION
222

FIG. 3

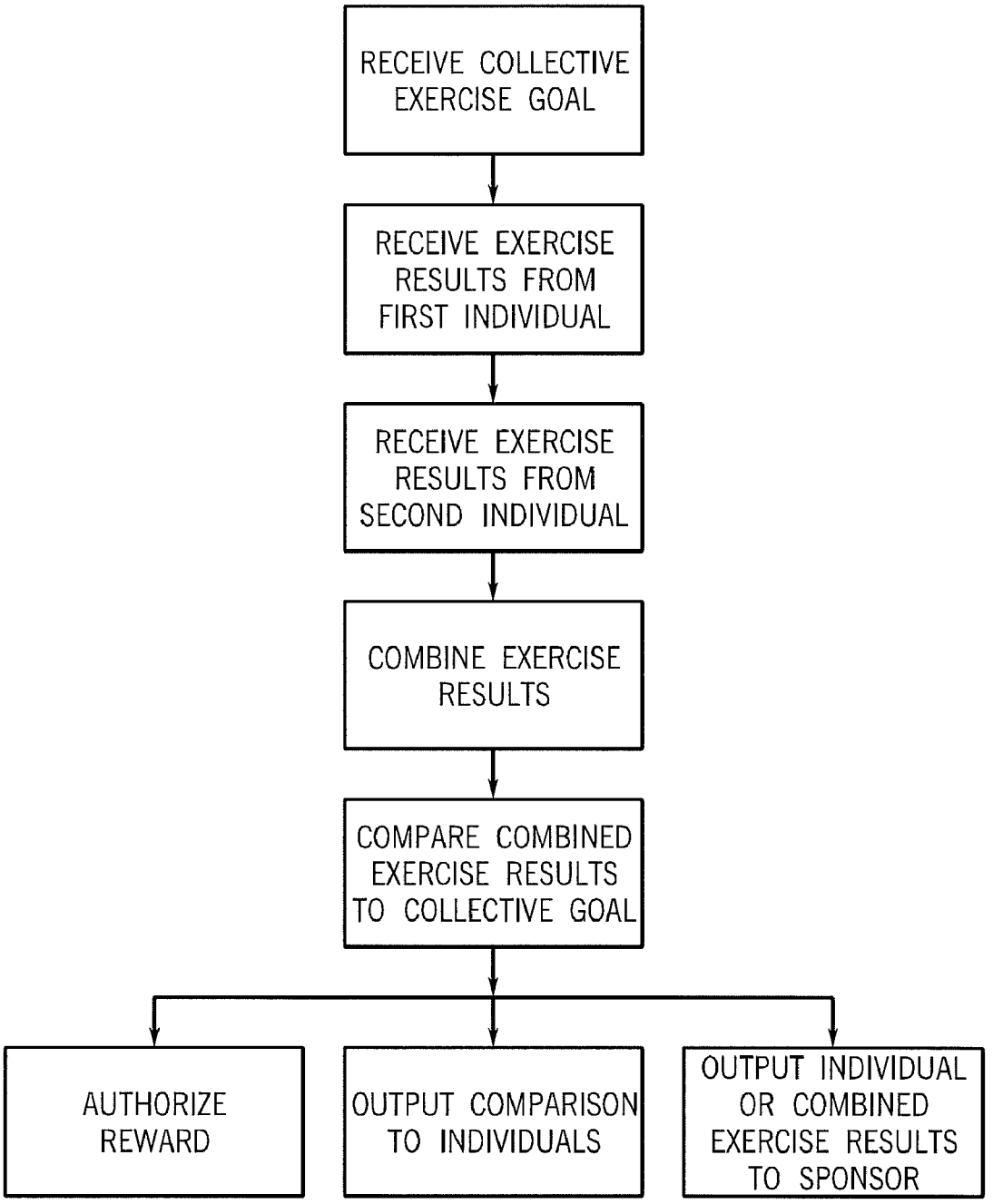

RECEIVE COLLECTIVE EXERCISE GOAL
RECEIVE EXERCISE RESULTS FROM FIRST INDIVIDUAL
RECEIVE EXERCISE RESULTS FROM SECOND INDIVIDUAL
COMBINE EXERCISE RESULTS
COMPARE COMBINED EXERCISE RESULTS TO COLLECTIVE GOAL
AUTHORIZE REWARD
OUTPUT COMPARISON TO INDIVIDUALS
OUTPUT INDIVIDUAL OR COMBINED EXERCISE RESULTS TO SPONSOR

FIG. 4

EXERCISE COMMUNITY SYSTEM

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] The present application is related to co-pending application Ser. No. _____ filed on the same date herewith by David E. Dyer, James S. Birrell, Brady A. Olason, Brian D. Wilson, David W. Flynt, and Autumn L. Stroupe and entitled EXERCISE GUIDANCE SYSTEM, the full disclosure of which is hereby incorporated by reference.

BACKGROUND

[0002] Exercising is largely an individualistic activity. Due to the lack of community, a person exercising may lack sufficient encouragement or motivation to maintain a disciplined exercise regimen or to achieve his or her health objectives.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. **1** is a schematic illustration of an exercise community system according to an example embodiment.

[0004] FIG. **2** is a schematic diagram of a community that may be established as part of a profile used in the system of FIG. **1**.

[0005] FIG. **3** is a flow diagram of a method that may be carried out by the system of FIG. **1** for providing exercise motivation.

[0006] FIG. **3** is a flow diagram of another method that may be carried out by the system of FIG. **1** for providing exercise motivation.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

[0007] FIG. **1** schematically illustrates an exercise community system **10** according to an example embodiment. Exercise community system **10** comprises a communications hub **11** of one of more servers interconnecting multiple individuals **12**A, **12**B and **12**C (collectively referred to as individuals **12**) to one another and to one or more third-party content and motivational sources or providers **14**A-**14**G (collectively referred to as source providers **14**). As will be described hereafter, exercise community system **10** provides a sense of community to persons who are exercising and provides a source of motivation to assist in the maintenance of a disciplined exercise regimen. In particular, system **10** delivers three motivational aspects: sharing, belonging and competition.

[0008] As shown by FIG. **1**, each individual **12** has an associated exercise device or fitness equipment unit (FEU) **16** and one or more communication peripherals **18**. In the example illustrated, FEU **16** is illustrated as an elliptical exercise device. In other embodiments, FEU **16** may comprise other exercise devices such as a treadmill, a stair-stepper, or other high or low impact cardio trainers or strength training equipment. FEU **16** is configured to receive force or motion from a person exercising. FEU **16** is further configured to provide a controlled and potentially adjustable resistance to the motion or force received from a person exercising such that the intensity of a workout may be adapted to the needs of the individual.

[0009] FEU **16** additionally includes a display **20** and an input **22** by which individual **12** may interact with FEU **16**. In particular, display **20** provides individual **12** with feedback as well as exercising suggestions. In one embodiment, display **20** comprises a display screen. In another embodiment, display **20** comprises one or more light emitting diodes. In still other embodiments, display **20** may provide auditory feedback. In particular embodiments, display **20** may include more than one display component types.

[0010] Input **22** facilitates the input of commands, data or requests to FEU **16**. Input **22** may comprise a touchpad, a touch screen (potentially incorporated as part of display **20**), a keyboard, push buttons, toggle switches, slider bars and the like. In some embodiments, input **22** may comprise a microphone and associated speech recognition software. Input **22** permits an individual identify himself or herself, to provide input regarding his or her health or fitness attributes, to select or adjust exercise routines and to communicate with other individuals **12** or 3rd organizational entities.

[0011] Although FEU **16** is illustrated as being associated with individual **12**, FEU **16** need not necessarily be owned by individual **12**. For purposes of this disclosure, with respect to FEU's **16**, the term "associated" means that any moment in time, a particular individual **12** is exercising using FEU **16** and is providing or receiving information via hub **11**. An individual may associate himself or herself with an FEU **16** by signing in or logging into system **10** and hub **11** while on a particular exercise device or FEU **16**. In some circumstances, FEU **16** may be located in a gym, hotel, or health or fitness club. In other circumstances, FEU **16** may be located in a person's office, home or other personal non-public location. Regardless of where situated, once connected to hub **11**, FEU **16** is configured to communicate with other FEU's **16**, with communication peripherals **18** of other individuals as well as with motivational providers **14** via hub **11**.

[0012] Communication peripherals **18** comprise devices configured to receive and potentially transmit data using hub **11**. Peripherals **18** may have a variety of sizes, shapes and configurations. FIG. **1** illustrates various example communication peripherals that may be used by an individual **12** when not exercising. Such examples include, but are not limited to, laptop or desktop computers **26**, cell phones **28**, personal training devices wearables **30** (such as wrist mounted personal trainers, wrist mounted computers or wrist mounted watches) and personal data assistants (PDA's) **32**. Communication devices may include displays by which exercise data or exercise routines may be presented to an individual **12** when not exercising for evaluation, selection or adjustment.

[0013] Hub **11** interconnects each of multiple individuals **12** with one another and with other third parties, such as motivational sources **14**. In one embodiment, hub **11** comprises one or more servers configured to communicate via a local network or a larger network such as the internet. Hub **11** operates according to one or more sets of instructions contained in software code, integrated circuits or other computer-readable programs or medium stored in some form persistent memory or embodied as a circuit. Hub **11** allows an individual **12** to communicate with other individuals **12** and with third parties when exercising on FEU **16** or while using one of his or her communication peripherals **18**. FEU **16** or communication peripherals **18** not only communicate with hub **11** but may also upload information to or download information from hub **11**. Examples of data or information that may be communicated include, but is not limited to, workout information, media, advertisements and the like. As a result, hub **11** provides a person exercising with a greater sense of community.

[0014] FIG. **2** is a schematic diagram illustrating one example set of "circles" or "rings" constituting an example community **100** to which an individual **12** may belong. In the example illustrated, community **100** includes four levels or rings of relationships: a personal community ring **102**, a local community ring **104**, a regional community ring **106** and a global community ring **108**. In the example illustrated, the personal community ring **102** includes friends of the individual **12**, his or her home or family, his or her personal trainer, personal doctor and civic other fitness users which may have the same interests or associations.

[0015] The local community ring **104** includes such entities as social causes, doctors, personal trainers, single hotels, single health clubs, universities, corporate employers, insurance companies and healthcare providers. The regional community ring **106** may include a social cause, multiple hotels or groups of hotels, multiple health clubs or groups of health clubs, a corporate employer, an insurance company, and a healthcare provider. The global community ring **108** may also include social causes, worldwide hotels, worldwide health clubs and corporate employers. What particular entities are located within each of rings **102-104** is determined by the individual **12**. It should be understood that the illustrated community **100** is one example of such a community. A particular individual's community may have a greater or fewer number of circles or levels and the number of entities within each community may be varied.

[0016] In the example illustrated, hub **11** is configured to prompt the individual **12** to create or establish a personal profile. In particular, the individual **12** is prompted to input (using an input **22** of FEU **16** or any input of peripherals **18**) those entities that the person desires to be within each of the aforementioned rings. Each level or ring may be assigned with different levels of security and access to information from the individual **12**. For example, those entities located in the innermost or intimate personal community ring **102** may have access to a first degree or amount of personal information of individual **12**. Those entities located in or assigned ito more outer rings may have access to more defined areas of information. In one embodiment, a profile may be created by hub **11** which provides a doctor or personal trainer with up-to-date exercise parameters or fitness indicators as sensed by FEU **16** during exercise such as weight, heart rate, exercise routine, exercise frequency, time and dates of exercise and even fitness or exercise goals or objectives. The same profile for individual **12** may provide access to a lesser extent of infoimation to those individuals located in more outer rings. As a result, individuals can choose to extend their reach and visibility to the community **100** to ever larger circles or rings as they deem relevant.

[0017] In one embodiment, hub **11** may further be configured to utilize the created profile to automatically download or access information from different entities located in different levels or rings. For example, in one embodiment, the profile may be created such that hub **11** automatically downloads information from a personal trainer or doctor assigned to personal community ring **102**. At the same time, the profile may require hub **11** to request confirmation before downloading data or information from those entities in more outer rings. With such a profile, individual **12** may define the inflow and outflow of information to reduce information overload or clutter and to identify and gather information most relevant or important to the individual **12**. In a similar fashion, other individuals **12** may establish profiles including the individual **12** in their inner rings of community **100**.

[0018] In one embodiment, hub **11** may be configured to automatically notify other individuals **12** that the individual **12** is exercising at any moment in time. For example, profile may be set up such that selected friends are automatically notified when an individual **12** begins exercising on any FEU **16** connected to hub **11**. Such notifications may be reciprocal. As a result, while the individual **12** is exercising, he or she may be informed of other individuals **12** in his or her community **100** who are also exercising at the same time. As a result, the individual **12** may not feel as alone when he or she is exercising. Consequently, system **10** provides those individuals **12** or exercising with a sense of sharing and belonging.

[0019] In particular embodiments, hub **11** may additionally provide other individuals **12** in selected rings of a person's community **100** with access to or additional information regarding the exercise being performed by the individual **12** or metrics of each other's workout. For example, a group of individuals **12** may be simultaneously alerted as to each other's levels of performance, workout intensity, type of workout and goals. In effect, hub **11** simulates an environment where multiple individuals **12** who are friends or associates effectively workout or exercise together as exercise or workout "partners." Such workout partners may see each other's progress so that they may provide or offer encouragement and accountability to one another. As exercise partners, individuals may also share content and media between one another as well as messages. For example, one individual may recommend an exercise or course to another individual **12**.

[0020] In some circumstances, hub **11** may facilitate competitions between such workout partners. Examples of competitions that may be facilitated by hub **11** include, but not limited to, challenges regarding fitness goals, exercise intensity, weight loss, workout frequency and the like. In some embodiments, hub **11** may facilitate the establishment of shared exercise or fitness goals amongst multiple individuals **12**.

[0021] In the example illustrated, hub **11** is further configured to store exercise or workout results from individual **12**. Hub **11** may further be configured to provide the stored exercise results to other individuals **12** within designated community rings (as established by the profile) at other times when a particular individual **12** is not exercising. As a result, the benefits of sharing and community between different individuals **12** during exercise may be achieved even when the individuals do not exercise at the same time. Because the exercise results are stored by hub **11**, such competitions may be based upon long-term exercise objectives or results extended over multiple workout sessions.

[0022] For example, in one embodiment, hub **11** is configured to store and collect a collective exercise goal of a plurality of individuals who exercise. Hub **11** communicates with each of FEU **16** used at different times by the individuals **12** and receives exercise results from FEU **16**. Hub **11** further compares the received exercise results to the collective exercise goal. After the exercise results of different individuals **12** are combined or otherwise aggregated, and compared to the collective excise goal, the comparison results are provided to each of the individual exercisers via display **20** or displays associated with peripherals **18**. Such comparison results may be transmitted via e-mails or may be made available on a website that is available to each of the individuals **12**.

[0023] In addition to facilitating sharing, belonging and competition amongst individuals **12** who share the common interest or objective of fitness, hub **11** further facilitates the sharing of such information with third party entities **14**. As shown in FIG. **1**, examples of third-party entities include, but are not limited to, charitable organizations **14**A, insurers **14**B, hotels **14**C, corporations **14**D, social networks **14**E, health clubs **14**F and sports communities **14**G. Each of such third-party entities may provide an individual **12** who is exercising with additional sources of motivation facilitated by hub **11** of system **10**.

[0024] FIG. **3** is a flow diagram illustrating one method **200** by which additional motivation may be provided to those individuals **12** exercising or who are partaking in an exercise regime facilitated by hub **11**. As shown by step **210**, upon completion of an exercise workout by an individual **12**, his or her exercise results are transmitted by FEU **16** to hub **11**. The transmittal of the exercise results may be done in a wired fashion or wirelessly via an internet connection or other communication mode. In some embodiments, the collection of exercise results by the web server of hub **11** may be automatic and may be initiated upon the beginning of a workout. In other embodiments, the individual **12** may connect to hub **11** and transmit the exercise results to hub **11**. In some embodiments, the collection of exercise results may be automatic or may merely require a confirmation depending upon the profile of the individual.

[0025] As indicated by step **212**, hub **11** stores the exercises results in a persistent storage device or memory. As indicated by step **214**, the received exercise results as well as the accumulated exercise results may additionally be displayed to the individual at display **20** of FEU **16** while the person is exercising on FEU **16** or after the individual has just completed exercising on FEU **16**. Alternatively, the exercise results may be displayed on one or more of peripherals **18** connected to hub **11**. Examples of exercise results that may be received, stored and displayed include, but are not limited to, distances covered during one more workouts, heart rates achieved during what are more workouts, workout intensity, workout duration, workout frequency and the like.

[0026] As indicated by step **216**, hub **11** further transmits the exercise results to one or more exercise sponsors such as one of more third-party entities **14** shown in FIG. **1**. As indicated by step **218**, upon a predefined fitness, exercise or workout objective or goal being satisfied, the one or more sponsors may grant a reward to or on behalf of the individual **12** who has satisfied the goal. For example, as indicated by step **220**, in one embodiment, the reward granted in step **218** may comprise a health insurance premium adjustment or reduction. Health insurance companies or healthcare providers **14**B may desire to offer incentives for those insureds that exercise or maintain a certain fitness level. System **10** and hub **11** facilitate the collection of exercise results or exercise data by the health insurance providers or healthcare providers, allowing confirmation of such fitness objective being met. At the same time, the health insurance provider **14**B may communicate back to the person or individual **12** exercising during this exercise so as to encourage individual while he or she is exercising. In one embodiment, the exercise results may be directly communicated to the health insurance provider. In another embodiment, the health insurance provider may provide **11** with fitness objectives or standards that must be met before a reward may be authorized, wherein hub **11** simply notifies a health insurance provider when the objective has been met and authorizes granting of the reward.

[0027] As indicated by step **222**, in one embodiment, the reward granted may be a corporate promotion. Certain companies or corporations may desire to reward those who maintain a certain level of fitness. Some companies that manufacture, sell or service fitness equipment, health drinks, health food and the like may desire to reward those individuals **12** who exercise or who use their products. System **10** and hub **11** facilitate the collection of exercise results or exercise data by the health insurance providers or healthcare providers, allowing confirmation of such fitness objective being met. At the same time, the corporate sponsor **14**D may communicate to the person or individual **12** who is exercising so as to encourage the individual while he or she is exercising. In one embodiment, the excise results may be directly communicated to the corporate sponsor. In another embodiment, the corporate sponsor provider may provide hub **11** with fitness objectives or standards that must be met before a reward may be authorized, wherein hub **11** simply notifies the corporate sponsor when the objective has been met and authorizes granting of the reward.

[0028] As indicated by step **222**, in one embodiment, the reward granted may be a donation to a charitable organization on behalf of the individual **12**. In a fashion similar to a walkathon or other charitable event, individuals may collect donations to a charitable cause or charitable organization based upon certain fitness objectives or workout goals being met or based in a pro rata manner upon some exercise metric. For example, donations to a charitable organization may be made based upon the number of miles or number of hours that a person exercises on a treadmill, elliptical machine or the like. System **10** and hub **11** facilitate the collection of exercise results or exercise data by the charitable organization running the charitable event or the donors themselves, allowing confirmation of such fitness objective being met or the metric results of exercise. At the same time, the charitable donors may receive notification of when the individual **12** if working out or exercising for the charitable cause on their peripheral devices **18**. As a result, the charitable donors may communicate to the person or individual **12** who is exercising so as to encourage the individual while he or she is exercising. In one embodiment, the exercise results may be directly communicated to the charitable organization **14**A (to one or more servers of the charitable organization **14**B. As a result, system **10** and hub **11** provide exercise motivation to an individual **12** while also promoting various charitable causes.

[0029] In other embodiments, hub **11** of system **10** may motivate individual **12** exercising by offering rewards from other sponsors such as hotels **14**C, social networks **14**E, the health clubs themselves **14**F or sports communities **14**G. Such sponsors may offer rewards directly to the individual exercising or may offer donations or contributions on behalf of the individual **12** exercising. Examples of social networks include, but are not limited to, FACEBOOK and TWITTER. Examples of sports communities include support organizations such as US Track and Field (USTAF), NIKEPLUS and others.

[0030] In addition to providing rewards and exercise motivation on individual basis, system **10** and hub **11** further provide boards and exercise motivation on a group level, once again facilitating a sense of sharing and belonging to those individuals exercising. FIG. **4** is a flow diagram of a method **300** for providing motivational assistance at a group level. As

indicated by step **310**, hub **11** initially receives or collects exercise goal from two or more individuals **12** via either input **22** or inputs associated with peripherals **18**. This collective exercise goal is stored and associate with each of the individuals **12**. Examples of such a collective exercise goal include a sum of exercise results from multiple individuals **12** or an average, median or other statistic derived from the exercise results of multiple individuals **12** or exercising. In one embodiment, the collective exercise goal is based upon excise metrics from a same type of FEU **16** in communication with hub **11**. In another embodiment, the collective exercise goal may be associated with multiple different types of FEUs **16**. For example, the click of exercise goal may involve exercise on both treadmills and elliptical machines. In one embodiment, hub **11** adjusts or modifies exercise results or handicaps certain excise results to establish a uniform standard amongst different types of exercise devices or FEUs.

[0031] As indicated by steps **312** and **314**, hub **11** receives (or collects) exercise results from each of the individuals **12** while they are exercising, upon completion of their workout or upon the uploading of exercise results from each of individuals **12** from intermediate peripherals **18** which have temporally stored the exercise results. As indicated by step **316**, hub **11** combines or otherwise aggregates the exercise results of the multiple individuals **12**. In one embodiment, hub **11** adjusts or modifies exercise results or handicaps certain exercise results to establish a uniform standard amongst different types of exercise devices or FEUs.

[0032] As indicated by step **318**, hub **11** compares the collective exercise goal (received or established in step **310**) to the combined or otherwise aggregated exercise results from multiple individuals **12**. This comparison yields a comparison result. As indicated by step **320**, the results of this comparison are output to one or more the individuals **12**. As a result, they want a more individuals **12** may see how they contribute towards the overall collective goal and how individuals **12**, as a group, or moving towards the collective goal. In one embodiment, the comparison results may be presented numerically or graphically, such as with a bar graph, pie chart and the like graphically illustrating the collective goal being met. In one embodiment, the comparison result may be outputted tricky to the exercise machines or FEUs **16** as movement towards the collective goal is achieved, providing the person exercising with motivation during exercise.

[0033] As indicated by steps **322** and **324**, the collective goals established in step **310** may also be awarded in a manner similar to the individual motivating towards described above. For example, a third-party entity such as a charitable organization, an insurance company, corporate sponsor and the like may establish a collective goal (in place of the goal input in step **310**) for a group of multiple individuals **12**. Upon the collective goal being met, each of the individuals **12** may receive an individual reward (such as a health care insurance premium reduction, frequent flyer miles or other product bonus or cost reduction). In other embodiments, the group of individuals **12** may receive a donation or cost reduction for their particular organization or group. Still another embodiment, a charitable donation a made on behalf of the group of individuals to a charitable cause our charitable organization. The reward may be authorized by hub **11** as indicated in step **324** or the individual or aggregated exercise results may be directly forwarded by hub **11** to one or more third-party reward sponsors.

[0034] Overall, system **10** and hub **11** provide a network by which individuals **12** who exercise may communicate with other individuals who exercise and may also communicate with third-party entities interested in promoting such exercise. System **10** and hub **11** facilitate a sense of sharing, belonging and competition. System **10** and hub **11** promote more disciplined workout regimens and benefit worthy charitable causes.

[0035] Although the present disclosure has been described with reference to example embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the claimed subject matter. For example, although different example embodiments may have been described as including one or more features providing one or more benefits, it is contemplated that the described features may be interchanged with one another or alternatively be combined with one another in the described example embodiments or in other alternative embodiments. Because the technology of the present disclosure is relatively complex, not all changes in the technology are foreseeable. The present disclosure described with reference to the example embodiments and set forth in the following claims is manifestly intended to be as broad as possible. For example, unless specifically otherwise noted, the claims reciting a single particular element also encompass a plurality of such particular elements.

1. An exercise system comprising:

a plurality of exercise devices, wherein the exercise devices are configured to sense and transmit exercise results;

at least one server storing a collective exercise goal of a plurality of individuals, the least one server in communication with a plurality of exercise devices so as to receive the exercise results and to compare the exercise results to the collective exercise goal, wherein the least one server provides comparison results to the individuals, wherein the at least one server is of a manufacturer of the plurality of exercise devices and wherein the system further comprises at least one second server of an exercise reward sponsor, wherein the least one second server receives the exercise results from the at least one first server.

2. The exercise system of claim **1**, wherein the at least one server authorizes a reward in response to the collective exercise goal being met.

3. The exercise system of claim **2**, wherein the reward comprises a donation to a charitable organization.

4. The exercise system of claim **3**, wherein the donation is pro-rata based upon a value of the exercise result.

5. The exercise system of claim **1**, wherein the reward comprises a health insurance premium reduction for one or more of the individuals.

6. The exercise system of claim **1**, wherein the plurality of exercise devices includes at least one elliptical exercise device.

7. (canceled)

8. The exercise system of claim **2**, wherein the plurality of exercise devices each includes a display and wherein the at least one server or the at least one second server is configured to transmit current and total accumulated levels of current donations to the display of at least one of the plurality of exercise devices.

9. The exercise system of claim **1**, wherein the collective exercise goal comprises an average of the exercise results from the individuals.

10. The exercise system of claim **1**, wherein the collective exercise goal comprises a sum or average of the exercise results from the individuals on different types of exercise devices.

11. The exercise system of claim **1**, wherein the at least one server receives and stores exercise results from a plurality of distinct exercise sessions of one of the individuals.

12. An exercise incentive system comprising:

an exercise device configured to transmit first exercise results of a first individual to at least one web server;

wherein the at least one web server receives the first exercise results and transmits the first exercise results or information based upon the first exercise results to an exercise incentive sponsor that provides a reward based upon the exercise results and wherein the at least one server is configured to store a profile for the first person identifying a second person and wherein the at least one server is configured to automatically notify the first person on one of the plurality of exercise devices when the second person is concurrently exercising on another of the plurality of exercise devices.

13. The exercise incentive system of claim **12**, wherein the reward comprises a donation to a charitable organization on behalf of the individual.

14. The exercise incentive system of claim **12**, wherein the exercise incentive sponsor comprises an insurance company.

15. The exercise incentive system of claim **14**, wherein the reward comprises a health insurance premium reduction or credit.

16. The exercise incentive system of claim **12**, wherein the at least one web server transmits the reward authorization to the exercise incentive sponsor.

17. The exercise incentive system of claim **12** further comprising a second exercise device configured to transmit second exercise results of a second individual to the at least one server, wherein the at least one server receives the second exercise results of the second individual, combines the first exercise results and the second exercise results, and transmits the combined exercise results to the first individual or the second individual.

18. The exercise incentive system of claim **17**, wherein the at least one server transmits the combined exercise results to the exercise incentive sponsor.

19. (canceled)

20. (canceled)

21. An exercise system comprising:

a plurality of exercise devices, wherein the exercise devices are configured to sense and transmit exercise results;

at least one server storing a collective exercise goal of a plurality of individuals, the least one server in communication with a plurality of exercise devices so as to receive the exercise results and to compare the exercise results to the collective exercise goal, wherein the least one server provides comparison results to the individuals;

at least one input and display associated with one of the plurality of exercise devices or a peripheral;

at least one computing device configured to cause the display to prompt a person to input groupings of entities by the input, wherein the groupings are assigned different levels of access to exercise information from an exercise device being used by the person.

22. An exercise system comprising:

a plurality of exercise devices, wherein the exercise devices are configured to sense and transmit exercise results;

at least one server storing a collective exercise goal of a plurality of individuals, the least one server in communication with a plurality of exercise devices so as to receive the exercise results and to compare the exercise results to the collective exercise goal, wherein the least one server provides comparison results to the individuals at least one input and display associated with one of the plurality of exercise devices or a peripheral;

at least one computing device configured to cause the display to prompt a person to input groupings of entities by the input, wherein the groupings are assigned different levels of information inflow authorization requirements.

23. An exercise system comprising:

a plurality of exercise devices, wherein the exercise devices are configured to sense and transmit exercise results;

at least one server storing a collective exercise goal of a plurality of individuals, the least one server in communication with a plurality of exercise devices so as to receive the exercise results and to compare the exercise results to the collective exercise goal, wherein the least one server provides comparison results to the individuals, wherein the collective exercise goal comprises a sum or average of the exercise results from the individuals on different types of exercise devices.

* * * * *

APPENDIX L

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(54) **SYSTEM FOR DEVELOPING IMPLEMENTING AND MONITORING A HEALTH MANAGEMENT PROGRAM**

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(60) Provisional application No. 60/229,005, filed on Aug. 30, 2000.

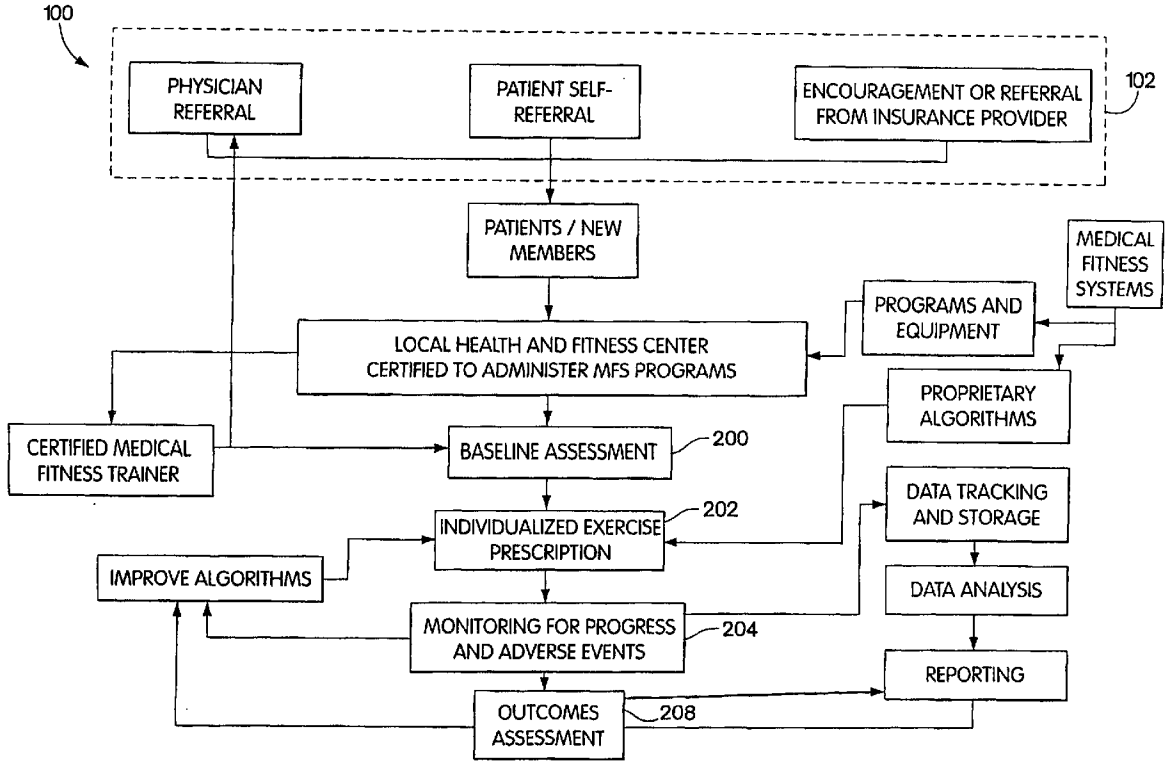
Publication Classification

(51) **Int. Cl.**[7] **G06F 17/60**

(52) **U.S. Cl.** **705/2**

(57) **ABSTRACT**

The method and system includes an integrated set of technology, scientifically-based algorithms and fitness equipment that: assesses a person's health, fitness and functional status; develops an individualized exercice program to address specific needs and improves limitations in health, fitness and function; monitors exercise program progress and adverse events; continuously adjusts exercise program progression in real time; measures changes in health, fitness and functional status; and reports exercise participation and changes in health, fitness and functional status to the participant, his/her health care provider (e.g., physician, physical therapist, psychologist) and health insurance provider. The method is also a vehicle for knowledge delivery of health education (e.g., nutrition, disease self-management, stress and time management), psychological coping strategies, and social support through integrated audio, video and web-based channels.



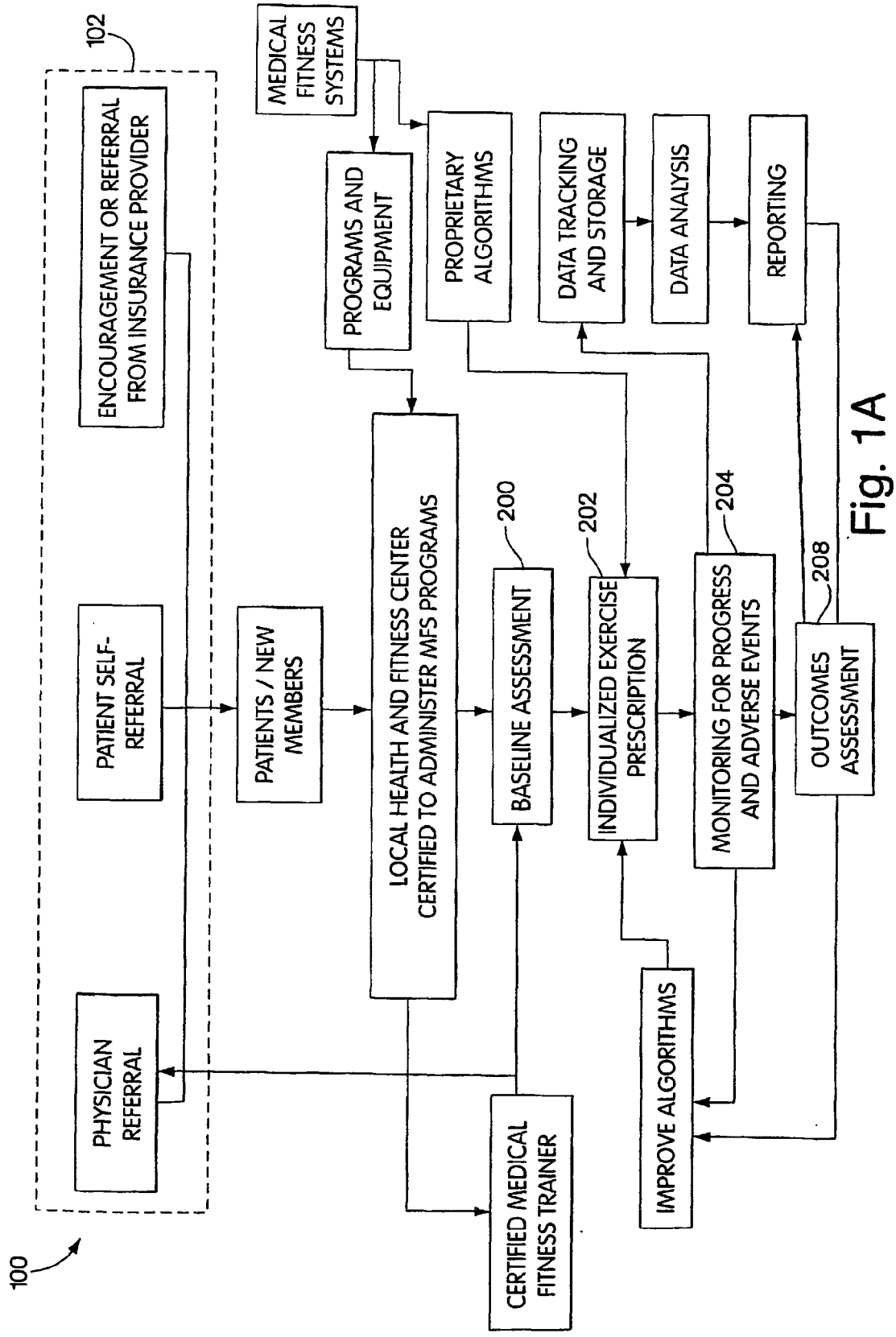

100
102
ENCOURAGEMENT OR REFERRAL FROM INSURANCE PROVIDER
PATIENT SELF-REFERRAL
PHYSICIAN REFERRAL
PATIENTS / NEW MEMBERS
MEDICAL FITNESS SYSTEMS
PROGRAMS AND EQUIPMENT
PROPRIETARY ALGORITHMS
DATA TRACKING AND STORAGE
DATA ANALYSIS
REPORTING
LOCAL HEALTH AND FITNESS CENTER CERTIFIED TO ADMINISTER MFS PROGRAMS
BASELINE ASSESSMENT
200
INDIVIDUALIZED EXERCISE PRESCRIPTION
202
MONITORING FOR PROGRESS AND ADVERSE EVENTS
204
OUTCOMES ASSESSMENT
208
CERTIFIED MEDICAL FITNESS TRAINER
IMPROVE ALGORITHMS

Fig. 1A

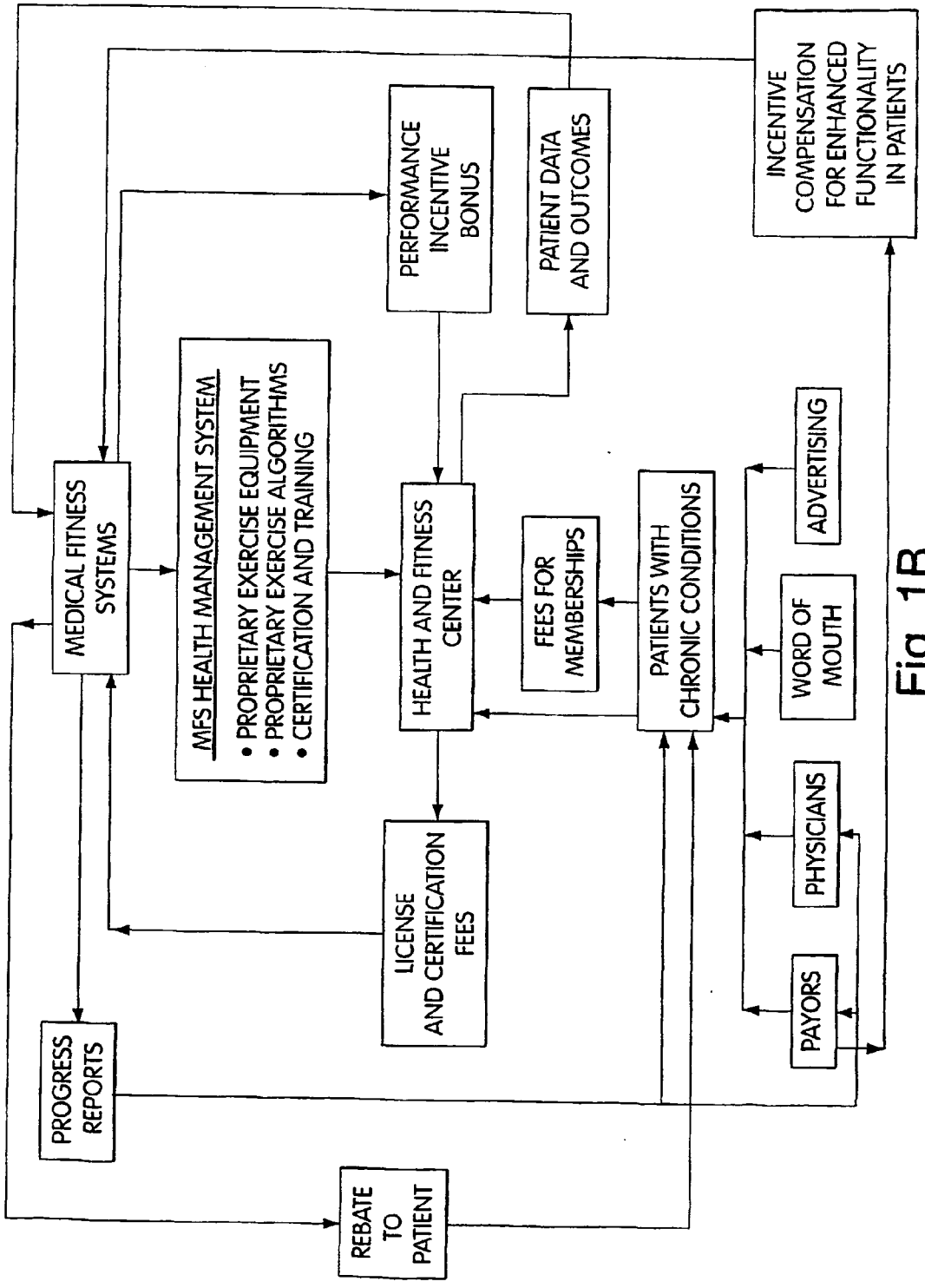

INCENTIVE COMPENSATION FOR ENHANCED FUNCTIONALITY IN PATIENTS
PERFORMANCE INCENTIVE BONUS
PATIENT DATA AND OUTCOMES
MFS HEALTH MANAGEMENT SYSTEM
• PROPRIETARY EXERCISE EQUIPMENT
• PROPRIETARY EXERCISE ALGORITHMS
• CERTIFICATION AND TRAINING
MEDICAL FITNESS SYSTEMS
HEALTH AND FITNESS CENTER
FEES FOR MEMBERSHIPS
PATIENTS WITH CHRONIC CONDITIONS
ADVERTISING
WORD OF MOUTH
PHYSICIANS
PAYORS
LICENSE AND CERTIFICATION FEES
PROGRESS REPORTS
REBATE TO PATIENT

Fig. 1B

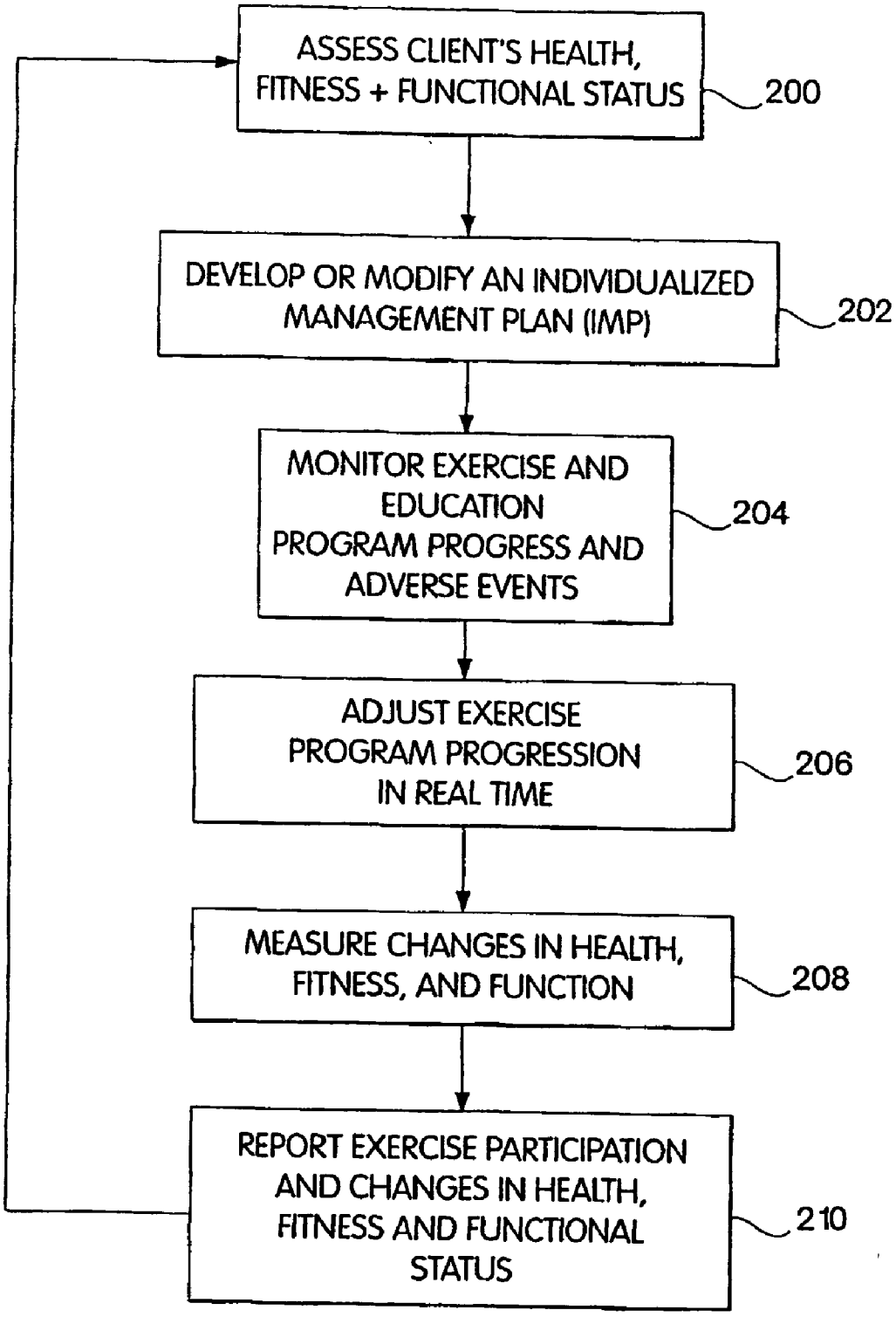

ASSESS CLIENT'S HEALTH, FITNESS + FUNCTIONAL STATUS
200
DEVELOP OR MODIFY AN INDIVIDUALIZED MANAGEMENT PLAN (IMP)
202
MONITOR EXERCISE AND EDUCATION PROGRAM PROGRESS AND ADVERSE EVENTS
204
ADJUST EXERCISE PROGRAM PROGRESSION IN REAL TIME
206
MEASURE CHANGES IN HEALTH, FITNESS, AND FUNCTION
208
REPORT EXERCISE PARTICIPATION AND CHANGES IN HEALTH, FITNESS AND FUNCTIONAL STATUS
210

Fig. 2

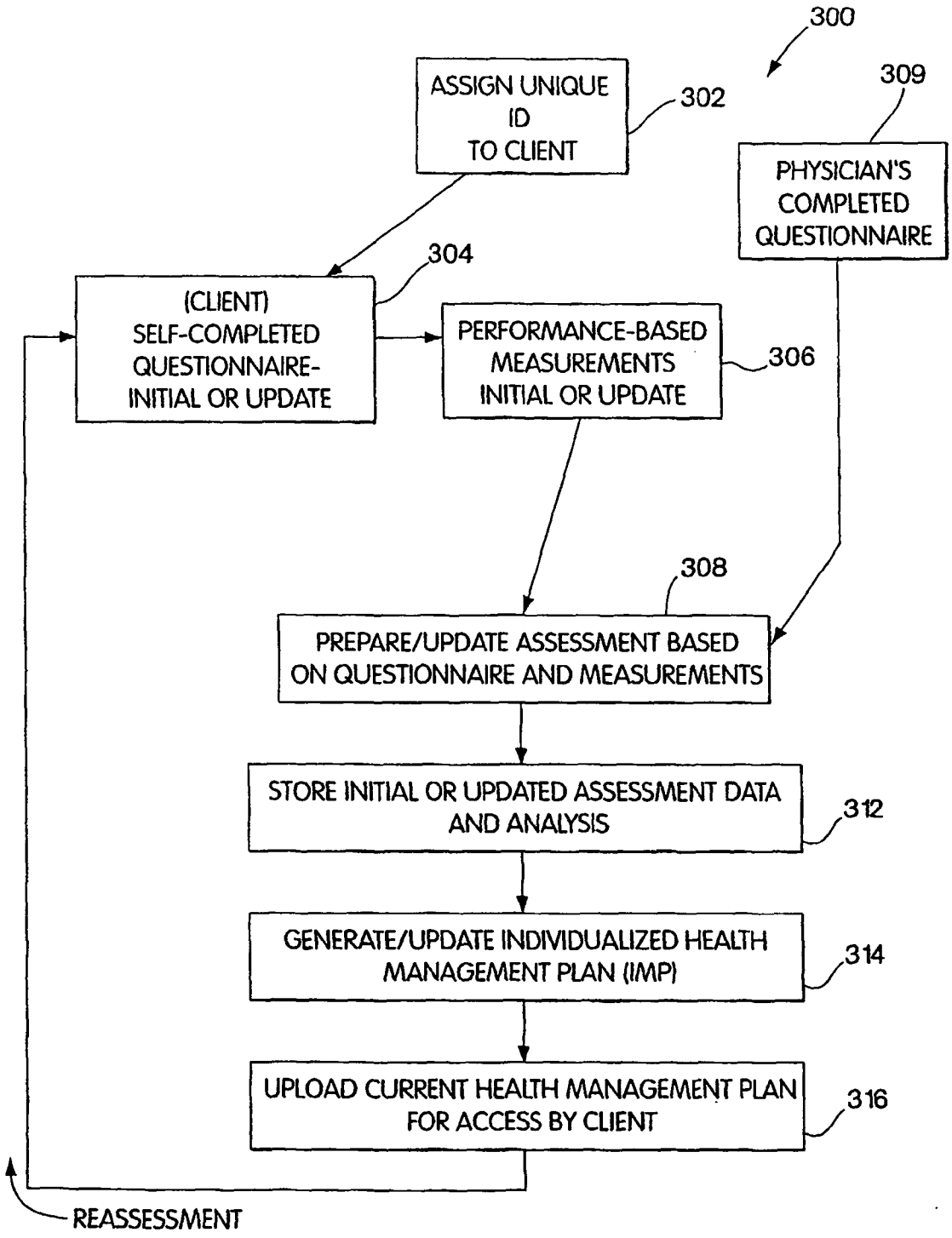

300
ASSIGN UNIQUE ID TO CLIENT
302
309
PHYSICIAN'S COMPLETED QUESTIONNAIRE
304
(CLIENT) SELF-COMPLETED QUESTIONNAIRE-INITIAL OR UPDATE
PERFORMANCE-BASED MEASUREMENTS INITIAL OR UPDATE
306
308
PREPARE/UPDATE ASSESSMENT BASED ON QUESTIONNAIRE AND MEASUREMENTS
STORE INITIAL OR UPDATED ASSESSMENT DATA AND ANALYSIS
312
GENERATE/UPDATE INDIVIDUALIZED HEALTH MANAGEMENT PLAN (IMP)
314
UPLOAD CURRENT HEALTH MANAGEMENT PLAN FOR ACCESS BY CLIENT
316
REASSESSMENT

Fig. 3

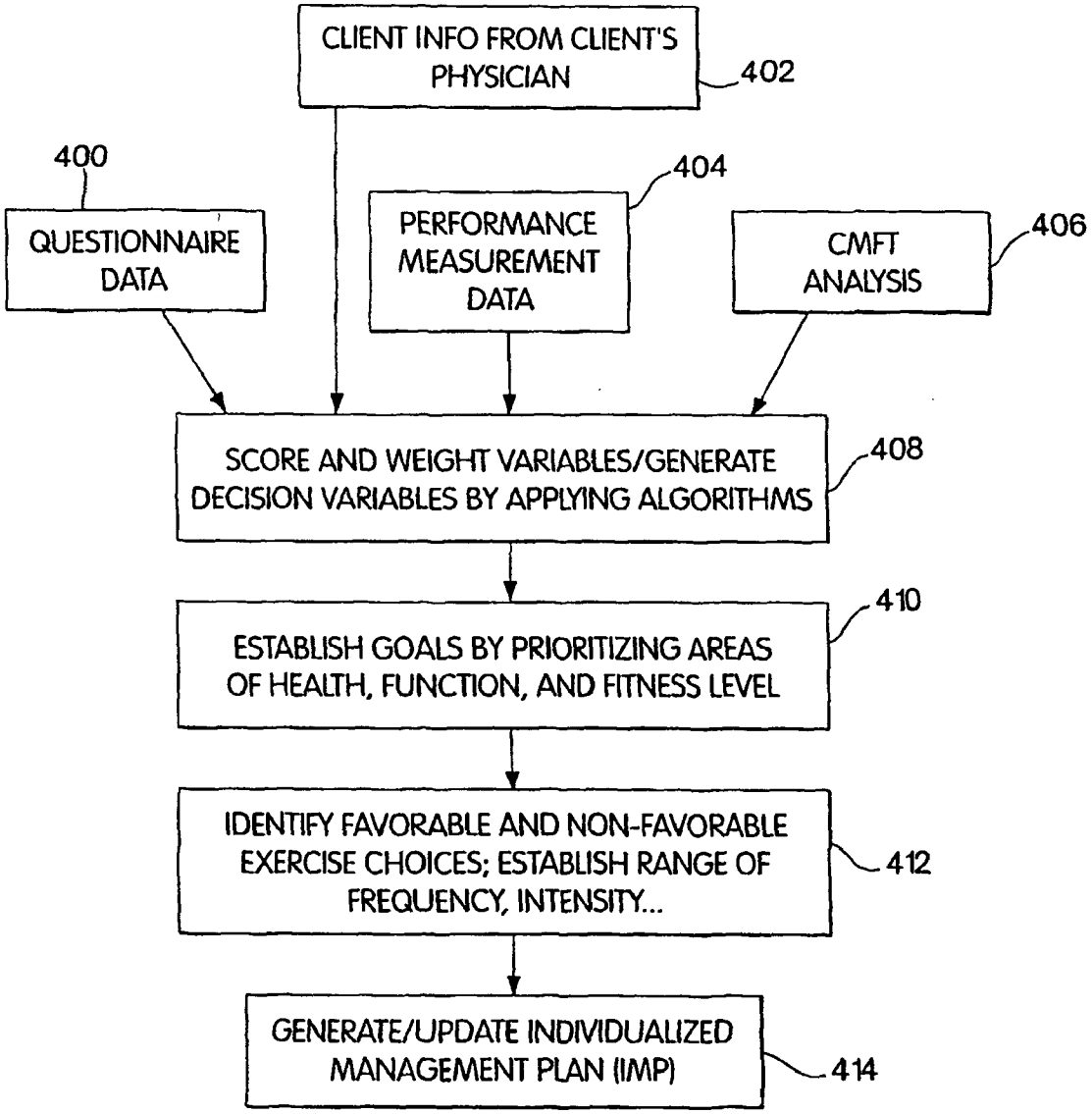

CLIENT INFO FROM CLIENT'S PHYSICIAN
402
400
QUESTIONNAIRE DATA
404
PERFORMANCE MEASUREMENT DATA
CMFT ANALYSIS
406
SCORE AND WEIGHT VARIABLES/GENERATE DECISION VARIABLES BY APPLYING ALGORITHMS
408
ESTABLISH GOALS BY PRIORITIZING AREAS OF HEALTH, FUNCTION, AND FITNESS LEVEL
410
IDENTIFY FAVORABLE AND NON-FAVORABLE EXERCISE CHOICES; ESTABLISH RANGE OF FREQUENCY, INTENSITY...
412
GENERATE/UPDATE INDIVIDUALIZED MANAGEMENT PLAN (IMP)
414

Fig. 4

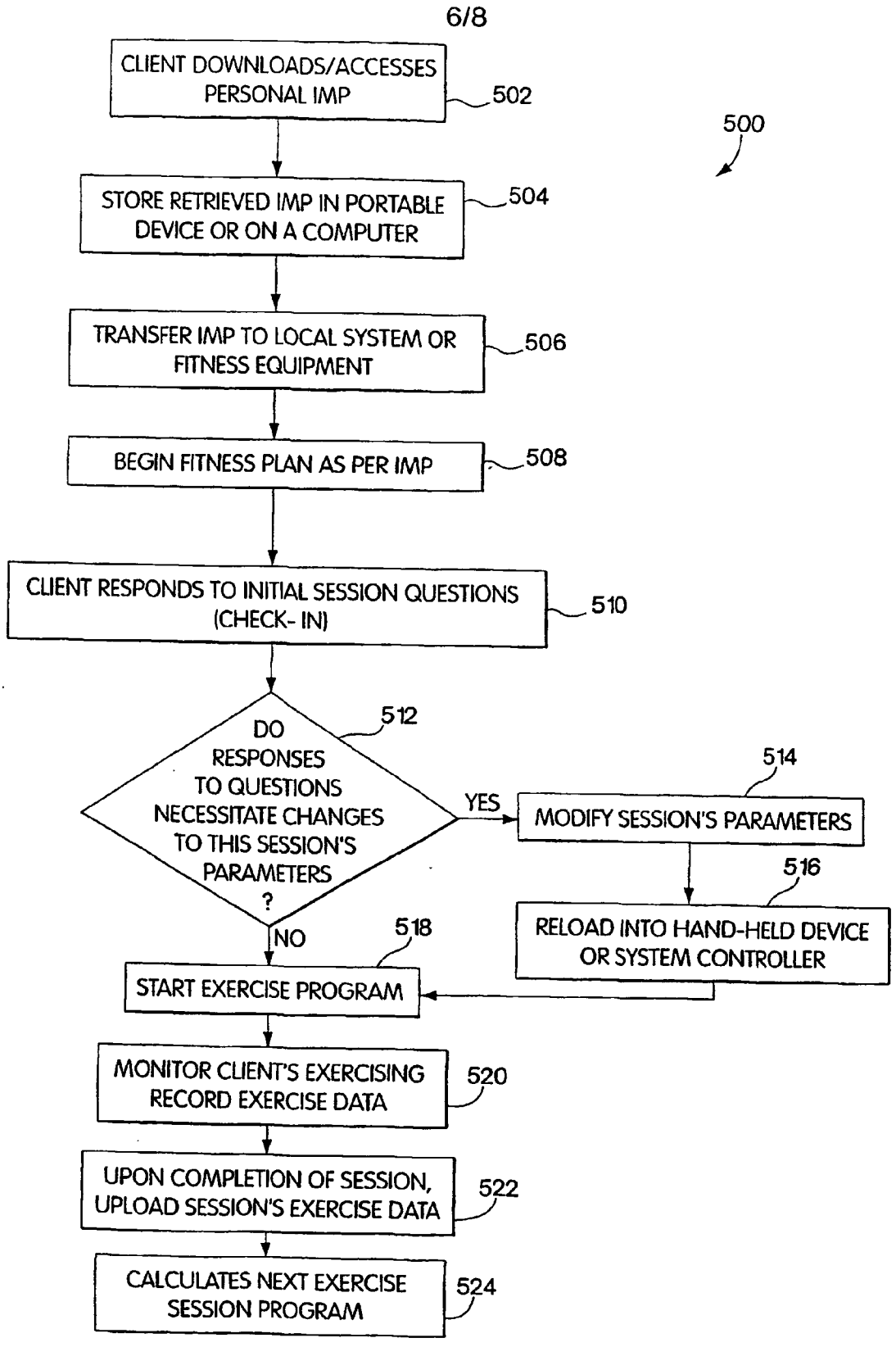

6/8
CLIENT DOWNLOADS/ACCESSES PERSONAL IMP
502
500
STORE RETRIEVED IMP IN PORTABLE DEVICE OR ON A COMPUTER
504
TRANSFER IMP TO LOCAL SYSTEM OR FITNESS EQUIPMENT
506
BEGIN FITNESS PLAN AS PER IMP
508
CLIENT RESPONDS TO INITIAL SESSION QUESTIONS (CHECK- IN)
510
DO RESPONSES TO QUESTIONS NECESSITATE CHANGES TO THIS SESSION'S PARAMETERS ?
512
YES
514
MODIFY SESSION'S PARAMETERS
516
RELOAD INTO HAND-HELD DEVICE OR SYSTEM CONTROLLER
NO
518
START EXERCISE PROGRAM
MONITOR CLIENT'S EXERCISING RECORD EXERCISE DATA
520
UPON COMPLETION OF SESSION, UPLOAD SESSION'S EXERCISE DATA
522
CALCULATES NEXT EXERCISE SESSION PROGRAM
524

Fig. 5

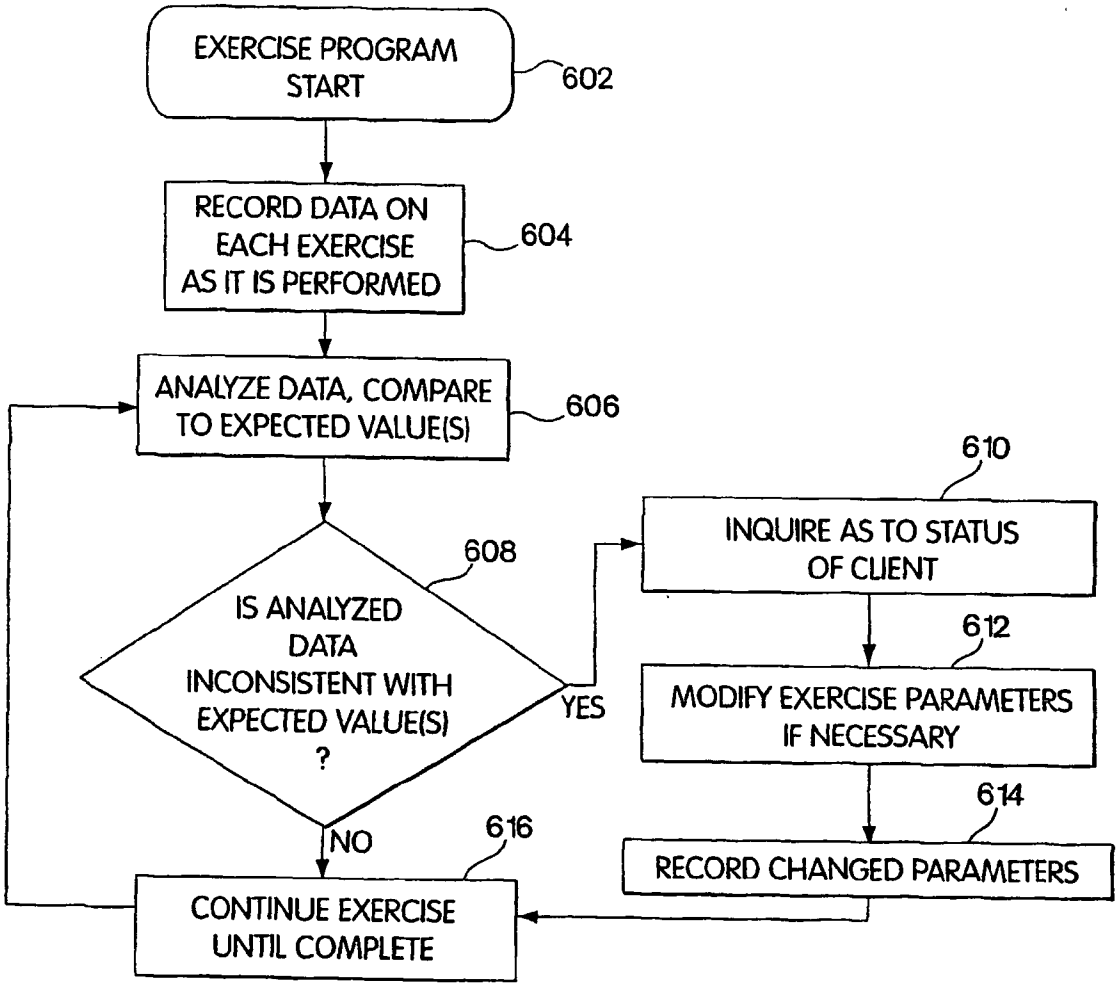

EXERCISE PROGRAM START
602
RECORD DATA ON EACH EXERCISE AS IT IS PERFORMED
604
ANALYZE DATA, COMPARE TO EXPECTED VALUE(S)
606
IS ANALYZED DATA INCONSISTENT WITH EXPECTED VALUE(S) ?
608
YES
NO
INQUIRE AS TO STATUS OF CLIENT
610
MODIFY EXERCISE PARAMETERS IF NECESSARY
612
RECORD CHANGED PARAMETERS
614
CONTINUE EXERCISE UNTIL COMPLETE
616

Fig. 6

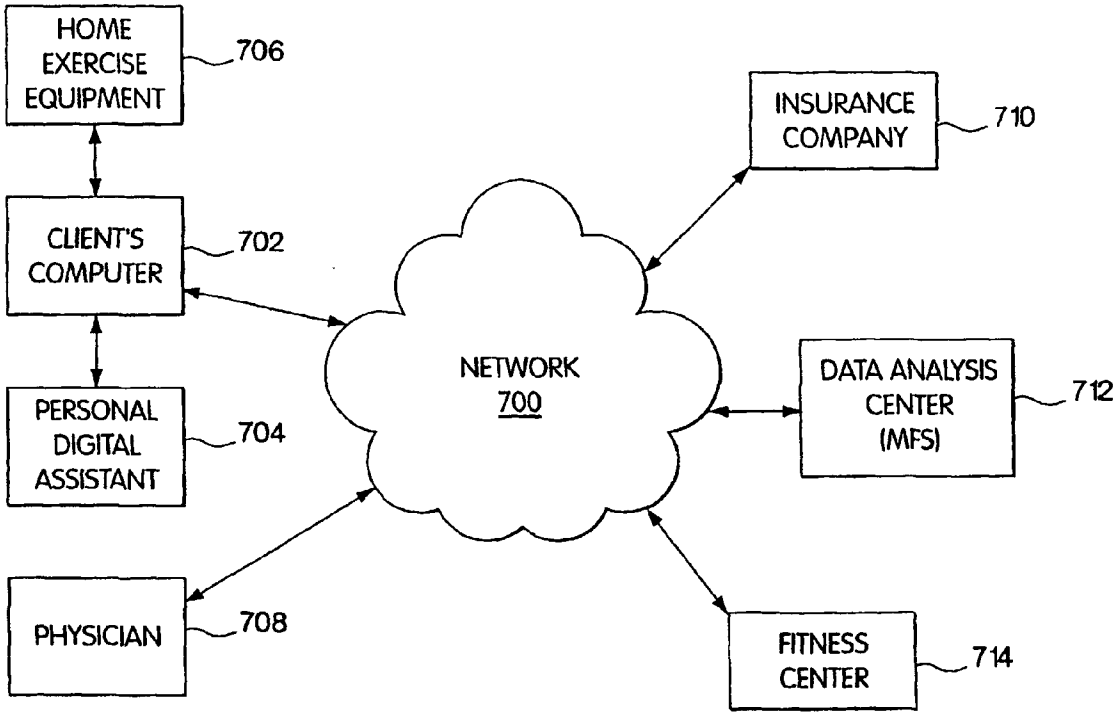

HOME EXERCISE EQUIPMENT
706
CLIENT'S COMPUTER
702
PERSONAL DIGITAL ASSISTANT
704
PHYSICIAN
708
NETWORK 700
INSURANCE COMPANY
710
DATA ANALYSIS CENTER (MFS)
712
FITNESS CENTER
714

Fig. 7

SYSTEM FOR DEVELOPING IMPLEMENTING AND MONITORING A HEALTH MANAGEMENT PROGRAM

RELATED APPLICATION

[0001] This application claims the benefit, under 35 U.S.C. §119(e), of the filing date of provisional application serial No. 60/229,005, filed Aug. 30, 2000.

FIELD OF THE INVENTION

[0002] The field of the invention is health management for persons who have or who are at risk for developing chronic illness

BACKGROUND

[0003] Chronic conditions are the predominant health care problem today, consuming 76% of health care expenses. Individual costs increase dramatically after the age of 65. As the wave of baby boomers reaches and surpasses 65 years of age, the incidence of chronic illness will increase exponentially. Currently, all costs associated with chronic illness approximate $900 billion. By the year 2030, it is estimated that approximately 150 million people in the United States will suffer from one or more chronic illness. This corresponds to a 70% increase in direct medical care costs. With the current health care system designed to primarily service acute health needs, the government and leading foundations are aggressively investigating methods of reducing the personal and economic impact of chronic illness. Among the several approaches examined, regular exercise has consistently been shown to be effective at improving physical and emotional health and quality of life in persons with and without chronic illness.

[0004] In the past ten years, several key reports from federal (Healthy People 2000, 1990; U.S. Preventative Services Task Force Report, 1996; Surgeon General's Report on Physical Activity and Health, 1996) and foundation (Successful Aging, the MacArthur Foundation, 1998) sources have been published. These reports demonstrate a consensus within the medical and scientific communities around the evidence that increased physical activity and exercise can improve the physical and emotional fitness, functional status and quality of life of persons with and without chronic illness. In addition, evidence is mounting that shows a positive relationship between increased physical activity (reduction in inactivity), improved health and reduced health care costs in several chronically ill populations.

[0005] One of the key questions that remain unanswered is how to translate the existing and future science into effective, accessible, and viable programs that have widespread applicability. Empowering a person to change a health behavior requires education, skill development, structure and emotional and social support. To date, the major efforts to promote increased physical activity have been directed through generalized public health education. Primary and specialty care providers, however, are not commonly trained to counsel patients on exercise, particularly in the areas of improving functional status and reducing disability in persons with chronic illness.

[0006] A person with chronic illness or increased risk for illness is without direction and is left to seek out other means of information and guidance surrounding exercise: What kinds? How much? How often? Easily accessible sources of accurate information regarding these questions remain relatively unavailable for the person with chronic illness. What continues to be missing in the continuum of health care is a method or system to integrate all, or even most, of the components of a health management system that is scientifically shown to improve health and prevent the onset, progression or exacerbation of chronic illness. Of the components of health management programs, the least well known, and therefore the least used, is the appropriate use of exercise.

SUMMARY

[0007] A method of coordinating a health management program for an individual is offered, the method comprising: (a) assessing the individual's status; (b) developing an individualized management plan, IMP, for the individual based upon at least the individual's status assessment, the IMP comprising an exercise regimen; (c) monitoring the individual's execution of the exercise regimen; (d) storing the results from steps (b) or (c); (e) measuring changes in any of health, fitness and functional status of the individual; (f) modifying the IMP as a function of data acquired in any one or more of steps (a) and (c)-(e); and (g) repeating one or more of steps (a) and (c)-(f). The method may further comprise (h) reporting at least one of: the IMP, the individual's exercise execution, and the changes in any of the health, fitness and functional status of the individual to at least one of: the individual's health care provider and the individual's insurer. Step (a) may comprise at least one of: (i) the individual completing a self-evaluation; (ii) measuring the individual's performance on a pre-defined set of physical activities; and (iii) a health care provider of the individual's completing an evaluation of the individual. Steps (c), (d) and (e) may occur while the individual executes the exercise regimen. Step (f) may occur while the individual executes the exercise regimen. Step (d) may occur on a server computer. Step (d) may occur on a personal storage device. Step (a) may comprise questioning the individual. Step (a) may comprise physically examining the individual. Step (c) may comprise recording data generated by a fitness machine.

[0008] In a further embodiment the fitness machine adjusts its performance based on one of the following: the IMP, the results from step (c), or the results from step (e). In a further embodiment any of a portion of the results from steps (a)-(f) is made available over the Internet. In a further embodiment any of a portion of the results from steps (a)-(f) is made available at an exercise location.

[0009] In a still further embodiment, a computer apparatus for use in a health management program is offered, the apparatus programmed to: send and receive exercise result data; send and receive patient status data; send and receive individualized management plan data. In another embodiment the computer apparatus is further programmed to measure changes in a patient's physical status based on the exercise result data and patient status data. In yet another embodiment the computer apparatus is further programmed to alter the individualized management plan data based on the exercise result data and patient status data.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIGS. 1A and 1B** are block diagrams of the overall system;

[0011] **FIG. 2** is a flowchart representing the broad steps of the present invention;

[0012] **FIG. 3** is a representation of steps involved in generating an individualized health management plan;

[0013] **FIG. 4** represents the detailed steps in generating the individualized management plans;

[0014] **FIG. 5** shows the steps involved in implementing the health management plan;

[0015] **FIG. 6** shows the steps of gathering exercise data; and

[0016] **FIG. 7** is an overview of the network system.

DETAILED DESCRIPTION

[0017] The present system provides comprehensive, scientifically-based, medically-sound health management programs for persons who have or who are at risk for chronic health conditions, and which quantifies and documents all aspects of the program. The method is an integrated system including scientifically-based algorithms and fitness equipment that: assesses a person's health, fitness and functional status; develops an individualized exercise program targeting specific needs and limitations in health, fitness and function; monitors exercise program progress and adverse events; continuously adjusts exercise program progression in real time; measures changes in health, fitness and functional status; and reports exercise participation and changes in health, fitness and functional status to the participant, his/her health care provider (e.g., physician, physical therapist, psychologist) and health insurance provider. The method is also a vehicle for knowledge delivery of health education information (e.g., nutrition, disease self-management, stress and time management), psychological coping strategies, and social support through integrated audio, video and web-based programming.

[0018] The integrated aspects of each of the following components of a system **100** according to the present invention are seen in **FIGS. 1A and 1B**. Persons with special health conditions will enter the system **100** by way of step **102**, which is by physician referral, self-referral (word of mouth, marketing materials, other forms of advertisement) and by encouragement or direct referral from the insurance provider (payer). As shown in **FIGS. 1A and 2**, initially at step **200**, the health, fitness and functional status of a client (client is preferred although the individual may also be referred to as a patient or participant) is assessed. At step **202**, an individualized management plan (IMP) is initially developed, if not already existing or an already existing IMP is modified. Subsequently, step **204**, exercise and education program progress is monitored and adverse events are recorded. In view of the monitored exercise program progress and adverse events, at step **206**, the exercise program progression is adjusted in real time. Changes in health, fitness and function are measured, step **208**, and exercise participation and changes in health fitness and functional status are reported at step **210**. The entire process may be repeated over time to adjust the individual management plan to changes in the client's health, fitness and function.

[0019] Assessment (step **200**) examines the current health, fitness and functional status of the participant. The initial assessment establishes a baseline for use in developing the first exercise prescription and for comparison of future assessments to determine changes in these areas over time. As shown in **FIG. 3**, the flowchart **300** represents the steps involved in the assessment step **200**. Initially, a unique identification number is assigned to each client at step **302**. The client completes a questionnaire at step **304**. Subsequently, performance-based measurements are taken in step **306**. An assessment is prepared at step **308** based on the analysis of questionnaire answers in step **304** and the performance-based measurements at step **306**. In addition to the questionnaires completed by the client, each client's physician(s) will be sent a questionnaire to obtain medical clearance, step **309**, for participation and to identify any goals or limitations of the participant. The assessment data analysis and physician input are stored at step **312** for subsequent retrieval. The individualized health management plan (IMP) is generated at step **314** based on an assessment at step **308** and input at step **309** and is uploaded for access by the client at step **316**. The process may be repeated multiple times by returning to step **304** for subsequent completion of additional questionnaires as well as a repeat of the performance based measurements, step **306**.

[0020] The assessment is composed of questionnaire- and performance-based measurements. Questionnaires include validated instruments to examine an individual's general health (mental and physical) and functional status, physical activity habits and patterns, medical history, personal characteristics (age, gender, occupation history, marital status), perceived self-efficacy regarding the management of his or her chronic illness and belief in the effect of participation in the health management program. The unique identification number will be used on all data to ensure confidentiality of the information being collected. Questionnaires may be automated and may be completed on computerized forms or directly on a web site. Written informed consent may be collected from each participant at the initial time of contact by a representative of the health management method, to ensure the participant has a clear understanding of the collection, storage and use of all data as part of the method being described in this disclosure.

[0021] Performance-based measurements assess muscle strength of the upper and lower extremities, abdomen and back; cardiorespiratory fitness; range of motion of the ankles, knees, hips, spine, shoulders, elbows, wrists, and neck; and a determination of percent body fat. Muscle strength measurement protocols are implemented. A person who has undergone training and has received a certificate confirming the presence of the required skills and competencies needed to adequately perform the assessment regimen will administer the assessment This is represented in **FIGS. 1A and 1B** as a Certified Medical Fitness Trainer (CMFT). Subsequent assessments will take place at predetermined time points to establish a chronology of changes in measurements over time. These time points will correspond to the start and completion of preset programs or dates that are established as part of goal setting. All assessment data will be stored in a secure location to ensure confidentiality, access for program development, data monitoring, and reporting.

[0022] An individualized health management plan is developed from the data generated in the assessment as shown in **FIG. 4**. All of the data, i.e., questionnaire data **400**, client's physician data **402**, performance measurement data **404**, CMFT analysis data **406**, are run through one or more algorithms that score and weight variables and create a list of "decision variables." These decision variables are subsequently operated on by additional algorithms that establish program goals, step **410**, by prioritizing areas of health and functional status and fitness level and factoring in input from the person's physician and other data collected during the assessment. The algorithms and decision variables for a particular patient are dependant upon the data collected above as well as multiple variables including, but not limited to, age, height, weight, illness (if any), symptoms, etc.

[0023] These algorithms are formulas or systems that use specific variables, for example, but not limited to, age, pain severity level, fatigue, exercise history, medical history and the like, which can be generated through the assessment phase, to determine appropriate components of the management plan thus enabling the development of an individualized program that targets priority needs. These algorithms may be based on both qualitative and quantitative data as to which combinations or sub-combinations of exercises, settings, frequency of occurrence, etc., produce positive results for individuals suffering from particular chronic conditions. Merely as an example, it may be known that a certain course of exercise is beneficial to sufferers of fibromyalgia. This baseline course of exercise could be modified for an individual depending on the individual's specific parameters as found at the initial assessment. Thus, the course of exercise for this person may be personalized based on his or her current measurements.

[0024] Further decisions are calculated, step **412**, through other algorithms to determine a list of favorable and non-favorable exercise choices; establish a range of frequency, intensity and duration for the exercise prescription; establish an exercise progression pattern; create a list of health education modules to be delivered during participation in the exercise sessions; and establish the time point for re-assessment. The health management plan, including the exercise prescription and education module schedule, is generated and uploaded, step **414**, to a site where the participant can load the entire plan onto a hand held or portable device such as a smart card or personal information assistant or manager, e.g., a Palm Pilot. In addition, a workbook/handbook of education materials (e.g., disease background, prognosis, medications, treatment pathway, and self-management information) is provided.

[0025] After the IMP is generated and uploaded, the client is then ready to start exercising according to the plan. With respect to the flowchart **500** as shown in **FIG. 5, a** client would then download and/or access his or her personal IMP at step **502**. The retrieved IMP is stored in a portable device or a personal computer at step **504**. As will be discussed below, the IMP can be transferred to a local system network at an implementation site or a particular piece of fitness equipment, step **506**, by the interaction of the portable device with the fitness equipment or the interaction of the fitness equipment with the computer. As per the IMP, the fitness plan is started at step **508**. Initially, however, the client responds to questions at session check-in, step **510**. If, as determined at step **512**, the responses to the check-in questions necessitate changes to the session parameters then, at step **514**, the session's parameters are modified and the modified IMP is reloaded into the hand-held device or system controller at step **516**. Control then passes to step **518** if either the responses to the questions at step **512** do not necessitate changes or a new/modified IMP has been loaded and the exercise program has started. Once started, step **520**, the client's exercising is monitored and the exercise data is recorded. Upon completion of the session, step **522**, the session's exercise data is uploaded for later analysis, retrieval and use in determining the next exercise session program, step **524**.

[0026] The monitoring of the client's exercising (step **520**) is described in further detail with respect to **FIG. 6**. At step **602**, the exercise program is started and data on each exercise as it is performed is recorded at step **604**. This data includes, but is not limited to, heart rate, blood pressure, temperature, blood oxygen saturation, and the like and exercise performance variables, including but not limited to, equipment settings (e.g., time, treadmill speed, resistance level) and technique (e.g., range of motion and speed of movement of resistance equipment). The data is analyzed and compared to expected values at step **606**. At step **608**, an evaluation of the analyzed data is performed and compared to expected values. If the analyzed data is inconsistent, the status of the client is determined at step **610**. If necessary, at step **612**, the exercise parameters are modified and the changed parameters are recorded as part of the IMP stored on the hand-held device and networked system at step **614**. Control passes to step **616** where the exercise is continued until complete with subsequent analysis of data being performed again at step **606**.

[0027] It should be noted that the modification of the exercise parameters at step **612** is different than that at step **514** although the same result is desired. At step **512** it is the client's own self-analysis that may or may not lead to modification of the session's parameters. Thus, if the client reports that he or she is not feeling well or is sore in a particular area, the system will then modify the parameters. In addition, as described with reference to steps **608-614**, if the client makes no indication of impaired condition but the measured exercise data indicates otherwise, the system will detect this and modify the parameters. Thus, even if the client is unaware or has declined to mention "not feeling well," the system can detect this by the analysis of the actual exercise data.

[0028] As shown in **FIG. 7**, all of the major components of the system are connected via a network **700**, for example, the Internet, for the sharing and transferring of data. Thus, a client's computer **702**, connected to a personal digital assistant **704** and home exercise equipment **706**, communicates with a data analysis center **712** in which the algorithms, educational materials, certification materials and the like are all centrally accessed. Further, a physician **708**, insurance company **710** and fitness center **714** are each connected to the network **700** to facilitate the exchange of data with respect to a particular client. Of course, the exchange of data would be encrypted and/or password protected in order to protect any confidential medical information of the client. Any one of a number of known encryption or password-protection schemes could be implemented.

[0029] Program implementation occurs at home, a community-based fitness or wellness center, or any other site that

installs the described technology. In the home, the health management program can be uploaded to the piece of fitness equipment or the computer located in the home via an Internet connection. The home program provides a list of detailed instructions for the number of minutes of cardiovascular exercise at a certain heart rate, which strength training exercises and the number of sets and repetitions, flexibility exercises, and a list of health education materials that the person can access through the internet or via recorded media. A computer board built into the piece of home equipment will interface directly with a computer that is responsible for communicating with the home equipment. Without a piece of fitness equipment that contains the proprietary technology, specially designed software running on a computer may act as the personal information storage device and interface with the central system computer.

[0030] Specially trained on-site staff (Site Manager, Site Director, Certified Medical Fitness Trainer) facilitate the fitness center-based implementation. The trainer will introduce the participant to the exercise program through one-on-one instruction sessions until the participant is capable of exercising independently or chooses to join a group of persons also using the health management method. At the beginning of each exercise session the participant checks in by interfacing his/her personal information storage device (smart card or personal information manager) with a dedicated computer at the exercise facility. This computer may store a copy of the information on each participant's personal storage device. As described above, the initial interface produces a greeting and interaction with the participant asking questions relating to his/her current state of health and well being. This information will be used as a check to finalize the exercise program for that session. If normal, the exercise program scheduled for that session is implemented. If, however, the person is not feeling well, answers to the questions will trigger an algorithm that will modify the exercise program for that day to ensure safe participation and reduce the chance of injury.

[0031] After completing the electronic check-in, the participant follows the exercise program, which details the order of exercises. Measurement technology may record the data on exercises performed at each session including the time, speed, distance, and incline of a treadmill; the time, speed, average number of revolutions per minute, distance, and seat adjustment on an upright or recumbent stationary bicycle; the time, speed, average number of steps per minute, and distance covered on an elliptical device, stair climber or other cardiovascular exercise equipment, such as a rowing machine or cross-country skiing simulator. An amount of resistance (weight), range of motion, speed of movement, seat and other body size adjustment on resistance training equipment is also captured.

[0032] This exercise equipment technology is provided in two forms: a retrofit system that attaches to different models of currently manufactured fitness equipment and an all-in-one piece of equipment that already incorporates the advantages of the present invention. All-in-one equipment/interfacing technology will be isokinetic, where the machine controls the speed of angular velocity, while a dynamometer or actuator provides accommodating resistance to joint movement. This form of resistance is ideal for special populations due to the accommodating nature where the machine provides an "equal and opposite" resistance to joint movement. The isokinetic form of resistance allows a person to stop anywhere throughout the range of motion and have little or no resistance on the joint-unlike today's common types of resistance equipment, which is isotonic, i.e., plate-loaded.

[0033] In addition to exercise performance, this recording device will provide feedback to the participant regarding proper exercise technique (speed of movement and range of motion). This feedback capability will have individual parameters to adjust according to the specific musculoskeletal limitations of each participant. Also, the device will query the participant if the exercise is not performed correctly (too slow or not through the full range of motion) to see if there is a problem (pain, soreness, fatigue, or other) and then will use an algorithm to decide whether to reduce the resistance, speed, or range of motion for that day, to eliminate the exercise from that session or to stop the entire exercise session and seek assistance from the professional in charge of the facility and/or recommend checking with his/her physician. One or more fitness professionals will monitor every participant of this program in his/her respective facility. The name of the fitness professional would be included in the participant's plan. Positive reinforcement is a critical component of successfully adopting a positive health behavior. Therefore, after completing every exercise, one of several statements is presented on the LCD panel of the participant-technology interface encouraging pride and a sense of accomplishment in the participant for completion of the activity.

[0034] Reporting of participant data is a part of the program as well. Participants have access to their own data at any time via a website. The use of security codes is used to ensure confidentiality and to limit access to only the authorized individual. Data can be presented in various forms (written, graphical) and can be printed or sent as email with an appropriate level of security. Participants will receive periodic reviews, (e.g., monthly reviews of their progress that will be delivered via email or accessed via their security code.) These reports provide another forum to reinforce positive behaviors in participants. In addition, the open communication enables feedback about the system to refine this technology and the method of health management.

[0035] In addition to participant reports, a summary of a participant's baseline assessment and exercise program and subsequent reports of re-assessments, new programs and quantification of changes in outcome variables, will be sent to one or more health care providers of the participant's choice. The health care provider report has a unique design and content structure and contains graphical and written representation as well as the raw data on compliance, exercise performance, assessment outcomes, education modules completed and behavioral milestones achieved by the participant. Reports are also delivered into a patient's electronic medical record, where possible, to encourage physician reinforcement and support of the participant's efforts and positive health behaviors. Another report, also uniquely designed, is sent to the participant's health insurance provider to document compliance and progress throughout the health management program and to qualify for reimbursement of health insurance premium fees.

[0036] Education is an important component in the successful adoption of a positive health behavior. Health edu-

cation modules are delivered through the LCD panel on the participant-technology interface. This occurs while on a piece of cardiovascular equipment and during the timed rest period between multiple sets of a resistance exercise, as well as facility wide conferences and education sessions. Education is presented in several forms. While working on a piece of cardiovascular equipment, the user could choose to access a web site and select a lecture on one of several topics of interest (general health, exercise, nutrition, stress management, etc.).

[0037] On resistance equipment where one sits for far shorter periods of time, education is presented in shorter "knowledge bites." This presentation takes several forms, including quizzes (multiple choice, true-false, question alone) and statements/questions. Regardless of format, answers are provided in the form of a "knowledge bite" to facilitate learning and awareness of relevant information. Information will be aimed to encourage decision making, (e.g., getting a flu shot) and will provide updates regarding current findings in medical research (e.g., appropriate use of nutritional supplements, new medications, or data supporting the participation in a program of regular exercise).

[0038] Education modules are developed in several categories (e.g., general health and well being, specific disease or illness, age appropriate) and are selected for each individual based on information provided at the initial assessment and subsequent follow up assessments. In addition, the participant has the choice to manually select any education module in the library in addition to those programmed as part of the person's individualized health management program. The system also offers restricted membership chat rooms for facilitating the adoption of positive health behaviors in participants of the health management program. The chat rooms can be accessed at any time, including while exercising. Additional education opportunities are delivered through web-based newsletters, articles summarizing research findings, copies of articles, ties to other sources of information, (e.g., National Institutes of Health, Arthritis Foundation, American Diabetes Association), and courses in related topics (e.g., exercise, nutrition, illness specific self-management, stress management) that increase the knowledge level of participants, and therefore the ability of people to make health related decisions that positively affect health and quality of life.

[0039] To facilitate compliance and success of participants, an incentive program is part of the system described in this disclosure. Participants will accumulate "health-points" for every activity they complete—exercise compliance, web-based education, video and audiotape education—and for maintaining a healthy lifestyle. These points will be accumulated and exchanged for gifts and prizes that cost certain numbers of points.

[0040] Education of the health care provider is important to maximizing the use, and therefore the impact, of the described health management method. Physicians and other health care providers who do not have formal training in the areas of exercise, nutrition and lifestyle management, will have web-based access to articles, updates, previously recorded presentations, discussion sites and scientific references regarding the contribution of health self-management and specifically the components of the method described in this disclosure. The goal of the provider education services and products is to provide the health care community with the most current, accurate scientific data and relevant information that will help them to make good decisions for their patients and, where appropriate, integrate this health management method into the care they provide.

[0041] Education of the fitness professional to attain CMFT status takes several forms and is important to the success of participants and the implementation of this health management method. Training will include web-based courses, lectures, on-site training and several levels of programming, including a multi-day course involving lectures and hands-on experiences with problem solving, equipment and technology. Courses will teach the pathophysiology, normative values for physical and emotional characteristics and limitations, contraindications of exercise, and exercise prescription development for many health conditions. Those who successfully complete these courses will have knowledge, technical skills, and competencies in exercise physiology, motivation, compliance, group dynamics and facilitation, as well as general communication and listening skills, and cultural competence. Programs will be offered for basic, intermediate and advanced levels, and will provide continuing education opportunities to maintain certificate standing. Fitness professionals have access to several "lines of learning" and knowledge maintenance through didactic and interactive programs, web-based information and courses and chat rooms.

[0042] The current system incorporates a unique line of resistance training equipment for older adults and persons with chronic disease. A drawback of current resistance equipment is that the devices are sized to accommodate persons with normal ranges of joint motion, including those of the hands. In addition, current resistance equipment uses pulleys and stack weight to supply a constant (isotonic) resistance to joint movement, which limits the level of resistance to the ends (weakest positions) of the muscle length-tension curve.

[0043] This equipment of the present invention is designed specifically to meet the unique biomechanical, structural, and mobility limitations of the person with chronic illness, particularly musculoskeletal system involvement. This line of equipment has special adjustments to enable persons with limited ranges of motion of hips, knees, shoulders, elbows and hands to perform appropriate exercises comfortably and safely. In addition to the difference in design shape and adjustments, this equipment supplies resistance via an isokinetic dynamometer or actuator that controls the speed of movement, not the resistance. This difference in the form of resistance enables a person with chronic illness to perform muscle-strengthening exercises throughout any range of motion while maximizing the total length-tension curve of a muscle by providing varying resistance throughout the joint range of motion corresponding to the strength of muscles at various points in the joint range. Furthermore, isokinetic technology allows the exerciser to stop at any time throughout the range of motion and have the resistance disappear due to there being equal and opposite resistance to the amount of muscular effort.

[0044] Technology enables the participant to begin an exercise session at any time and to perform the exercise at any site that incorporates the health management technology. This allows those who travel for short or extended

periods of time or relocate to maintain the positive healthy habits established through this health management method and, advantageously, to continue to benefit from their individualized exercise program regardless of geographical location. The data from all exercise sessions are stored at a central location and participants can access their exercise data via the Internet regardless of where they are and are portable (can be taken with them) via the smart card and handheld personal data system (Palm Pilot).

[0045] A large amount of data is one of the key consequences of this method of health management. This invaluable asset will be mined to continuously evaluate, refine and evolve the health management method described here.

[0046] An embodiment of the method includes an integrated system of technology, scientifically-based algorithms and fitness equipment that: assesses a person's health, fitness and functional status; develops an individualized exercise program to address specific needs and improves limitations in health, fitness and function; monitors exercise program progress and adverse events; continuously adjusts exercise program progression in real time; measures changes in health, fitness and functional status; and reports exercise participation and changes in health, fitness and functional status to the participant, his/her health care provider (e.g., physician, physical therapist, psychologist) and health insurance provider. The method is also a vehicle for knowledge delivery of health education (e.g., nutrition, disease self-management, stress and time management), psychological coping strategies, and social support through integrated audio, video and web-based channels.

[0047] Other embodiments of the method and system enable the adoption and long term maintenance of an exercise and education program that is designed to address the specific needs and improve the limitations of individuals with and without chronic illnesses.

[0048] Having now described a few embodiments of the present invention, it should be apparent to those skilled in the art that the foregoing is merely illustrative and not limiting, having been presented by way of example only. Numerous modifications and other embodiments are within the scope of one of ordinary skill in the art and are contemplated as falling within the scope of the invention. Merely as an example, the connection to the Internet could be via a wireless connection without the necessity of a hard-wired connection such as a phone line and modem or cable network and cable modem. The personal device used to access the IMP could also be a web-enabled wireless telephone or similar device. Of course, fitness equipment either retrofitted to operate with the present invention or having components originally installed may be part of a wireless LAN within a facility, thus minimizing any retrofit requirements of the infrastructure of the fitness center.

What is claimed is:

1. A method of coordinating a health management program for an individual, the method comprising:

(a) assessing the individual's status;

(b) developing an individualized management plan, IMP, for the individual based upon at least the individual's status assessment, the IMP comprising an exercise regimen;

(c) monitoring the individual's execution of the exercise regimen;

(d) storing the results from steps (b) or (c);

(e) measuring changes in any of health, fitness and functional status of the individual;

(t) modifying the IMP as a function of data acquired in any one or more of steps (a) and (c)-(e); and

(g) repeating one or more of steps (a) and (c)-(f).

2. The method of claim 1, further comprising:

(h) reporting at least one of: the IMP, the individual's exercise execution, and the changes in any of the health, fitness and functional status of the individual to at least one of: the individual's health care provider and the individual's insurer.

3. The method of claim 1, wherein step (a) comprises at least one of:

(i) the individual completing a self-evaluation;

(ii) measuring the individual's performance on a predefined set of physical activities; and

(iii) a health care provider of the individual's completing an evaluation of the individual.

4. The method of claim 1, wherein steps (c), (d) and (e) occur while the individual executes the exercise regimen.

5. The method of claim 4, wherein step (f) occurs while the individual executes the exercise regimen.

6. The method of claim 1, wherein step (d) occurs on a server computer.

7. The method of claim 1, wherein step (d) occurs on a personal storage device.

8. The method of claim 1, wherein step (a) comprises questioning the individual.

9. The method of claim 1, wherein step (a) comprises physically examining the individual.

10. The method of claim 1, wherein step (c) comprises recording data generated by a fitness machine.

11. The method of claim 10, wherein the fitness machine adjusts its performance based on one of the following: the IMP, the results from step (c), or the results from step (e).

12. The method of claim 1, wherein any of a portion of the results from steps (a)-(f) is made available over the Internet.

13. The method of claim 1, wherein any of a portion of the results from steps (a)-(f) is made available at an exercise location.

14. A computer apparatus for use in a health management program, the apparatus programmed to:

send and receive exercise result data;

send and receive patient status data;

send and receive individualized management plan data.

15. The computer apparatus of claim 14 further programmed to measure changes in a patient's physical status based on the exercise result data and patient status data.

16. The computer apparatus of claim 14 further programmed to alter the individualized management plan data based on the exercise result data and patient status data.

* * * * *