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Energy Generation

Abstract

Various embodiments are described that relate to energy generation. A housing can retain a spring coupled to a gear set. As the spring experiences linear compression and extension, the spring can cause rotational movement in the gear set. The rotational movement from the gear set can cause rotation of a rotational magnet. The rotational magnet, when rotated about a coil set, can convert an energy. The energy can be used to charge a battery.

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Background/Summary

CROSS-REFERENCE [0001] This application is a divisional application of, and claims priority to, U.S. application Ser. No. 15/275,543 filed on Sep. 26, 2016. The entirety of U.S. application Ser. No. 15/275,543 is hereby incorporated by reference. This application is a divisional application of, and claims priority to, U.S. application Ser. No. 17/016,483 filed on Sep. 10, 2020; U.S. application Ser. No. 17/016,483 claims priority to U.S. application Ser. No. 15/275,543. The entirety of U.S. application Ser. No. 17/016,483 is hereby incorporated by reference.

BACKGROUND
[0003] Electronic devices have a wide variety of uses and applications in modern society. These electronic devices use electrical energy to function. In one example, this energy is derived from a battery. As the devices are used, the battery level lowers and ultimately reaches a level so low that the electronic device does not function without a new battery, which can be expensive, or the battery being recharged. Therefore, it can be valuable to recharge a battery.
SUMMARY
[0004] In one embodiment, a system can comprise a linear hardware component that can be configured to experience a linear movement sequence. The system also can comprise a conversion hardware component that can be configured to convert the linear movement sequence into a rotational movement sequence. The system additionally can comprise an energy generation hardware component that can be configured to generate an energy from the rotational movement sequence.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0005] Incorporated herein are drawings that constitute a part of the specification and illustrate embodiments of the detailed description. The detailed description will now be described further with reference to the accompanying drawings as follows:
[0006] FIGS. **1**A-**1**D illustrate various views of a first embodiment of a housing;
[0007] FIGS. **2**A-**2**B illustrate various views of a second embodiment of the housing;
[0008] FIG. **3** illustrates one embodiment of a processor and a computer-readable medium;
[0009] FIG. **4** illustrates one embodiment of a method comprising four actions; and
[0010] FIG. **5** illustrates one embodiment of a method comprising two actions.
DETAILED DESCRIPTION
[0011] In one embodiment, energy conversion can occur from a housing. A person, as well as an item carried by the person, can experience movement. That movement can be captured and converted into electrical energy. As an example of this capturing, linear movement of a spring coupled to a backpack can be transferred into rotational movement. The rotational movement can cause a rotational magnet(s) to rotate. Rotation of the rotational magnet in conjunction with a coil assembly can be used to convert a kinetic energy (captured as a mechanical energy) into electrical energy.
[0012] The following includes definitions of selected terms employed herein. The definitions include various examples. The examples are not intended to be limiting.
[0013] “One embodiment”, “an embodiment”, “one example”, “an example”, and so on, indicate that the embodiment(s) or example(s) can include a particular feature, structure, characteristic, property, or element, but that not every embodiment or example necessarily includes that particular feature, structure, characteristic, property, or clement. Furthermore, repeated use of the phrase “in one embodiment” may or may not refer to the same embodiment.

[0014] “Computer-readable medium”, as used herein, refers to a medium that stores signals, instructions and/or data. Examples of a computer-readable medium include, but are not limited to, non-volatile media and volatile media. Non-volatile media may include, for example, optical disks, magnetic disks, and so on. Volatile media may include, for example, semiconductor memories, dynamic memory, and so on. Common forms of a computer-readable medium may include, but are not limited to, a floppy disk, a flexible disk, a hard disk, a magnetic tape, other magnetic medium, other optical medium, a Random Access Memory (RAM), a Read-Only Memory (ROM), a memory chip or card, a memory stick, and other media from which a computer, a processor or other electronic device can read. In one embodiment, the computer-readable medium is a non-transitory computer-readable medium.

[0015] “Component”, as used herein, includes but is not limited to hardware, firmware, software stored on a computer-readable medium or in execution on a machine, and/or combinations of each to perform a function(s) or an action(s), and/or to cause a function or action from another component, method, and/or system. Component may include a software controlled microprocessor, a discrete component, an analog circuit, a digital circuit, a programmed logic device, a memory device containing instructions, and so on. Where multiple components are described, it may be possible to incorporate the multiple components into one physical component or conversely, where a single component is described, it may be possible to distribute that single component between multiple components.

[0016] “Software”, as used herein, includes but is not limited to, one or more executable instructions stored on a computer-readable medium that cause a computer, processor, or other electronic device to perform functions, actions and/or behave in a desired manner. The instructions may be embodied in various forms including routines, algorithms, modules, methods, threads, and/or programs, including separate applications or code from dynamically linked libraries.

[0017] FIGS. **1**A-**1**D (collectively referred to as ‘FIG. **1**’) illustrate various views of an embodiment of a housing **100** (described by the different views **100**A-**100**G). FIG. **1**A illustrates a first perspective view **100**A of the housing **100**. The housing **100** can retain a rack **110** coupled to a spring **120**. The rack **110** can also be coupled to a user or an item of a user, such as a backpack (e.g., rucksack strap), purse, briefcase, computer satchel, etc. In one example, the rucksack (e.g., Modular Lightweight Load-carrying Equipment (MOLLE) rucksack) can have a rigid frame that aligns with a wearer's waist. The housing **100** can be coupled (e.g., affixed) to the rigid frame. The rack **110** can be coupled to a strap or other item of the rucksack, such as a strap from a shoulder area of the rucksack. The strap can weave through an end of the rack **110**, by way of a slit **130**, so that it is taught. As the rucksack is worn, the shoulder area and therefore the strap can experience linear movement (e.g., when decoupled from the hip-belt) due to movement of the rucksack upon the user. As the strap experiences linear movement, the rack **110** and spring **120** can experience the linear movement. In this, the spring **120** can be an example of a linear hardware component configured to experience a linear movement sequence.

[0018] In one embodiment, the spring **120** is a compression coil spring and therefore an example of an elastic energy storage hardware component in compression configured to be coupled to a connector (e.g., the strap). The compression spring can be in a neutral compressed position. As the rucksack moves up in response to user movement, the strap (e.g., coupled in tension) can pull the compression spring into decompression. Once the rucksack movement is complete, the compression spring can return to the neutral uncompressed position. This decompression and return to state position can be the linear movement sequence.

[0019] The linear movement sequence (e.g., completely linear or substantially linear) of the spring **120** can be converted into a rotational movement sequence by a conversion hardware component. In one example of the conversion hardware component, the rack **110** can rotate a gear set **140**. As the spring **120** moves linearly, the rack **110** can move the gear set **140** rotationally (e.g., alternating clockwise and counter-clockwise).

[0020] The gear set **140** can be coupled to a rotational magnet assembly **150** that can function as an example energy generation hardware component configured to convert an energy from the rotational movement sequence. In one example, the rotational magnet assembly **150** can comprise twelve cube magnets that rotate around a stationary set of nine coils to convert 3-phase alternating current power. The gear set **140** and rotational magnet assembly **150** can be calibrated with one another. In one example, a gear of the gear set **140** that couples with the rack **110** can be at a ratio of 12.96 in comparison to the rotational magnet assembly **150**.

[0021] The energy generated from the rotational magnet assembly **150** can, in one embodiment, be transferred to an electronic device. This transfer can be achieved by way of a port **160**. The port can be configured to couple the housing **100** with the electronic device (e.g., smartphone, radio, etc.). A plug **162** can be inserted into the port **160** to facilitate the transfer; in one embodiment the plug is hardwired such that the battery is integrated.

[0022] In one embodiment, the energy can be transferred to a battery **164**. The port **160** can function as a battery retention hardware component configured to retain the battery. The port **160** can function to charge the battery with the energy. However, other configurations can be used. In one example, the battery can be removable (e.g., as illustrated through the arrows **166**A and **166**B), but physically integrated into the housing **100** by way of a distinct battery retention hardware component **166** configured to retain the battery **162**. In another example, the housing **100** can contain an incorporated battery that is recharged. The port **160** can connect the housing **100** to the electronic device and the incorporated battery can directly power the electronic device and/or be used to power an incorporated battery of the electronic device.

[0023] As illustrated, there are a gear set **140** and a rotational magnet assembly **150** on the sides of the rack **110**. However, various other embodiments can be practiced other than what is illustrated. In one example, the rack **110** can directly couple to the rotational magnet assembly **150** without the gear set **140**. In this example, the rack **110** can itself be the conversion hardware component configured to convert the linear movement sequence into the rotational movement sequence. In one embodiment, as opposed to connecting with a strap, the housing **100** can be self-functioning. The spring **120** can be a tension coil spring where the spring **120** is fixed at one end of the housing **100** and has a mass **170** on the opposite end (e.g., the slit end). As the housing **100** moves (e.g., is jostled while within a woman's purse), the mass can extend the tension coil spring. The mass **170** can be independent as well as be encapsulated by a different housing **180** (e.g., that also encapsulates the battery **162**, such as when the battery is integrated into the housing **180**).

[0024] Conversely, if the spring **120** is a compression spring, then the mass can compress the compression spring. In one example, the housing **100** can be non-affixed to the purse and the stiffness of the compression coil spring can be relatively small. Therefore, the mass can move relatively freely to create the linear movement as compression and decompression. In one example, the mass and spring **120** can be designed such that the mass compresses the spring **120** in rest, but with relatively little movement, the mass can cause decompression. With other directional movement or a return to rest for the housing **100**, the spring **120** can return to the compressed state.

[0025] FIG. **1**B illustrates an exploded view **100**B of the housing **100**. The rack **110** and/or the spring **120** can be a capture hardware component configured to experience a movement sequence as a result of the spring **120** being placed in compression (e.g., by way of the strap, in tension, of the rucksack coupling with the rack **110** through the slit **130**). The rotational magnet assembly **150** (e.g., along with the gear set **140**) can be an energy generation hardware component configured to convert an energy from the movement sequence. The port **160** can be configured to operatively couple the housing **100** to an electronic device that is powered by the rotational magnet assembly and/or the housing **100** can charge the battery **164** as discussed above.

[0026] In one embodiment, the housing **100** can function without the slit **130** and instead comprise a mass **170** at the rectangular end of the rack **110**. The rack **110** and spring **120** can be a capture hardware component, coupled to the mass **170**, configured to experience a movement sequence due to movement of the mass **170** resultant from movement of the housing **100**. The rotational magnet assembly **150** (e.g., directly coupled with the rack **110**) can function as an energy generation hardware component configured to convert an energy from the movement sequence. The port **160** can function along with an integrated battery of the housing **100** to power an electronic device with the energy. In one example, the energy generation hardware component can be configured to charge the integrated battery with the energy generated from the movement sequence. The integrated battery can be configured to provide power to the electronic device by way of the port **160**.

[0027] The housing **100** can be low mass, low profile, and function as an energy harvester (e.g., charge the integrated battery). In one example, the housing **100** can be fastened to a frame of the rucksack (e.g., a waist portion of the frame). A shoulder strap of the rucksack can loop through the housing **100**, such as through the slit **130** and looped with an end of the rack **110** (e.g., the strap is looped through the rack **110** and then connected to itself by way of a hook-and-loop configuration).

[0028] The system can harness the tension force in the strap by causing the rack **110** to oscillate vertically (e.g., when the system is the housing **100** of FIG. **1** worn on the waist and therefore in line with applied force of the strap). The spring **120** (e.g., functioning as a compression spring) can force the rack **110** back down to the neutral position in response to the strap causing the rack **110** to oscillate. This oscillation can cause the rack **110** to rotate gears in the gear set **140**—illustrated as two sets of symmetrical gears—and cause the rotational magnet of the rotational magnet assembly **150** to rotate (e.g., oscillate clockwise and counter-clockwise).

[0029] FIG. **1**C illustrates three different views **100**C-E of the housing **100**. The view **100**C is a front view of the housing **100** (e.g., with a front cover removed). The view **100**D is a top view of the housing **100**. While views of the housing **100** are given with perspective, such as the top view **100**D being where the strap can integrate, the housing **100** can function without a required orientation. The view **100**E is an isometric view of the housing **100**.

[0030] FIG. **1**D illustrates two different views **100**F-G of the housing **100**. The view **100**F is of a front semi-transparent view of the housing **100**. The view **100**G is of a top semi-transparent view of the housing **100**.

[0031] FIGS. **2**A-**2**B (collectively referred to as ‘FIG. **2**’) illustrate various views of an embodiment of a housing **200**. The housing **200** can function as a second energy conversion system. The view **200**A is a front view of a housing **200** and the view **200**B is an isometric view of the housing **200**. A spring housing **210** can terminate at one end of the spring **120** of FIG. **1**, while the rack **110** terminates at the other end of the spring **120**. The rack **110** can move when integrated with the strap and the spring **120** of FIG. **1** can function as described above. As the rack **110** moves, the magnet housing **220** (e.g., that includes the rotational magnet assembly **150** of FIG. **1**) can rotate about the coil housing **230** such that the energy is produced.

[0032] FIG. **3** illustrates one embodiment of a system **300** comprising a processor **310** (e.g., a general purpose processor or a processor specifically designed for performing a functionality disclosed herein) and a computer-readable medium **320** (e.g., non-transitory computer-readable medium). In one embodiment, the computer-readable medium **320** is communicatively coupled to the processor **310** and stores a command set executable by the processor **310** to facilitate operation of at least one component disclosed herein (e.g., a component that can perform at least part of the method **500** discussed below). In one embodiment, the computer-readable medium **320** is configured to store processor-executable instructions that when executed by the processor **310**, cause the processor **310** to perform at least part of a method disclosed herein (e.g., at least part of the method **500** discussed below).

[0033] FIG. **4** illustrates one embodiment of a method **400** comprising four actions **410-440**. In one example, a housing (e.g., a hardware set comprising one or more pieces of hardware) that experiences the method **400** can be integrated into a piece of hardware, such as being integrated in a running watch and used to power the running watch. The housing (e.g., housing **100** of FIG. **1** or the housing **200** of FIG. **2**) can comprise a capture hardware component and/or a linear hardware component. By way of the capture hardware component and/or the linear hardware component, a linear movement can be experienced at **410**. At **420**, the linear movement can be converted to rotational movement. This conversion can take place by way of a conversion hardware component of the housing. At **430**, the rotational movement can be used to generate an energy and can be performed by the energy generation hardware component. This energy can be, at **440**, used to power the battery **164** of FIG. **1** or a device as discussed above.

[0034] FIG. **5** illustrates one embodiment of a method **500** comprising two actions **510-520**. The method **500** can be used to create (e.g., assemble) a system, such as the housing discussed above with regard to the method **400** of FIG. **4**. At **510**, parts can be obtained. In one example, robotic arms can physically obtain various hardware components. At **520**, the system can be constructed. In one example, construction can occur by a robotic assembly mechanism. The robotic arms and/or the robotic assembly mechanism, as well as other hardware that can be used to implement the method **500**, can be controlled by an industrial controller that comprises the system **300** of FIG. **3**. In one embodiment, the system can be created, at least in part, by hand.

[0035] Once created, the system can be used to capture kinetic movement from a wearer and transform this kinetic movement into electrical power. As discussed above, the system can be a housing that retains hardware components and can be integrated with a rucksack, such as a rucksack used by a soldier. The soldier may carry various electronic devices and the system can be used to power those devices (e.g., wirelessly). Since the soldier can power his or her own devices, then the soldier can carry less batteries and therefore lighten his or her load. Outside of a rucksack, in addition to other examples listed above, the system can be included in an armored plate carrier (e.g., vest), civilian backpack, duffle bag, etc.

[0036] While the methods disclosed herein are shown and described as a series of blocks, it is to be appreciated by one of ordinary skill in the art that the methods are not restricted by the order of the blocks, as some blocks can take place in different orders. Similarly, a block can operate concurrently with at least one other block.

Claims

1. A system, retained by a housing, comprising: a mass; a capture hardware component, coupled to the mass, configured to experience a movement sequence due to movement of the mass resultant from movement of the housing; and an energy generation hardware component configured to generate an energy from the movement sequence.

2. The system of claim 1, where the capture hardware component comprises a spring in tension at rest, where the movement sequence is a compression sequence, and where the compression sequence is compression and decompression of the spring.

3. The system of claim 2, comprising: a gear set configured to transfer a linear movement of the spring from the compression sequence into a rotational movement; where the energy generation hardware component comprises a rotational magnet and where the rotational magnet is configured to rotate in response to the rotational movement of the gear set to generate the energy.

4. The system of claim 3, comprising: a battery retention portion configured to retain a battery removable from the housing, where the energy generation hardware component is configured to charge the battery, while the battery is retained by the battery retention portion, with the energy generated from the movement sequence.

5. The system of claim 4, where the energy generation hardware component comprises a rotational magnet configured to rotate in response to the movement sequence to transform the energy.

6. The system of claim 3, comprising: a port configured to operatively couple the housing to an electronic device, where the energy generation hardware component is configured to charge the electronic device with the energy generated from the movement sequence when the electronic device is coupled to the housing by way of the port.

7. The system of claim 6, where the energy generation hardware component comprises a rotational magnet configured to rotate in response to the movement sequence to transform the energy.
8. The system of claim 3, comprising: an integrated battery, a port configured to operatively couple the housing to an electronic device, where the energy generation hardware component is configured to charge the integrated battery with the energy generated from the movement sequence and where the integrated battery is configured to provide power to the electronic device by way of the port.
9. The system of claim 8, where the energy generation hardware component comprises a rotational magnet configured to rotate in response to the movement sequence to transform the energy.
10. The system of claim 3, where the housing is configured to be rigidly affixed to a personal carrying device.
11. The system of claim 1, where the capture hardware component comprises a spring in compression at rest, where the movement sequence is a compression sequence, and where the compression sequence is compression and decompression of the spring.
12. The system of claim 11, comprising: a gear set configured to transfer a linear movement of the spring from the compression sequence into a rotational movement; where the energy generation hardware component comprises a rotational magnet and where the rotational magnet is configured to rotate in response to the rotational movement of the gear set to generate the energy.
13. The system of claim 12, comprising: a battery retention portion configured to retain a battery removable from the housing, where the energy generation hardware component is configured to charge the battery, while the battery is retained by the battery retention portion, with the energy generated from the movement sequence.
14. The system of claim 13, where the energy generation hardware component comprises a rotational magnet configured to rotate in response to the movement sequence to transform the energy.
15. The system of claim 12, comprising: a port configured to operatively couple the housing to an electronic device, where the energy generation hardware component is configured to charge the electronic device with the energy generated from the movement sequence when the electronic device is coupled to the housing by way of the port.
16. The system of claim 15, where the energy generation hardware component comprises a rotational magnet configured to rotate in response to the movement sequence to transform the energy.
17. The system of claim 12, comprising: an integrated battery, a port configured to operatively couple the housing to an electronic device, where the energy generation hardware component is configured to charge the integrated battery with the energy generated from the movement sequence and where the integrated battery is configured to provide power to the electronic device by way of the port.
18. The system of claim 17, where the energy generation hardware component comprises a rotational magnet configured to rotate in response to the movement sequence to transform the energy.
19. The system of claim 13, where the housing is configured to be rigidly affixed to a personal carrying device.
20. The system of claim 11, where the housing is non-affixed to another item.