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Switch for a lighting system

Abstract

A switch includes a first terminal, a second terminal, and a third terminal. The switch includes an output node coupled to the second terminal and the third terminal. The switch includes a contactor coupled to the first terminal and movable between at least a first position and a second position. The first terminal is coupled to the second terminal when the contactor is in the first position. The first terminal is coupled to the third terminal when the contactor is in the second position. When the contactor is in the first position, the switch is configured to provide direct current power at the output node. When the contactor is in the second position, the switch is configured to provide alternating current power at the output node.

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Background/Summary

PRIORITY CLAIM (1) This application claims the benefit of U.S. patent application Ser. No. 17/751,206, filed May 23, 2022, which claims the benefit of U.S. patent application Ser. No. 16/165,162, filed Oct. 19, 2018, which claims priority of U.S. Provisional Patent Application No. 62/581,913, filed on Nov. 6, 2017, and U.S. Provisional Patent Application No. 62/576,895, filed on Oct. 25, 2017, the entire contents of which are all incorporated herein by reference.

FIELD

(1) The present disclosure relates generally to lighting systems.

BACKGROUND

(2) A lighting fixture can include a light source that provides illumination for a room or area in which the lighting fixture is mounted. The light source can be selectively coupled to a power source (e.g., mains power supply) via manipulation of a switch (e.g., toggle switch) that is movable between at least a first position and a second position. When the switch is in the first position, the light source can receive electrical power from the power source and can illuminate the room or area. When the switch is in the second position, however, the light source no longer receives electrical power from the power source. In this way, operation of the light source can be controlled via manipulation of the switch.

BRIEF DESCRIPTION

(3) Aspects and advantages of embodiments of the present disclosure will be set forth in part in the following description, or may be learned from the description, or may be learned through practice of the embodiments.

(4) In an example embodiment, a switch can include a first terminal, a second terminal, and a third terminal. The switch includes an output node coupled to the second terminal and the third terminal. The switch includes a contactor coupled to the first terminal and movable between a first position and a second position. The first terminal is coupled to the second terminal when the contactor is in the first position. The first terminal is coupled to the third terminal when the contactor is in the second position. When the contactor is in the first position, the switch is configured to provide direct current power at the output node. When the contactor is in the second position, the switch is configured to provide alternating current power at the output node.

(5) In another example embodiment, a system for controlling operation of a lighting system that includes a light source and an auxiliary load is provided. The system includes a switch couplable to a power source for the lighting system. The switch is movable between at least a first position and a second position. When the switch is in the first position, the switch can be configured to provide direct current power to the auxiliary load. When the switch is in the second position, the switch can be configured to provide alternating current power to both the auxiliary load and the light source.

(6) In yet another example embodiment, a switch includes a first terminal, a second terminal, and a third terminal. The switch includes a first output node and a second output node. The first output node is coupled to the second terminal. The second output is coupled to the third terminal. The

switch includes a contactor coupled to the first terminal and movable between at least a first position and a second position. The first terminal is coupled to the second terminal when the contactor is in the first position. The first terminal is coupled to the third terminal when the contactor is in the second position. When the contactor is in the first position, the switch is configured to provide direct current power at the first output node. When the contactor is in the second position, the switch is configured to provide alternating current power at the second output node.

(7) These and other features, aspects and advantages of various embodiments will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the present disclosure and, together with the description, serve to explain the related principles.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) Detailed discussion of embodiments directed to one of ordinary skill in the art are set forth in the specification, which makes reference to the appended figures, in which:

(2) FIG. **1** provides a lighting fixture according to example embodiments of the present disclosure;

(3) FIG. **2** provide a schematic of a circuit according to example embodiments of the present disclosure;

(4) FIG. **3** provides a lighting system according to example embodiments of the present disclosure;

(5) FIG. **4** provides a block diagram of an example control device according to example embodiments of the present disclosure;

(6) FIG. **5** provides a light system according to example embodiments of the present disclosure;

(7) FIG. **6** provides a schematic of a system for controlling operation of a lighting system according to example embodiments of the present disclosure;

(8) FIG. **7** provides another schematic of the system of FIG. **6** according to example embodiments of the present disclosure;

(9) FIG. **8** provides a schematic of another system for controlling operation of a lighting system according to example embodiments of the present disclosure; and

(10) FIG. **9** provides another schematic of the system of FIG. **8** according to example embodiments of the present disclosure.

DETAILED DESCRIPTION

(11) Reference now will be made in detail to embodiments, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the embodiments, not limitation of the present disclosure. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made to the embodiments without departing from the scope or spirit of the present disclosure. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that aspects of the present disclosure cover such modifications and variations.

(12) Example aspects of the present disclosure are directed to a switch that can be configured to provide an electrical output for powering one or more loads associated with a lighting fixture or other device even when the switch is in a position to disconnect AC electrical power from the lighting fixture or other device. For instance, a lighting fixture can include one or more auxiliary loads, such as a controller, wireless communication device, camera, environmental detection sensor, etc. In some applications, the auxiliary load can receive electrical power from a battery positioned onboard the auxiliary load. However, since the auxiliary load relies on the battery for electrical power, a user must regularly replace the battery to ensure proper operation of the

auxiliary load. Replacing the battery can be a rather burdensome task.

(13) According to example embodiments of the present disclosure, electrical power (e.g., DC power) can be provided to a lighting fixture or other device regardless of a position of a switch used to provide AC power to the lighting fixture or other device. In this way, one or more auxiliary loads associated with the lighting fixture can remain powered without requiring a battery or other dedicated power source onboard the lighting fixture.

(14) In some embodiments, a switch can include a first terminal, a second terminal, and a third terminal. The switch can include a first output node and a second output node. The first output node can be coupled to the second terminal. The second output node can be coupled to the third terminal. The switch can include a contactor coupled to the first terminal and movable between a first position and a second position. When the contactor is in the first position, the first terminal can be coupled to the second terminal. When the contactor is in the second position, the first terminal can be coupled to the third terminal. As will be discussed below in more detail, the switch can be configured to output direct current power at the first output node, and alternating current power at the second output node.

(15) In some embodiments, the switch can include a power converter coupled between the first output node and the second terminal. The power converter can be configured to convert alternating current power to direct current power. As such, when the contactor is in the first position, the power converter can receive alternating current power from a power source and can convert the alternating current power to direct current power. In some implementations, the first output node can be coupled to an auxiliary load of the lighting system. As such, when the contactor is in the first position, the switch can deliver DC power to the auxiliary load via the first output node.

(16) When the contactor is in the second position, the switch can provide AC power at the second output node. In some implementations, the switch can be coupled to the light source and auxiliary load of the lighting system via the second output node. In this way, the switch can provide power to both the light source and the auxiliary load when the contactor is in the second position.

(17) The switch according to example embodiments of the present disclosure can provide a number of technical effects and benefits. For instance, when a user toggles the switch to deactivate (e.g., turn off) the light source, the switch can continue to provide electrical power to one or more auxiliary loads via the first output node. In this way, use of energy storage devices (e.g., batteries) to power the auxiliary load can be reduced.

(18) Example aspects of the present disclosure are discussed with reference to a switch used to power a lighting fixture for purposes of illustration and discussion. Those of ordinary skill in the art, using the disclosures provided herein, will understand that switches according to example embodiments of the present disclosure can be used with other loads without deviating from the scope of the present disclosure.

(19) Referring now to the FIGS., FIG. **1** depicts a lighting fixture **100** disposed within a ceiling **120** that extends between a first surface **122** and a second surface **124** along a vertical direction V. As shown, the ceiling **120** can separate a first space **130** (e.g., positioned beneath the ceiling **110**) from a second space **140** (e.g., positioned above the ceiling **110**) along the vertical direction V. In some implementations, the first space **130** can include a room (e.g., kitchen, living room, etc.) of a residential home, and the second space **140** can include an attic positioned above the room.

(20) The lighting fixture **100** can include a light source **110** to provide illumination for the first space **130**. As shown, the light source **110** can be disposed within the lighting fixture **100**. In some implementations, the light source **110** can include an array of light emitting diodes (LEDs) or any other suitable light source. As discussed below, operation of the light source **110** can be controlled via manipulation of a switch **150**, such as a wall switch.

(21) Referring briefly now to FIG. **2**, the lighting fixture **100** can include a power converter **112** configured to receive an input power from a power source **160** (e.g., an AC or DC power source) and convert the input power to an output power suitable for powering the light source **110**. In some

instances, the light source **110** can include an array of LED light sources, and the power converter **112** can be configured to provide different driving currents to each of the LED light sources. For instance, the power converter **112** can include one or more of a multi-channel driver circuit, a current splitter circuit, one or more current regulators, and/or other devices that can be used to independently provide a driver current to each of the LED light sources.

(22) As mentioned above, the switch **150** can be used to control operation of the light source **110**. More specifically, the switch **150** can be used to selectively couple the light source **110** to the power source **160**. For instance, the switch **150** can be a single pole single throw (SPST) switch movable between a first position **152** and a second position **154**. When the switch **150** is in the first position **152**, the light source **110** is not coupled to the power source **160**. However, when the switch **150** is in the second position **154**, the light source **110** is coupled to the power source **160**. In this way, the switch **150** can be used to activate (e.g., turn on) and deactivate (e.g., turn off) the light source **110**.

(23) Referring now to FIG. **3**, a lighting system **200** according to example embodiments of the present disclosure can include the light source **110** and an auxiliary load **210**. In some implementations, the auxiliary load **210** can include one or more sensor(s) **220** operable to sense one or more parameters associated with the first space **130**. For instance, the one or more parameters can include an environmental parameter, such as amount of smoke present within the first space **130**. In this way, the sensor(s) **220** can collect data that can be used to monitor the first space **130**. It should be appreciated, however, that the sensor(s) **220** can be configured to detect any parameter. For example, the sensors(s) **220** can be operable to detect an amount of carbon monoxide (CO) present within the first space **130**. In this way, the sensor(s) **220** can collect data that can be used to determine whether there is a CO leak within the first space **130**.

(24) As shown in FIGS. **3** and **4**, the auxiliary load **210** can additionally or alternatively include one or more control device(s) **230**. For instance, the control device(s) **230** can include at least one processor **232** and associated memory device **234** configured to perform a variety of computer-implemented functions (e.g., performing the methods, steps, calculations and the like disclosed herein). As used herein, the term “processor” refers not only to integrated circuits referred to in the art as being included in a computer, but also refers to a controller, microcontroller, a microcomputer, a programmable logic controller (PLC), an application specific integrated circuit (ASIC), a Field Programmable Gate Array (FPGA), and other programmable circuits. Examples of the memory device **234** can include computer-readable media including, but not limited to, non-transitory computer-readable media, such as RAM, ROM, hard drives, flash drives, or other suitable memory devices.

(25) The memory device **234** can store information accessible by the processor(s) **232**, including computer-readable instructions **236** that can be executed by the processor(s) **232**. The computer-readable instructions **236** can be any set of instructions that, when executed by the processor(s) **232**, cause the processor(s) **232** to perform operations. The computer-readable instructions **236** can be software written in any suitable programming language or can be implemented in hardware. In some implementations, the computer-readable instructions **236** can be executed by the processor(s) **232** to perform operations, such as generating a control action associated with presenting an alarm or notification based on an environmental parameter associated with the room or space in which the lighting fixture **100** is located. For instance, the processor(s) **232** can generate a control action based on data received from the sensor(s) **220**. The memory device **234** can further store data **238** that can be accessed by the control device(s) **230**. In example embodiments, the data **238** can include data received from the sensor(s) **220**.

(26) Additionally or alternatively, as shown in FIG. **4**, the control device(s) **230** can include a communication interface **240**. In example embodiments, the communications interface **240** can include associated electronic circuitry that can be used to communicatively couple the control device(s) **230** with other devices, such as the sensor(s) **220**. In some embodiments, the

communication interface **240** can allow the control device(s) **230** to communicate directly with other devices. As will be discussed below, the communication interface **240** can provide for communication with other devices over a network **170** (FIG. **5**).

(27) Referring to FIG. **5**, the network **170** can be any suitable type of network. For instance, the network **170** can be a local area network (e.g., intranet), wide area network (e.g., internet), low power wireless network (e.g., Bluetooth Low Energy (BLE), Zigbee, etc.), or some combination thereof and can include any number of wired or wireless links. In general, communication over the network **170** can be implemented via any type of connection, using a wide variety of communication protocols, encodings or formats, and/or protection schemes.

(28) Example communication technologies used in accordance with example aspects of the present disclosure can include, for instance, Bluetooth low energy, Bluetooth mesh networking, near-field communication, Thread, TLS (Transport Layer Security), Wi-Fi (e.g., IEEE, 802.11), Wi-Fi Direct (for peer-to-peer communication), Z-Wave, Zigbee, Halow, cellular communication, LTE, low-power wide area networking, VSAT, Ethernet, MoCA (Multimedia over Coax Alliance), PLC (Power-line communication), DLT (digital line transmission), etc. Other suitable wired and/or wireless communication technologies can be used without deviating from the scope of the present disclosure.

(29) In some implementations, the control device(s) **230** can generate one or more control actions associated with controlling operation of the light source **110**. For instance, the control action(s) can include activating (e.g., turn on) or deactivating (e.g., turn off) the light source **110**. More specifically, the control device(s) **230** can command the light source **110** to flash (that is, activate and deactivate) at a predetermined frequency. In this way, the light source **110** can be used to indicate an environmental condition (e.g. fire) detected based, at least in part, on data from the sensor(s) **220**.

(30) In some implementations, the control device(s) **230** can communicate with a user device **180** over the network **170**. The user device **180** can be any suitable type of device, such as, for example, a personal computing device (e.g., laptop or desktop), a mobile computing device (e.g., smartphone or tablet), a wearable computing device, an embedded computing device, a remote computing device, or any other suitable type of computing device. The user device **180** can include one or more computing device(s) **184** with the same or similar components as described above with regard to the control device(s) **230**. For instance, the computing device **184** of the user device **180** can include one or more processors and one or more memory devices that store instructions that are executable by the processor to cause the user device **180** to perform operations, such as e.g., communicating one or more control signals over the network **170** to the control device(s) **230**. In this way, a user can control operation of the light source **110** via the user device **180**.

(31) In some implementations, the control device(s) **230** can communicate data to the user device **180** via the communication interface **240**. For instance, the control device(s) **230** can provide data captured by the sensor(s) **220** to the user device **180**. The information can be displayed (e.g., via a display device) or otherwise presented (e.g., via audio speakers) to the user through a suitable interface **182**. In this way, a user can observe data collected by the sensor(s) **220**.

(32) In some implementations, the control device(s) **230** can communicate a notification or alert indicative of a detected environmental condition (e.g., fire) to the user device **180** via the communication interface **240**. For instance, the control device(s) **230** can communicate an electronic message (e.g., email, short message service (SMS) text message, etc.) indicating a detected environmental condition for the first space **130** (FIG. **1**). In this way, a person using the user device **180**, such as a homeowner, can be apprised of the detected environmental condition.

(33) In some implementations, the lighting fixture **200** can include a power converter **240** configured to receive an input power from the power source **160** and convert the input power to an output power (DC power) suitable for powering the sensor(s) **220** and the control device(s) **230**.

(34) Referring now to FIGS. **6** and **7**, a system **500** for controlling operation of the lighting system

200 is provided according to example embodiments of the present disclosure. As shown, the system **500** can include a switch **510**. In some implementations, the switch **510** can include a first terminal **520**, a second terminal **522**, and a third terminal **524**. The switch **510** can include a contactor **526** coupled to the first terminal **520** and movable between a first position **530** and a second position **540**. When the contactor **526** is in the first position **530**, the contactor **526** can couple the first terminal **520** to the second terminal **522**. When the contactor **526** is in the second position **540**, the contactor **526** can couple the first terminal **520** to the third terminal **524**. As will be discussed below in more detail, the switch **510** can be coupled to the power source **160** and can be used to distribute electrical power to the lighting system **200**. A user can manipulate the position of the contactor **526** by toggling the switch **510**.

(35) In some implementations, the first terminal **520** can receive electrical power from the power source **160**, such as AC power. The AC power can be, for instance, 120V mains power or other suitable power. As mentioned above, the contactor **526** can be used to selectively couple the first terminal **520** to the second or third terminals **522**, **524**. More specifically, the second terminal **522** can receive the electrical power when the contactor **526** is in the first position **530**. The third terminal **524** can receive the electrical power when the contactor **526** is in the second position **540**.

(36) As shown, the switch **510** can include a first output node **550** coupled to the second terminal **522**. In this way, the switch **510** can output electrical power at the first output node **550** when the contactor **526** is in the first position **530**. In some implementations, the switch **510** can include a power converter **560** coupled between the second terminal **522** and the first output node **550**. The power converter **560** can be configured to convert alternating current power from the power source **160** to direct current power. The power converter **560** can include, for instance, a rectifier, one or more switching elements (e.g., transistors) and filters and/or other circuit components for converting AC power to DC power. As such, when the contactor **526** is in the first position **530**, the switch **510** can output DC power at the first output node **550**. In some implementations, the first output node **550** can be coupled to the auxiliary load **210** of the lighting system **200**. In this way, the switch **510** can provide DC power to the auxiliary load **210** when the contactor **526** is in the first position **530**.

(37) Still referring to FIGS. **6** and **7**, the switch **510** can include a second output node **570** coupled to the third terminal **524**. In this way, the switch **510** can output electrical power at the second output node **570** when the contactor **526** is in the second position **540**. More specifically, the switch **510** can output AC power at the second output node **570**. In some implementations, the second output node **570** can be coupled to both the light source **110** of the lighting system **200** and the auxiliary load **210** of the lighting system **200**. In this way, the switch **510** can provide AC power to both the light source **110** and the auxiliary load **210** when the contactor **526** is in the second position **540**.

(38) Referring now to FIGS. **8** and **9**, another system **600** for controlling operation of the lighting system **200** is provided according to example embodiments of the present disclosure. As shown, the system **600** can include a switch **610**. In some implementations, the switch **610** can include a first terminal **620**, a second terminal **622**, and a third terminal **624**. The switch **610** can include a contactor **626** coupled to the first terminal **620** and movable between a first position **630** and a second position **640**. When the contactor **626** is in the first position **630**, the contactor **626** can couple the first terminal **620** to the second terminal **622**. When the contactor **626** is in the second position **640**, the contactor **626** can couple the first terminal **620** to the third terminal **624**. As will be discussed below in more detail, the switch **610** can be coupled to the power source **160** and can be used to distribute electrical power to the lighting system **200**. A user can manipulate the position of the contactor **626** by toggling the switch **610**.

(39) In some implementations, the first terminal **620** can receive electrical power from the power source **160**, such as AC power. The AC power can be, for instance, 120V mains power or other suitable power. As mentioned above, the contactor **626** can be used to selectively couple the first

terminal **620** to the second terminal **622** or the third terminal **624**. More specifically, the second terminal **622** can receive the electrical power when the contactor **626** is in the first position **630**. The third terminal **624** can receive the electrical power when the contactor **626** is in the second position **640**.
(40) As shown, the switch **610** can include an output node **650** coupled to the second terminal **622** and the third terminal **624**. In some implementations, the switch **610** can include a power converter **660** coupled between the second terminal **622** and the output node **650**. The power converter **660** can be configured to convert alternating current power from the power source **160** to direct current power. The power converter **660** can include, for instance, a rectifier, one or more switching elements (e.g., transistors) and filters and/or other circuit components for converting AC power to DC power. As such, when the contactor **626** is in the first position **630**, the switch **610** can output DC power at the output node **650**. When the contactor **626** is in the second position **640**, the switch **610** can output AC power at the output node **650**.
(41) The system **600** can include a power circuit **680** in electrical communication with the switch **610** and both the light source **110** and the auxiliary load **210**. In some implementations, the power circuit **680** can be onboard the lighting fixture **100**. In alternative implementations, the power circuit **680** can be external to the lighting fixture **100**. The power circuit **680** can include, for instance, one or more switching elements (e.g., transistor) and/or other circuit components for routing DC power to the auxiliary load **210** or AC power to both the light source **110** and the auxiliary load **210**. As will be discussed below in more detail, the power circuit **680** can be configured to route DC power or AC power based on a position of the contactor **626**.
(42) When the contactor **626** is in the first position **630**, the power circuit **680** receives the DC power from the switch **610** and routes the DC power to the auxiliary load **210**. When the contactor **626** is in the second position **640**, the power circuit **680** receives the AC power from the power source **160** via the switch **610** and routes the AC power to both the light source **110** and the auxiliary load **210**. In this way, the auxiliary load **210** can receive DC power when the contactor **626** has been moved to the first position **630** to deactivate (e.g., power off) the light source **110**.
(43) While the present subject matter has been described in detail with respect to specific example embodiments thereof, it will be appreciated that those skilled in the art, upon attaining an understanding of the foregoing may readily produce alterations to, variations of, and equivalents to such embodiments. Accordingly, the scope of the present disclosure is by way of example rather than by way of limitation, and the subject disclosure does not preclude inclusion of such modifications, variations and/or additions to the present subject matter as would be readily apparent to one of ordinary skill in the art.

Claims

1. A switch, comprising: an output node coupled to a first terminal and a second terminal; and a contactor movable between the first terminal and the second terminal, wherein when the contactor is at the first terminal, the switch is configured to provide direct current power at the output node, wherein when the contactor is at the second terminal, the switch is configured to provide alternating current power at the output node, and wherein the switch comprises a power converter coupled between the first terminal and the output node.
2. The switch of claim 1, wherein when the contactor is at the first terminal, the power converter is configured to convert the alternating current power to the direct current power and provide the direct current power to the output node.
3. A system for controlling operation of a lighting system including a lighting fixture comprising a light source and an auxiliary load, the system comprising: a switch couplable to a power source for the lighting system, the switch movable between at least a first position and a second position, wherein when the switch is in the first position, the switch is configured to provide direct current

power to the auxiliary load, and wherein when the switch is in the second position, the switch is configured to provide alternating current power to both the auxiliary load and the light source.
4. The system of claim 3, wherein the switch comprises: a first terminal; a second terminal; a third terminal; a first output node coupled to the second terminal; a second output node coupled to the third terminal; and a contactor coupled to the first terminal and movable between the first position and the second position, the first terminal coupled to the second terminal when the contactor is in the first position, the first terminal coupled to the third terminal when the contactor is in the second position, wherein when the contactor is in the first position, the switch is configured to provide the direct current power at the first output node, and wherein when the contactor is in the second position, the switch is configured to provide the alternating current power at the second output node.
5. The system of claim 4, wherein the switch comprises a power converter coupled between the second terminal and the first output node.
6. The system of claim 5, wherein when the contactor is in the first position, the power converter is configured to convert the alternating current power to the direct current power and provide the direct current power to the first output node.
7. The system of claim 3, wherein the auxiliary load comprises a camera disposed within the lighting fixture of the lighting system.
8. The system of claim 3, wherein the auxiliary load comprises one or more sensors operable to sense one or more environmental parameters associated with a space in which the one or more sensors are located.
9. The system of claim 8, wherein the one or more environmental parameters comprise an amount of carbon monoxide within the space.
10. The system of claim 8, wherein the auxiliary load further comprises one or more control devices configured to control operation of the light source based, at least in part, on the one or more environmental parameters detected by the one or more sensors.
11. The system of claim 10, wherein the one or more control devices are configured to flash the light source at a predetermined frequency to indicate occurrence of an environmental condition within the space.
12. The system of claim 11, wherein the environmental condition includes at least one of a fire and a carbon monoxide leak.
13. The system of claim 4, further comprising a power circuit coupled between the switch and the auxiliary load.
14. The system of claim 13, wherein the power circuit is coupled between the switch and the light source.
15. The system of claim 14, wherein the power circuit is external to the lighting fixture, which is configured to accommodate the light source and the auxiliary load.
16. The system of claim 14, wherein the power circuit is disposed within the lighting fixture, which is configured to accommodate the light source and the auxiliary load.
17. A switch, comprising: a contactor movable between a first position and a second position; and a power converter coupled between the first position and a power circuit, wherein when the contactor is in the first position, the power converter is configured to convert alternating current power to direct current power and provide the direct current power to the power circuit, and wherein when the contactor is in the second position, the switch is configured to provide the alternating current power to the power circuit.
18. The switch as recited in claim 17, wherein the power circuit is configured to provide power to an auxiliary load of a light fixture.
19. The switch as recited in claim 17, wherein the power circuit is configured to provide power to an auxiliary load of a light fixture and a light source of a light fixture.