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(71) Applicant: **VKR Holding A/S**
2970 Hørsholm (DK)

(72) Inventors:
- **THOMSEN, Jan**
  2970 Hørsholm (DK)
- **COGGAN, Andrew James**
  2970 Hørsholm (DK)

(74) Representative: **Høiberg P/S**
Adelgade 12
1304 Copenhagen K (DK)

(54) BUILDING APERTURE COVERING SYSTEM COMPRISING A DRIVE SYSTEM COMPRISING A WAKE-UP UNIT CONFIGURED TO PROVIDE A WAKE-UP COMMAND AND METHOD OF PROVIDING AN AUTOMATIC FIRST ACTIVATION OF A RADIO COMMUNICATION CONTROL ARRANGEMENT OF A DRIVE SYSTEM

(57) The present disclosure relates to a building aperture covering system (20) comprising a drive system (1) for controlling a movable building aperture covering unit (5a-5c). The drive system (1) comprises an actuator (10) and an actuator control system (11) configured to control the actuator (10). The actuator control system (11) comprises a radio communication control arrangement (11b) comprising one or more radio communication controllers. The drive system comprises a rechargeable battery (12) configured to supply power to the radio communication control arrangement (11b) and the electrically powered actuator (10), and a photovoltaic panel (13) is connected so as to charge the rechargeable battery (12). A wake-up unit (2) is configured to provide a wake-up command (WUC). The radio communication control arrangement (11b) is configured to switch from a first low-power mode (M1) to a second activated mode (M2) in response to the wake-up command (WUC), so as to execute one or more radio communication tasks. The wake-up unit (2) is configured to receive electric power from the photovoltaic panel (13) while the radio communication control arrangement (11b) is arranged in the first low-power mode (M1), and the wake-up unit (2) is configured to provide the wake-up command (WUC) when one or more criteria is complied with. The criteria (THR_P, THR_E, TMR_THR) is based on the output from the photovoltaic panel (13), and the criteria (THR_P, THR_E, TMR_THR) is configured so as to provide that the wake-up command (WUC) is provided at a time (T_wuc) after the photovoltaic module provides output to the wake-up unit (2). The disclosure also relates to a transportation package and a method.

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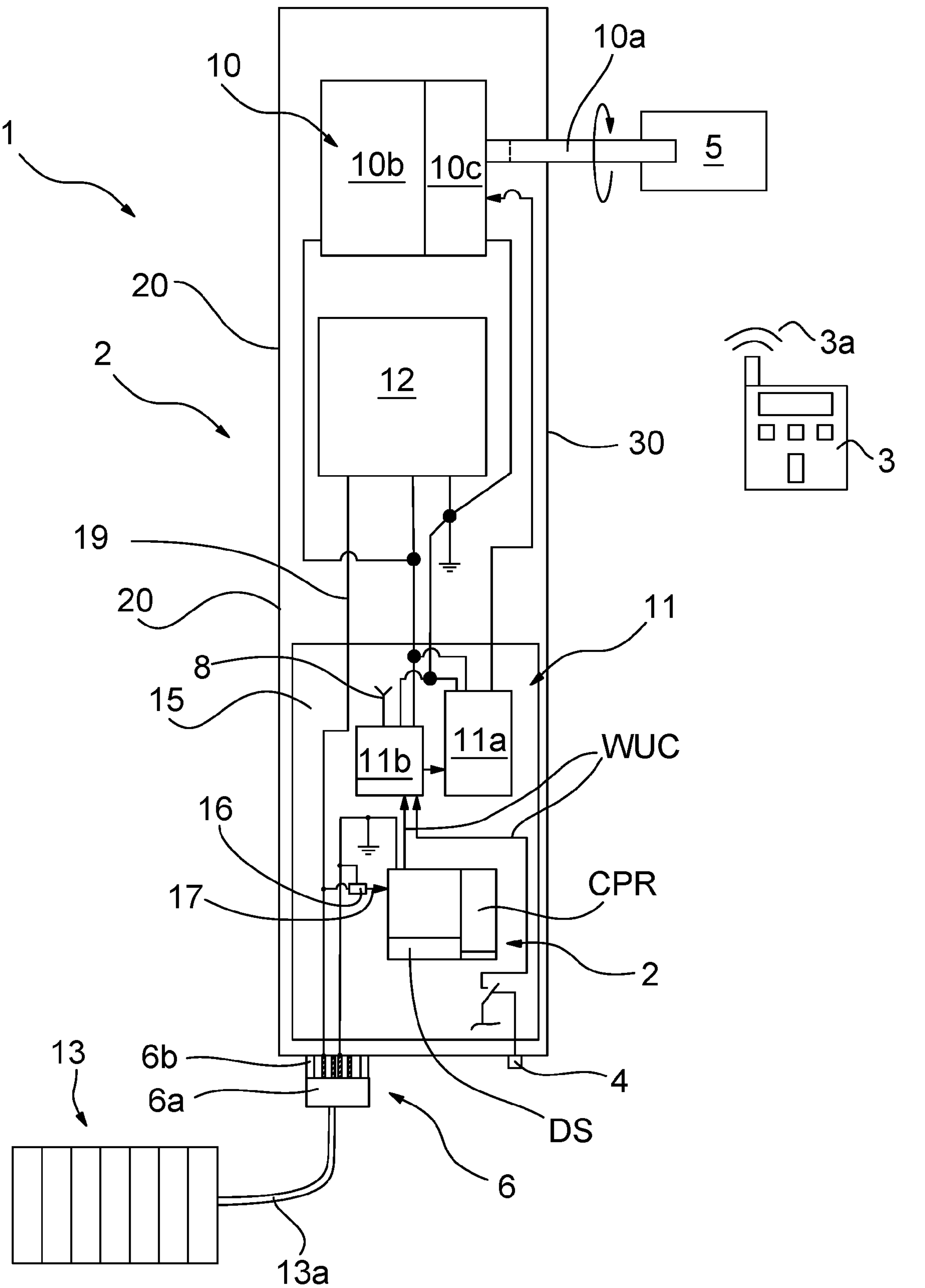
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WUC
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Fig. 1

Description

[0001] The present disclosure relates to a building aperture covering system, a transportation package and a method of providing an automatic first activation of a radio communication control arrangement.

Background

[0002] A building aperture covering system may comprise a movable building aperture covering unit. This movable covering unit may e.g. comprise a sun screening device such as a shutter, a blind or an awning for a window, or it may comprise a movable unit of a window such as a movable frame comprising an insulated glass unit that may be opened or closed for e.g. ventilation purposes.

[0003] Often, such movable covering units may be operated by means of a drive system at the window comprising an actuator. The drive system may comprise a rechargeable battery that may be recharged by a photovoltaic panel at the building aperture covering system, and the rechargeable battery may power an electrically powered actuator and one or more processors of the drive system, such as e.g. a radio communication control arrangement. The radio communication control arrangement listen for and receives radio signals from e.g. a remote control, and the drive system comprises a controller that operates the actuator based on the data of the received radio signals. The rechargeable battery is often pre-charged from the factory in order to ensure an operational battery already upon drive system installation at the window.

[0004] Such drive systems may be configured to be switched on upon installation at the building, e.g. by means of a physical "main switch/button" which is operated by a human installer to turn on among others the radio communication control arrangement. Hereby it is ensured that the radio communication control arrangement does not drain battery from the rechargeable battery before installation. Such a switch may however be space consuming and/or may be considered cost expensive. Also, such a switch may provide issues with regards to accessibility.

[0005] US 10,017,987 B2 suggests to detect power supply and cut-off periods of electricity supply from a photovoltaic cell by means of measurements, and data may be reset after a simulation of a sequence of power supply and cut-off periods of the electricity supply from the photovoltaic panel. Other documents, such as EP 2 567 055 B1 and US 11,205,921 B2 discloses other drive system solutions relating to operation of an actuator at a window.

[0006] The above mentioned disclosures may e.g. suffer from drawbacks relating to user friendliness and may moreover require a cost expensive and/or space consuming solution.

[0007] The present disclosure provides a user friendly yet power saving "first activation" solution for a drive system for a building aperture covering system. The present disclosure may additionally provide a cost efficient and/or space saving "first activation" solution for a drive system for a building aperture covering system.

Summary

[0008] The present disclosure relates, in a first aspect, to a building aperture covering system comprising a drive system for controlling a movable building aperture covering unit. The drive system comprises:

- an electrically powered actuator,
- an actuator control system configured to control the electrically powered actuator, wherein the actuator control system comprises a radio communication control arrangement comprising one or more radio communication controllers,
- a rechargeable battery configured to supply power to the radio communication control arrangement and the electrically powered actuator,
- a photovoltaic panel connected so as to charge the rechargeable battery,
- a wake-up unit configured to provide a wake-up command.

[0009] The radio communication control arrangement is configured to switch from a first low-power mode to a second activated mode in response to the wake-up command, so as to execute one or more radio communication tasks. The wake-up unit is configured to receive electric power from the photovoltaic panel while the radio communication control arrangement is arranged in the first low-power mode, and the wake-up unit is configured to provide the wake-up command when one or more criteria is complied with. The one or more criteria is based on the output from the photovoltaic panel, and the one or more criteria is configured so as to provide that the wake-up command is provided at a time after the photovoltaic module provides output to the wake-up unit.

[0010] The present disclosure provides a solution that may provide a first, automatic start up of the radio communication control arrangement after drive system installation. For example, the first low-power mode may be a factory setting mode.

[0011] A drive system for controlling a movable building aperture covering unit such as a blind, awning, shutter, window or the like may often comprise a rechargeable battery. This battery is often pre-charged from the factory to assure that the drive system works when installed in/at a building. The controller(s) of the actuator control system, such as the radio communication control arrangement, may be arranged so as to be powered by the rechargeable battery when in normal "active" mode. However, if set to run in "normal mode" from the factory/manufacturer, the controller(s) of the control system may drain the pre-charged battery before system installation so that the system does not work when installed. For example by "listening" for radio signals, which may generally not be necessary before installation and may also for other reasons not be desired. A system may e.g. be stored for more than 6 months or more than one or two years before system installation.

[0012] Therefore, according to embodiments of the present disclosure, controller/ controllers, such as one or more controllers of the radio communication control arrangement, may be arranged in the first low-power mode (which may e.g. be a so called sleep-mode), e.g. from factory, for power saving, and hence reduce usage of the power from the pre-charged battery. Here, for example "listening tasks" provided by the radio communication control arrangement and configured to register radio signals from e.g. a remote control may be unexecuted or significantly reduced, and hence power is saved when compared to when in the second activated mode.

[0013] In the second, activated mode, in embodiments of the present disclosure, listening for radio signals may be started up (upon entering the second mode), or may be provided more often than in the first low power mode.

[0014] Drive systems for controlling a movable building aperture covering unit such as a blind, awning, shutter, window or the like may often be installed at locations that may be hard to access, for example in roof windows or at windows at a location that is placed high above the building floor level. It may be unfortunate if a user after system installation may need to get physically close to the drive system to activate the drive system by hand, such as by means of a physical button/switch. For example because the system installer forgot activate the system during system installation.

[0015] The inventors have realized that for example providing a system that is designed so that an automatic first activation of the radio communication control arrangement the moment a photovoltaic panel is connected to the system may be undesired for a first activation scenario. The inventors have realized that the system may be exposed to e.g. factory testing, temporary system unpacking, general temporary exposure to light before system installation and/or the like which may cause situations where undesirable first automatic activation may occur if automatic first activation of the radio communication control arrangement is triggered the moment a photovoltaic panel is connected to the system. For example, the present inventors have found that briefly exposing the photovoltaic panel temporarily to sunlight or indoor "artificial"/electrically powered light when connected to the system should not automatically trigger the first start up of the system, since this may start a draining of the pre-charged rechargeable battery by the radio communication control arrangement that is not intended if the system is to be stored or saved again for later installation.

[0016] However, the present inventors have found that providing that a wake-up unit of the system that is configured to receive electric power from the photovoltaic panel while the radio communication control arrangement is arranged in the first low-power mode may be beneficial. The wake-up unit may hence be configured so as to first provide the wake-up command when one or more criteria is complied with. These criteria may be specifically configured/designed so that the wake-up command (WUC) is first provided at a time after an output from the photovoltaic module is registered. Thereby, temporary exposures of the photovoltaic panel to sunlight after it has been connected to the system will not trigger that the wake-up command is unintentionally provided during for example factory testing conditions, temporary unpacking and temporary operation and/or the like, or the risk of such unfortunate triggering may be significantly reduced.

[0017] The present disclosure may hence help to provide a solution where the risk of ending up with an uncharged battery upon system installation is reduced. Additionally, the present disclosure provide a user friendly solution where automatic/ autonomous, first activation is provided after system installation. Hence, the risk of needing that a user get close to the system after installation of the system in a building, such as at a window, to provide a first activation by means of e.g. an activation button or by means of another physical, manually performed activation solution at the system, may be reduced, thereby improving user experience and/or ease installation. It may also enable providing a faster and/or more easy installation.

[0018] The present disclosure may also provide a cost efficient solution enabling providing an automatic activation of the system.

[0019] The present disclosure may additionally or alternatively provide a solution where the photovoltaic module may be fully connected to the system from factory as the risk of undesired first system activation may be reduced due to the one or more criteria.

[0020] In one or more embodiments of the pre present disclosure, the wake-up unit may be configured so as to provide the wake-up command automatically based on the one or more criteria without human interaction, after the drive system has been installed at a building.

[0021] Hence, in the event that the system does not have a physical "wake-up" button for system activation (by pressing the button), or if the system comprises such a button, but that an installer has forgot to press it during system installation, the system can still provide the wake-up command of the system automatically. Hence, a user does not need to try to get in physical reach of the system after installation to activate the system to activate it. The user instead just needs to wait until the one or more criteria is complied with.

[0022] In one or more embodiments of the present disclosure, the one or more criteria comprises one or more predefined criteria. In one or more embodiments of the present disclosure, the one or more criteria comprises one or more test criteria. In one or more embodiments of the present disclosure, the one or more criteria comprises one or more predefined test criteria.

[0023] In one or more embodiments of the present disclosure, the wake-up-unit may be configured to provide initiation of the wake-up command so as to provide a first wake-up of the radio communication control arrangement from the first low-power mode.

[0024] In one or more embodiments of the present disclosure, the first low-power mode is a factory setting mode. The factory setting mode may be configured to provide energy conservation to conserve energy of the rechargeable battery when compared to the second mode.

[0025] Hence, the manufacturer may deliver the drive system with the control system the first low-power mode, such as a factory setting mode, where a very low or no power consumption is provided by the radio communication control arrangement from the pre-charged, rechargeable battery. Hence, first when the wake-up command (WUC) is initiated by the wakeup unit when the criteria are complied with, the second activated mode enters the second mode which may be more power consuming. For example in order to listen for/detect radio control signals.

[0026] In one or more embodiments of the present disclosure, the one or more criteria is configured so as to postpone the providing of the wake-up command based on the output from the photovoltaic panel to a time after the time output to the wakeup unit from the photovoltaic module has been provided.

[0027] Providing an intentional postponing of the wake-up command (WUC) to a time after output from the photovoltaic module is registered, but which is based on the actual output from the photovoltaic panel, may help to provide a reliable solution, for example in a cost efficient way. The postponing may provide a time delay relative to when the photovoltaic panel starts to generate and provide electric power.

[0028] In one or more embodiments of the present disclosure, the power output (mW) and/or energy output (mWh) from the photovoltaic module are configured to be used as a measure of when the criteria is complied with.

[0029] In one or more embodiments of the present disclosure, said one or more criteria comprises one or more thresholds relating to the power output and/or energy output from the photovoltaic module.

[0030] The present inventors have found that utilizing one or more thresholds, such as predefined thresholds, relating to the power output (mW) and/or energy output (mWh) from the photovoltaic module may help to provide a reliable solution where the risk of providing an unwanted/undesired activation of the radio communication control arrangement so that the controller enters the second activated mode, may be reduced.

[0031] The inventors have found that the power output (mW) and/or energy output (mWh) from the photovoltaic module may help to indicate when the level of energy provided by the photovoltaic panel should be of a magnitude and/or consistency indicating that it may be acceptable to assume that the device is installed at a building.

[0032] Utilizing at the power output (mW) and/or energy output (mWh) from the photovoltaic panel as at least a part of the criteria to obtain a measure of when to provide the wake-up command may help to induce a desired postponement/delay of the wake-up command until larger certainty to that the system is actually installed in a building and is to be set into normal operation, has been obtained.

[0033] In one or more embodiments of the present disclosure, said one or more criteria comprises at least one time delay threshold, such as a predefined time delay threshold.

[0034] The present inventors have found that providing a time delay threshold, such as a predefined time delay threshold may help to reduce the risk of an unwanted activation of the controller so that the controller enters the second activated mode. Utilizing a time delay threshold as a criteria of when to provide the wake-up command may help to obtain a desired postponement/delay of the wake-up command until larger certainty to that the system is actually installed in a building and is to be set into normal operation, has been obtained.

[0035] The time delay threshold may in some embodiments of the present disclosure be configured to postpone the wake-up command at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes from a power output from the photovoltaic module is registered.

[0036] In some embodiments of the present disclosure, the time delay threshold may be configured to provide a time delay relative to, such as defined from, the time output to the wakeup unit from the photovoltaic module has been provided. If the photovoltaic power stops providing power, the time may in further embodiments be reset.

[0037] In some embodiments of the present disclosure, the criteria comprises a plurality of criteria.

[0038] In some embodiments of the present disclosure, the criteria comprises one or more thresholds relating to the power output (mW) and/or energy output (mWh) from the photovoltaic module, and one or more further criteria comprising at least one time delay threshold, such as a predefined time delay threshold.

[0039] In some embodiments of the present disclosure, said one or more criteria comprises one or more thresholds relating to the power output and/or energy output from the photovoltaic module, and at least one time delay threshold, such as a predefined time delay threshold.

[0040] In some embodiments of the present disclosure, said one or more criteria comprises:

a threshold relating to the power output from the photovoltaic module,
a threshold relating to the energy output from the photovoltaic module, and at least one time delay threshold, such as a predefined time delay threshold, such as a time delay threshold configured to provide a time delay relative to, such as defined from, the time output to the wakeup unit from the photovoltaic module has been provided.

[0041] In one or more embodiments of the present disclosure, the criteria is configured so as to postpone/delay the wake-up command for at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes or at least 170 minutes from the time an output from the photovoltaic module has been provided, such as has been initiated.
[0042] The present inventors have found that providing a time delay may help to reduce the risk of providing an unwanted activation of the controller so that the controller enters the second activated mode. For example, the present inventors have found that a threshold of for example three hours may assure that the system may be arranged in a larger amount of geographical locations without unwanted activation.
[0043] This time delay may in embodiments of the present disclosure be implemented by means of one or more of:

- a power threshold,
- an energy threshold,
- a threshold related to a voltage from the photovoltaic module, such as a voltage above a certain voltage threshold,
- a measure, such as a time measure, of how long time the wake-up unit has been in operation,
- a threshold related to a current from the photovoltaic module, such as a current above a certain current threshold,
- a threshold related to an integration result of one or more outputs, and/or derivatives thereof, from the photovoltaic module. For example, the integration result may comprise a result relating to the energy output from the photovoltaic module since it started to provide power.

[0044] In one or more embodiments of the present disclosure, the wake-up unit may comprise a computer processor configured to process one or more parameters, wherein the one or more parameters are based on the output from the photovoltaic panel.
[0045] Providing a wake-up unit comprising a hardware processor, such as a micro processor or another type of computer processor, configured to process one or more parameters based on the Photovoltaic Module output enables providing a solution where a more precise determination and/or adaption of when the wake-up command should be provided.
[0046] Additionally or alternatively, it enables more advanced calculations and/or more advanced criteria that may be adapted to optimise when the wake-up command should be provided.
[0047] In other embodiments of the present disclosure, the wake-up unit may comprise a device, such as an energy storage device, which, when sufficiently charged by the photovoltaic panel, is configured to induce the wake-up command. This energy storage device may e.g. comprise a capacitor and/or or another suitable energy storage device. The energy storage device may be dimensioned so that when a certain charging level is obtained, the capacitor may activate circuitry, such as a switching device or the like, which causes the wake up command to be provided.
[0048] In one or more embodiments of the present disclosure, the criteria may require fulfilment one or more rules, such as one or more rules relating to one or more thresholds. The computer processor may in further embodiments be configured to determine, based on said processing, when the one or more rules is complied with.
[0049] This provides that the processor is able to determine, based on the one or more rules (may also be referred to as one or more conditions), such as one or more predefined rules, when the wake-up command should be provided. Hence, various rules relating to one or more of for example current, voltage, provided power, provided energy and/or the like, from the photovoltaic panel may be used as input for the processor to be able to determine when the rule(s) is/are complied with. Hence, for example, a rule may define that the power output (mW) or energy output (mWh) from the photovoltaic module must reach a threshold, for example within e.g. a predefined time period, before the wake-up command is provided.
[0050] In one or more embodiments of the present disclosure, the processing comprises one or more calculations, such as one or more calculations configured to be initiated with a time interval such as a predefined time interval.
[0051] This may help to provide reliable data for determining when to switch to the second mode. If it is provided with a predefined time interval, this may be a more power saving solution.
[0052] For example, an integration calculation, a power calculation and/or the like may be provided. This may in further embodiments be provided with a predefined interval in order to determine if the criteria is complied with. This may e.g. provide a less energy consuming solution. The time interval may e.g. in some embodiments of the present disclosure be between 0.05 second and 10 seconds, such as between 0.1 second and 5 seconds, for example between 0.2 second and 1 second. For example, four calculations may be provided per second.

[0053] In one or more embodiments of the present disclosure, the processing of one or more parameters may be based on one or more measurements of voltage and/or current supplied by the photovoltaic panel. In further embodiments, said system may comprise measurement circuitry for providing one or more of said measurements to the processor.

[0054] In one or more embodiments of the present disclosure, the processing may comprise determining, such as calculating, the power output and/or the energy output from the photovoltaic module.

[0055] In one or more embodiments of the present disclosure, the computer processor is configured to be powered by electric power output provided from the photovoltaic panel.

[0056] Hence, no power is consumed from pre-charged rechargeable battery in order to determine when the system should be started up by means of the wake-up signal. Thereby, undesired drainage of power from the pre-charged battery is reduced.

[0057] The processor may in embodiments of the present disclosure be solely powered by output from the photovoltaic panel, and not be powered by energy from the rechargeable battery.

[0058] In one or more embodiments of the present disclosure, the computer processor is configured to be unpowered and/or inactive when insufficient power is available from the photovoltaic panel, and the computer processor may be configured so as to provide said processing when sufficient power is available from the photovoltaic module.

[0059] In one or more embodiments of the present disclosure, content of one or more data storages comprising data relating to the output from the photovoltaic module may be configured to be deleted, reset or overwritten if a situation with insufficient power from the photovoltaic module has occurred.

[0060] Providing that the computer processor (CPR) is configured to be unpowered and/or inactive when insufficient power is available from the photovoltaic module, may e.g. provide an energy saving solution. Hence, the wake up unit may e.g. not need to use power from the rechargeable battery.

[0061] Additionally, it may in further embodiments of the present disclosure enable providing a solution where automatic deletion/reset or overwriting of one or more data in a data memory/storage, relating to the output from the photovoltaic module may be provided. For example, a stored maximum power value and/or a calculated energy value may be reset or deleted if power from the photovoltaic panel disappears or gets below a critical threshold. This may e.g. be used in order to assure that updated data related to output from the photovoltaic panel is used. Additionally or alternatively, it may provide that the start time of the processor may be used for determining when a time threshold, such as a predefined time threshold, is complied with.

[0062] In one or more embodiments of the present disclosure, the wake-up unit may be configured to provide an integration, such as an integration calculation, based on one or more output parameters of the photovoltaic panel.

[0063] In one or more embodiments of the present disclosure, the wake-up unit is powered by electric power provided from the photovoltaic panel. Hence drainage of power from the pre-charged battery is reduced.

[0064] In some embodiments, the integration may be provided by means of a capacitor that is gradually charged by the photovoltaic module. In other embodiments of the present disclosure, integration may be provided by means of calculation by means of a computer processor of the wake up unit. The result of this calculation may be stored and/or used for a one or more tests of if one or more of the criteria is/are complied with.

[0065] In one or more embodiments of the present disclosure, the drive system may furthermore comprises a button configured to/arranged to be pressed by a user, and wherein the wake-up command is configured to be provided if the button is pressed. The button may in embodiments of the present disclosure be a physical button.

[0066] Hence, an installer or user may press this button, and this manually define when the system should start up. Hence, the automatic providing of the wake up command by means of the wake up unit may be a backup feature in case the system is out of reach and the installer forgot to activate the system during installation to get the radio communication control arrangement into the second activated mode by pressing the button.

[0067] In some further embodiments, the switch from the first low-power mode to the second activated mode may be activated by means of software based on the input from the button. This may e.g. help to provide a space saving and/or cost efficient solution.

[0068] In other embodiments of the present disclosure, this button may however be omitted.

[0069] In one or more embodiments of the present disclosure, the criteria comprises one or more thresholds related to the output from the photovoltaic panel.

[0070] In one or more embodiments of the present disclosure, the wake-up unit and the radio communication control arrangement comprises separate units, such as separate processors, such as separate computer processors.

[0071] In one or more embodiments of the present disclosure, the wake-up unit and the radio communication control arrangement are separate processors, such as separate computer processors.

[0072] In one or more embodiments of the present disclosure, the wake-up unit and the radio communication control arrangement is arranged at a printed circuit board such as a common printed circuit board.

[0073] In one or more embodiments of the present disclosure, the radio communication control arrangement may be configured to use power from the rechargeable battery in the second activated mode.

[0074] In one or more embodiments of the present disclosure, the radio communication control arrangement may be configured to consume at least four times less, such as at least seven times less, such as at least nine times less energy from the rechargeable battery in the first low-power mode when compared to the energy consumption in the second mode. This may in further embodiments be the case when monitoring the power consumption over a predefined time period such as for example 1 minute, two minutes or three minutes or a longer period of time such as e.g. 30 minutes, 1 hour or 24 hours.

[0075] In one or more embodiments of the present disclosure, the radio communication control arrangement may be configured to use at least 5 times more, such as at least 8 times more power from the rechargeable battery in the second activated mode than used in the first low-power mode. This may in further embodiments be the case when monitoring the power consumption over a predefined time period such as for example 1 minutes, two minutes, three minutes, or a longer period of time such as e.g. 30 minutes, 1 hour or 24 hours. This may be tested in each mode.

[0076] In one or more embodiments of the present disclosure, the radio communication control arrangement may be configured to use less than 20 μA, such as less than 10 μA, such as less than 7 μA from the rechargeable battery in the first low-power mode. In one or more embodiments of the present disclosure, the radio communication control arrangement may be configured to use at least one μA, such as at least two μA, from the rechargeable battery in the first low-power mode. The voltage may in embodiments be between 2V and 7 V, such as between 3 V and 6V.

[0077] In one or more embodiments of the present disclosure, the radio communication control arrangement may be configured to be substantially turned off in the first low-power mode.

[0078] In one or more embodiments of the present disclosure, the actuator control system moreover comprises an actuator controller, wherein the actuator controller is configured to control the electrically powered actuator based on a predefined set of rules.

[0079] In one or more embodiments of the present disclosure, the actuator controller is configured to provide control of the electrically powered actuator based on radio signals received by means of the radio communication control arrangement.

[0080] In one or more embodiments of the present disclosure, the wake-up command (WUC) comprises or consists of an interrupt signal configured so as to cause one or more controllers of the radio communication control arrangement to switch to the second activated mode.

[0081] Such a solution may be very power saving and some data processors may be configured to have low or substantially no power consumption when in the first low-power mode, so that controller substantially only checks for if the interrupt is provided. Such a solution may be used in embodiments of the present disclosure.

[0082] In one or more embodiments of the present disclosure, the wake-up unit is moreover configured to provide charging control so as to control the charging of the rechargeable battery.

[0083] In one or more embodiments of the present disclosure, said charging control comprises a Maximum Power Point Tracking feature which when executed is configured to retrieve one or more output parameters from the photovoltaic panel and adapt a pulse width modulation of a boost converter based thereon.

[0084] In one or more embodiments of the present disclosure, the building aperture covering system comprises a sun covering device for a window, such as a blind, an awning or a shutter.

[0085] In one or more embodiments of the present disclosure, the building aperture covering system comprises a window such as a roof window and wherein the movable building aperture covering unit comprises a movable unit of the window comprising an insulated glazing.

[0086] In one or more embodiments of the present disclosure, the at least one photovoltaic power supply panel has a maximum output voltage that is below 10V DC, such as below 8V DC, for example below 6V DC, such as around 4.2V DC.

[0087] In one or more embodiments of the present disclosure, the photovoltaic panel comprises between 3 and 15 solar cells, such as between 4 and 10 solar cells (both end points included).

[0088] In one or more embodiments of the present disclosure, the at least one photovoltaic panel has a maximum output voltage that is at least 1.3 times lower, such as at least 2 times lower, for example at least 2.5 times lower than the maximum output voltage of the rechargeable battery, and wherein the drive system comprises a boost converter.

[0089] A boost converter may be configured to boost the voltage from the photovoltaic panel so as to charge the rechargeable battery.

[0090] In one or more embodiments of the present disclosure, the radio communication control arrangement:

- in the second activated mode is configured so as to execute one or more radio communication tasks, such as listening for radio signals from a remote control,
- in the first low-power mode is configured so that the one or more radio communication tasks is unexecuted or reduced.

[0091] In one or more embodiments of the present disclosure, the radio communication control arrangement, when in the second activated mode, is configured to enter a third sleep mode between execution of consecutive power consuming tasks.

[0092] In one or more embodiments of the present disclosure, the first low-power mode is a factory setting mode.

[0093] In one or more embodiments of the present disclosure, the overall surface area of the cells of the photovoltaic module is less than 0.1 m^2.

[0094] In one or more embodiments of the present disclosure, said rechargeable battery unit has a rated power between 5Wh and 50Wh, such as between 10 Wh and 35 Wh, such as between 14Wh and 26 Wh.

[0095] The rechargeable battery may in embodiments of the present disclosure comprise or be a a Lithium ion (Li-ion) battery, a Nickel Cadmium (NiCd), a Nickel- Metal Hydride (NiMH) Battery or the like.

[0096] In one or more embodiments of the present disclosure, a device comprises a housing enclosing said drive system.

[0097] In one or more embodiments of the present disclosure, a device comprises said movable building aperture covering unit and a housing enclosing said drive system.

[0098] The present disclosure relates, in a second aspect, to a transportation package comprising a building aperture covering system. This building aperture covering system may e.g. be a system as described above according to one or more embodiments. The building aperture covering system may be enclosed by the transportation package, and the radio communication control arrangement is arranged in said first low-power mode from factory while enclosed by said transportation package.

[0099] The transportation package may in embodiments of the second aspect be a disposable package, such as a package made from a e.g. such as a cellulose based transportation package material and/or a cardboard transportation package material.

[0100] In one or more embodiments of the second aspect, the wake-up unit may be configured to provide the wake-up command after the building aperture covering system has been unpacked from the transportation package and the one or more criteria is complied with.

[0101] In one or more embodiments of the second aspect, the photovoltaic panel may be pre-connected to the drive system in said transportation package. This may e.g. provide a more user friendly solution and/or help to reduce errors due to erroneous connection of the photovoltaic module at the installation site.

[0102] In one or more embodiments of the second aspect, the pre-connected photovoltaic panel may be arranged in the transportation package so as to be substantially unexposed to light such as sunlight or electrically powered light.

[0103] In one or more embodiments of the second aspect, the transportation package comprises a unit to be controlled by the actuator, such as an awning, a shutter, a blind or a window.

[0104] The present disclosure moreover relates, in a third aspect, to a window comprising one or more building aperture covering systems according to one or more of the previously described embodiments, which is installed so as to control a movable building aperture covering unit.

[0105] The present disclosure moreover relates, in a fourth aspect, relates to a device comprising a housing, wherein the device is configured to be installed at a building window, wherein the device comprises a building aperture covering system according to one or more of the previously described embodiments.

[0106] The present disclosure additionally relates, in a fifth aspect, to a method of providing an automatic first activation of a radio communication control arrangement of a drive system, after installation of the drive system at a building. The radio communication control arrangement comprises one or more radio communication controllers, and the radio communication control arrangement and the electrically powered actuator are configured to be powered by a rechargeable battery, wherein the rechargeable battery is configured to be charged by a photovoltaic panel. The radio communication control arrangement is configured to switch from a first low-power mode to a second activated mode in response to a wake-up command, so as to execute one or more radio communication tasks. The drive system comprises a wake-up unit providing the wake-up command so as to initiate the first activation of the radio communication control arrangement. The method comprises: installing the drive system, such as at a window, such as a roof window, so that the installed drive system is configured to control a movable building aperture covering unit, such as a blind, awning, shutter or window, of a building aperture covering system, by means of the electrically powered actuator,

> wherein the wake-up unit of the installed drive system receives electric power from the photovoltaic panel while the radio communication control arrangement is arranged in the first low-power mode, wherein the photovoltaic panel is arranged at the building aperture cover system,
>
> wherein the wake-up unit provides the wake-up command when one or more criteria is complied with, wherein the one or more criteria is based on output from the photovoltaic panel and wherein the criteria is configured so that the wake-up command is provided at a time after the photovoltaic module has started to provide the power to the wake-up unit.

[0107] In one or more embodiments of the fifth aspect, the drive system is provided to an installation site to be installed at a building, wherein the provided drive system is enclosed by a housing, and wherein the housing is arranged in a transportation package,

wherein the radio communication control arrangement is arranged in said first low-power mode from factory while enclosed by said transportation package,
wherein the drive system is unpacked from the transportation package and installed at the building, and
wherein the wake-up unit provides the wake-up command automatically based on the one or more criteria, without human interaction, after the unpacked drive system has been installed at the building.

[0108] In further embodiments, the transportation package may e.g. be a transportation package as described above and/or below.

[0109] In one or more embodiments of the fifth aspect, the photovoltaic module is pre-connected to the drive system in said transportation package.

[0110] In one or more embodiments of the fifth aspect, the transportation package moreover encloses the movable building aperture covering unit such as an awning, shutter, blind or window.

[0111] In one or more embodiments of the fifth aspect, the radio communication control arrangement consumes energy from the rechargeable battery in the first low-power mode.

[0112] In one or more embodiments of the fifth aspect, the energy consumption may be less than 20 μA, such as less than 10 μA, such as less than 7 μA from the rechargeable battery in the first low-power mode,

[0113] In one or more embodiments of the fifth aspect, the radio communication control arrangement is configured to be substantially turned off in the first low-power mode.

[0114] In one or more embodiments of the fifth aspect, the radio communication control arrangement may be configured to use at least 5 times, such as at least 8 times more power from the rechargeable battery in the second activated mode than used in the first low-power mode. This may be tested by monitoring the power consumption over a predefined time period such as for example 1 minute, two minutes or three minutes or a longer period of time such as e.g. 30 minutes, 1 hour or 24 hours, in each mode.

[0115] In one or more embodiments of the fifth aspect, the drive system is retrofitted onto an existing, installed window.

[0116] In one or more embodiments of the fifth aspect, the first low-power mode is a factory setting mode, such as a factory setting mode for energy conservation to conserve energy of the rechargeable battery.

[0117] In one or more embodiments of the fifth aspect, the method is provided at a building aperture covering system according to one or more embodiments described above, e.g. in relation to the first aspect and/or below in e.g. one or more items or one or more claims.

Figures

[0118] Aspects of the present disclosure will be described in the following with reference to the figures in which:

fig. 1 : illustrates a building aperture covering system according to embodiments of the present disclosure,

fig. 2 : illustrates an operation of a wake-up unit based on output from a photovoltaic module, according to embodiments of the present disclosure,

fig. 3 : illustrates an operation of a wake-up unit based on output from a photovoltaic module, according to further embodiments of the present disclosure,

fig. 4 : illustrates an operation of a wake-up unit based on voltage from a photovoltaic module, according to embodiments of the present disclosure,

fig. 5 : illustrates an operation of a wake-up unit based on a predefined time delay, according to embodiments of the present disclosure,

fig. 6 : illustrates a flow chart relating to an operation of a wake-up unit, according to embodiments of the present disclosure,

fig. 7 : illustrates a building aperture covering system, according to further embodiments of the present disclosure,

fig. 8 : illustrates schematically a boost converter controlled by means of a charging controller that may be the same controller as a controller of a wake-up unit, according to embodiments of the present disclosure,

figs. 9-13 : illustrates a building aperture covering system comprising a drive system for controlling a movable building aperture covering unit, according to various embodiments of the present disclosure, and fig. 14 : illustrates schematically a transportation package comprising a building aperture covering system, according to embodiments of the present disclosure.

Detailed description

[0119] Fig. 1 illustrates schematically a building aperture covering system 20 according to various embodiments of the present disclosure.

[0120] In fig. 1, the building aperture covering system 20 comprises a drive system 1 for controlling, such as moving, a movable building aperture covering unit 5. The movable building aperture covering unit 5 may e.g. be or comprise a sun screen such as a blind (for example a roller blind or a venetian blind), a shutter, an awning or the like, e.g. for shading purpose. The movable building aperture covering unit 5 may in other embodiments of the present disclosure comprise a movable unit of a window, such as a movable frame part, for example a movable sash comprising an insulated glass unit. Various embodiments hereof are disclosed in more details further below.

[0121] The drive system is in fig. 1 enclosed in a common housing 30, such as a plastic or metal housing.

[0122] The drive system 1 may be preinstalled at, such as integrated in, a building aperture cover such as a window, for example a roof window, for installation at a building. Alternatively, the drive system 1 may be configured to be retrofitted onto a pre-installed building aperture cover, such as a window.

[0123] The drive system 1 comprises an electrically powered actuator 10. This actuator 10 may in some embodiments of the present disclosure comprise an electrical motor and a movable actuator unit 10a such as a shaft, a chain actuator, a spindle and/or the like which is configured to be operated by the electrical motor and which is directly or indirectly connected to the movable building aperture covering unit 5 so as to move the movable building aperture covering unit 5.

[0124] The electrically powered actuator 10 may also in some embodiments comprise a gear arrangement 10c such as a reduction gear. The motor 10a may hence operate the movable actuator unit 10a through/by means of the gear arrangement 10c.

[0125] The drive system 1 moreover comprises an actuator control system 11 configured to control the electrically powered actuator 10. The actuator control system 11 may comprise one or more data processing units 1 1a, 11b, such as one or more micro controllers for providing various tasks in the control of the electrically powered actuator 10.

[0126] The actuator control system 11 may comprise one or more data processing units 11b providing a radio communication control arrangement 11b. The data processing arrangement 1 1b may hence comprise one or more radio communication controllers configured so as to receive radio command signals 3a from a remote control.

[0127] The radio command signals 3a comprises command data configured, when received by the radio communication control arrangement 11b, to be extracted and the actuator control system 11 is configured to control the electrically powered actuator 10 based on the received command data of the radio command signals 3a.

[0128] Actuator control system 11 may in embodiments of the present disclosure comprise one or more dedicated actuator controllers 11a configured to provide the actuator control, and this/these dedicated actuator controller(s) 11a may comprise one or more hardware processors that is different from the processing unit(s) of the processing unit(s) 11b of the radio communication control arrangement. The dedicated actuator controller 11a may provide control of the actuator 10 based on a predefined set of rules that may be stored in a data storage (not illustrated) of the system 1.

[0129] The radio control arrangement 11b and the actuator controller 11a may in other embodiments of the present disclosure be the same integrated processing unit such as a common hardware data processor.

[0130] The drive system 1 moreover comprises a rechargeable battery 12. This battery is configured to supply electric power to the radio communication control arrangement 11b and the electrically powered actuator 10 so as to power these. If the actuator control system 11 comprises a plurality of data processors 11a, 11b, the rechargeable battery 12 may be configured to power these.

[0131] The rechargeable battery may in embodiments of the present disclosure comprise or be a Lithium ion (Li-ion) battery, a Nickel Cadmium (NiCd), a Nickel- Metal Hydride (NiMH) Battery or the like.

[0132] A photovoltaic panel 13 is connected so as to charge 19 the rechargeable battery 12.
The photovoltaic panel 13may in embodiments of the present disclosure be considered a part of the drive system. In other embodiments, it may be considered as not being part of the drive system 1.

[0133] The photovoltaic panel 13 is connected to the battery 12 by means of a connector arrangement 6 such a plug 6a, socket 6b solution and one or more wires 13a. In other embodiments, more than one photovoltaic panel 13 (not illustrated) may be connected by a plug to the system 1 in order to provide power to recharge the battery 12.

[0134] The photovoltaic power supply panel 13 may in some embodiments of the present disclosure have a maximum output voltage that is below 10V DC, such as below 8V DC, for example below 6V DC, such as around 4.2V DC.

[0135] The photovoltaic panel 13 may in embodiments of the present disclosure comprise between 3 and 15 solar cells, such as between 4 and 10 solar cells (both end points included).

[0136] In some embodiments of the present disclosure, the overall surface area of the cells of the photovoltaic module may be less than 0.1 m^2, such as less than 0.05 m^2.

[0137] In some embodiments, the photovoltaic panel 13 may be arranged locally at the building aperture covering system 20. For example, the photovoltaic panel 13 may be e.g. attached to:

- a housing,
- a frame part,
- a cover, or
- in a rail (see e.g. fig. 9)

of the building aperture covering system 20.

[0138] In other embodiments of the present disclosure, the photovoltaic panel 13 may be arranged locally at the building aperture covering system 20by being arranged at or integrated in the drive system housing 30. In still further embodiments of the present disclosure, the photovoltaic panel 13 may be arranged locally at the building aperture covering system 20 by being arranged at the movable building aperture covering unit 5.

[0139] In one or more embodiments of the present disclosure, the rechargeable battery 12 may have a rated (maximum) power between 5Wh and 50Wh, such as between 10 Wh and 35 Wh, such as between 14Wh and 26 Wh.

[0140] The radio communication control arrangement 11b is configured to switch from a first low-power mode to a second activated mode in response to the wake-up command WUC. In the second activated mode, the radio communication control arrangement 11b is configured so as to execute one or more radio communication tasks. This may in some embodiments at least comprise "listening tasks" provided by the radio communication control arrangement 11b and configured to register radio signals 3a from e.g. a remote control.

[0141] An antenna 8 is connected to the radio communication control arrangement 11b and is configured to receive the signal(s) 3a. The antenna may e.g. be arranged at a printed circuit board 15 together with the radio communication control arrangement 11b.

[0142] It is to understood that the radio communication control arrangement 11b may be configured to receive radio signals according to one or more protocols. For example, Zigbee, Bluetooth, 5G, a 802.11 protocol such as a 802.11g, 802.1 1a, a 802.11b and/or the like.

[0143] In some embodiments, the radio communication control arrangement 11b may be configured to receive radio signals according to a single protocol. In other embodiments of the present disclosure, the radio communication control arrangement 11b may be configured to receive radio signals according to a plurality of different protocols, and hence one or more antennas may be provided for this purpose. It is understood that one communication protocol may be used for receiving command signals 3a, while another communication protocol may be used for e.g. wireless firmware update.

[0144] The drive system 1 moreover, according to embodiments of the present disclosure, comprises a wake up unit 2. The wake-up unit 2 is configured to provide a wake-up command WUC.

[0145] The wake-up unit 2 is configured to receive electric power from the photovoltaic panel 13 while the radio communication control arrangement 11b is arranged in the first low-power mode. Hence, the wake up unit 2 does not use power from the rechargeable battery, but is instead powered "directly" by the power output from the photovoltaic panel 13.

[0146] According to embodiments of the present disclosure, the wake-up unit 2 is configured to provide the wake-up command WUC when one or more criteria is complied with. In one or more embodiments of the present disclosure, the one or more criteria comprises one or more predefined criteria. In one or more embodiments of the present disclosure, the one or more criteria comprises one or more test criteria. In one or more embodiments of the present disclosure, the one or more criteria comprises one or more predefined test criteria.

[0147] The one or more criteria is based on the output from the photovoltaic panel 13, and the one or more criteria is configured so as to provide that the wake-up command is provided at a time after the photovoltaic module provides output to the wake-up unit.

[0148] The wake-up unit (2) may hence be configured so as to provide the wake-up command WUC automatically based on the one or more criteria without human interaction, after the drive system (1) has been installed at a building. Hence a "first activation" after system installation may be provided so that the radio communication control arrangement 11b e.g. starts to listen for command signals 3a.

[0149] The wake-up unit 2 may be configured to provide initiation of the wake-up command WUC so as to provide a first wake-up of the radio communication control arrangement from the first low-power mode. The first low-power mode may in some embodiments be a factory setting mode.

[0150] The rechargeable battery 12 may be pre-charged from the factory to assure that the drive system works when installed in/at a building, and the first low-power mode may be configured so as to ensure that the radio communication control arrangement 1 1b only uses very little or no of the energy of the pre-charged battery.

[0151] In some embodiments of the present disclosure, the radio communication control arrangement 11b, such as a data processing unit of the arrangement 15 may be configured to use less than 20 μA, such as less than 10 μA, such as less than 7 μA from the rechargeable battery 12 in the first low-power mode, or it may be configured to be substantially turned off in the first low-power mode. This may be continuous or periodical power consumption. The voltage may in embodiments be between 2V and 7 V, such as between 3 V and 6V.

[0152] In some embodiments of the present disclosure, the radio communication control arrangement may be configured to consume at least four times less, such as at least seven times less, such as at least nine times less energy from the rechargeable battery in the first low-power mode M1 when compared to the energy consumption in the second mode M2. This may be when monitoring the power consumption over a predefined time period such as for example 1 minute, two minutes or three minutes or a longer period of time such as e.g. 30 minutes, 1 hour or 24 hours, in the respective mode M1, M2.

[0153] In some embodiments of the present disclosure, the radio communication control arrangement may be configured to use at least 5 times, such as at least 8 times more power from the rechargeable battery in the second activated mode M2 than used in the first low-power mode M1. This may be the case when monitoring the power consumption over a predefined time period such as for example 1 minute, two minutes or three minutes or a longer period of time such as e.g. 30 minutes, 1 hour or 24 hours in the respective mode M1, M2.

[0154] The first low-power mode M1may hence, in embodiments of the present disclosure, be a factory setting mode M1 which is configured to provide energy conservation to conserve energy of the rechargeable battery when compared to the second mode M2.

[0155] In some embodiments of the present disclosure, the wake-up command WUC may comprise or consists of an interrupt signal configured so as to cause one or more controllers of the radio communication control arrangement 11b to switch to the second activated mode M2. Hence, the first low-power mode may be a sleep mode.

[0156] It is to be understood that the radio communication control arrangement 1 1b may be configures to that the wake-up command WUC provides a first start up from a first the first low-power mode M1, which may be a factory setting. Hence, after this, the radio communication control arrangement 11b may be configured so as to not enter the first low-power mode again before some special criteria are complied with. For example by providing a special user input or the like, e.g. by means of a button or the like.

[0157] However, the radio communication control arrangement, when in the second activated mode M2, may in some embodiments of the present disclosure be configured to enter a third sleep mode (See SM3 of fig. 2 - lowermost CGC graph) between execution of consecutive power consuming tasks, such as between two time periods where listening for a radio signal 3a may be provided. This time period may e.g. be a predefined time period.

[0158] During listening LI for a radio signal 3a, the consumption of power from the battery is larger than when in the intermediate third sleep mode SM3.

[0159] In some embodiments, the power consumption from the battery may be larger in the third sleep mode SM3 when compared to the power consumption in the first low-power mode M1. In other embodiments, the power consumption from the battery in the third sleep mode SM3 may be substantially identical with the power consumption in the first low-power mode M1.

[0160] In embodiments of the present disclosure, the wake-up unit 2 comprises one or more computer processors CPR. This processor(s) CPR is configured to process one or more parameters which is/are based on output from the photovoltaic panel. The computer processor may be a hardware processor such as a micro processor or another type of computer processor,

[0161] In other embodiments of the present disclosure (not illustrated), however, the wake-up unit 2 may comprise a device, such as an energy storage device. The energy storage device may be configured to be charged by the photovoltaic panel 13, and configured to induce the wake-up command WUC. This energy storage device may e.g. comprise a capacitor and/or or another suitable energy storage device. The energy storage device may be dimensioned so that when a certain charging level of the energy storage device (that in some embodiments may be a criteria for when the wake up command WUC should be provided) is obtained/provided, the energy storage device may activate circuitry, such as a switching device or the like, which causes the wake up command WUC to be provided. In this embodiment, no computer processing may be provided.

[0162] The computer processor CPR of the wake-up unit 2 may be configured to determine, based on said processing, when one or more rules/conditions is complied with.

The said criteria for when the wake up command WUC should be provided may hence require fulfilment of the one or more rules, such as one or more rules relating to one or more thresholds.

[0163] For example, the processing provided by the processor CPR may comprise one or more calculations, such as one or more calculations configured to be initiated with a time interval such as a predefined time interval. For example, an integration calculation, a power calculation and/or the like may be provided with a predefined interval in order to determine if the criteria is complied with. The time interval may e.g. in some embodiments of the present disclosure be between 0.05 second and 10 seconds, such as between 0.1 second and 5 seconds, for example between 0.2 second and 1 second. For example, four calculations may be provided per second.

[0164] In one or more embodiments of the present disclosure, the drive system may comprise measurement circuitry 16, 2 configured to provide 17 one or more measurements to the processor relating to the output from the photovoltaic module. The measurement circuitry may e.g. be configured to measure the current I_PV and/or voltage U_PV provided by the photovoltaic panel.

[0165] The processing by the processor CPR may e.g. be configured to process one or more parameters that is/are based on one or more measurements of the voltage U_PV and/or current I_PV supplied by the photovoltaic panel 13.

[0166] For example, in some embodiments of the present disclosure, the processing provided by the computer processor of the wake up unit may comprise determining, such as calculating, the power output PV_mW and/or the energy output PV_mWh from the photovoltaic module 13.

[0167] The computer processor CPR may be is configured to be powered by electric power output provided from the photovoltaic panel. Hence, no power is consumed from pre-charged rechargeable battery in order to determine when the system should be started up by means of the wake-up signal.

[0168] The processor CPR may in embodiments of the present disclosure be solely powered by output from the photovoltaic panel, and not be powered by energy supplied from the rechargeable battery.

[0169] The computer processor CPR may in embodiments of the present disclosure be configured to be unpowered and/or inactive when insufficient power is available from the photovoltaic module.

[0170] On the other hand, when sufficient power is available from the photovoltaic module 13, the computer processor CPR starts up and provides the processing.

[0171] In some embodiments of the present disclosure, content of one or more data storages DS comprising data relating to the output from the photovoltaic panel, such as one or more of panel 13 voltage PV_U, panel 13 current, PV_I, panel 13 power supply PV_P and/or panel energy supply PV_E, from the photovoltaic module may be configured to be deleted, reset or overwritten if a situation with insufficient power from the photovoltaic module has occurred. For example, during night, or if the system 1 is re-packed in a transportation package, or the like, this scenario may happen and hence help to assure that "old"/obsolete data in a data storage DS is not used by the wake-up system for determining if the one or more criteria is/are complied with.

[0172] For example, if the system 1 is temporarily removed from a transportation package so that a user can see the building aperture cover comprising the drive system 1 or if a quality check is provided and/or the like, it may be desired that this does not trigger the wake up command WUC.

[0173] The photovoltaic module 13 may provide power to the wake-up unit 2 while the system 1 is unpacked (if e.g. connected 6 after unpacking or if pre-connected 6 in the package). But when the system then is repacked in the transportation package, the photovoltaic module does not provide power to the processor anymore, and hence, any data that may be stored in a data storage, such as calculated power PV_P, energy PV_E, info on voltage PV_U and/or current PV_I, or the like, may be deleted. Hence, this data that may be considered obsolete upon system installation will not be used for determining if the wake up command should be provided.

[0174] Another example, may be that night-time with no/significantly reduced sunlight and/or reduced artificial, electrically powered light, may provide that the photovoltaic module 13 provides insufficient power, thereby resulting in that the wake-up unit processor CPR get inactive. Hence, this may provide/result in that data that may be considered obsolete the next day may be deleted automatically from the data storage DS.

[0175] Hence, in one or more embodiments of the present disclosure, the one or more criteria related to the output from the photovoltaic panel 13 may be configured so as to postpone (see also Td of fig. 2 and/or 3) the providing of the wake-up command WUC based on the output from the photovoltaic panel to a time after the time when output to the wakeup unit from the photovoltaic module has been provided/initiated.

[0176] Fig. 1 moreover illustrates a further embodiment of the present disclosure wherein the drive system 1 comprises a button/switch 4 configured to be pressed by a user. The/a wake-up command WUC is configured to be provided if the button 4 is pressed. If for example an installer forget to press the button/switch 4 to obtain a first start up from factory mode/setting, the wake-up unit 2 however will still, automatically, provide the wake up command WUC when the criteria are complied with. This may in some embodiments be provided as a command/input to the wakeup unit, which may based thereon induce the wakeup command WUC, or it may on other embodiments, as illustrated in fig. 1, be provided directly to the controller 11b and/or 11a. At least in the latter case (directly to the controller), the command from the button/switch 4 may comprise or consists of an interrupt signal configured so as to cause one or more controllers of the radio communication control arrangement 11b to switch to the second activated mode M2.

[0177] The switch/button 4 may in some embodiments of the present disclosure be a space saving button/switch that merely provide an input when pressed (and e.g. in some embodiments, not when unpressed/unactivated), and the switch from the first to the second mode may hence so to say be software activated based on the input from the switch 4. The button 4 may hence, in some embodiments, not be a "main switch" where a continuous, galvanic connection to the rechargeable battery, one or more controllers and/or the like is established when arranged in "on" mode.

[0178] Fig. 2 illustrates schematically three graphs according to embodiments of the present disclosure.

[0179] Fig. 2 comprises an uppermost scenario example graph SCG, a lowermost communication control arrangement operation graph CCG and a mode example graph MG placed between the uppermost SCG and lowermost examples CCG.

[0180] The uppermost example SCG illustrates the power output PV_P over time t from the photovoltaic module 13, e.g. measured/defined in mW (milliwatt). The value over time of the power output PV_P may e.g. be calculated by a wake up unit 2 processor CPR (see fig. 1).

[0181] Moreover, the uppermost example SCG moreover illustrates the energy output PV_E over time t from the photovoltaic module 13, e.g. measured/defined in mWh (milliwatt-hours). The value over time of the energy output PV_E may e.g. be calculated by a wake-up unit 2 processor CPR (see fig. 1), for example by an integration calculation such as integrating the power PV_P.

[0182] At time T0a, the photovoltaic module starts to generate power PV_P. This may be caused by e.g. the system 1 being installed at a window and hence the photovoltaic panel is subjected to light. As can be seen, the power output PV_P gradually increases until a peak time, PET, after which the power output PV_P decreases again, e.g. due to less energy in the light such as sunlight.

[0183] As can be seen, the energy output/accumulated energy PV_E provided by the photovoltaic panel 13 flattens when the photovoltaic panel 13 stops providing power.

[0184] Two criteria THR_P and THR_E, being thresholds, are based on/related to the output from the photovoltaic panel. The first threshold THR_P relates to a minimum power output PV_P that should be provided by the photovoltaic panel 13 before the criteria is fulfilled.
The second threshold THR_E relates to a minimum energy output PV_E that should be provided by the photovoltaic panel 13 before the criteria is fulfilled.

[0185] As can be seen the energy output PV_E does fulfil (at time t1) the energy threshold criteria THR_E, as the energy output PV_E from the photovoltaic module 13 is above the threshold THR_E (within the time Tpe measured from time T0a that the photovoltaic module provides power). However, the power output PV_P does not fulfil the power threshold criteria THR_P as the power output from the photovoltaic module does not get above the threshold THR_P (within the time Tpe the photovoltaic module provides power). Accordingly, the wake up command WUC is not provided.

[0186] A time after, at time T0b, the photovoltaic module starts again to provide power PV_P. At time t2, the power output PV_P from the photovoltaic panel/module 13 reaches the power threshold THR_P, and hence this criteria gets fulfilled. At time t3, the energy output from the photovoltaic panel 13 reaches the energy threshold THR_E. Hereby, both thresholds THR_P and THRE_E are complied with, and the wake-up unit at the time t3, T_wuc triggers the wake up command WUC.

[0187] It is noted that it may not be required that both thresholds THR_P and THRE_E are complied with simultaneously, the power PV_P may have been failed below the threshold THR_P again before the threshold THR_E is complied with. Hence, the power threshold THR_P may be tested up against a stored, registered maximum power threshold (See "MAX_P" described further below). which may be saved in a data storage DS (see fig. 1). As can be seen in the graph MG of fig. 2, the wake up command WUC provided at time T_wuc result in that the radio communication control arrangement 11b switch from the first low-power mode M1 to the second activated mode M2.

[0188] As can be seen in the lowermost graph, this trigger the communication control arrangement to enter the active operation mode M2. In this example, this active mode M2 comprises that the communication control arrangement 1 1b starts listen LI for control signals 3a with a predetermined time interval. Between listening LI, the communication control arrangement 11 may be configured to be put into a third, further sleep mode SM for power saving.

[0189] Before the wake-up command time T_wuc, it can be seen in the lowermost graph that the communication control arrangement 11b, according to embodiments of the present disclosure, may not listen for radio signals. Hence, the radio communication task relating to listening LI for radio signals is unexecuted in the first mode M1, and activated in the second mode M2.

[0190] In other embodiments of the present disclosure (not illustrated), the radio communication task relating to listening LI for radio signals may be reduced in the first mode M1 when compared to the second mode M2. Hence, e.g. the time the communication control arrangement 11b may in the third sleep mode SM3 may be significantly longer, such as e.g. more than 10 times, such as more than 20 times or more than 100 times longer in the first mode than in the second mode M2. Hence, in this embodiment, the radio communication task relating to listening LI for radio signals is reduced in the first mode M1 when compared to the second mode M2.

[0191] As can be seen from fig. 2, the criteria, in this case comprising thresholds THR_P THR_E, is configured so as to postpone (time td) the wake-up command WUC relative to the start T0b of when the photovoltaic panel provides power. This provides that a first start up after system 1 installation is first provided when the output from the photovoltaic panel indicates that the drive system has been finally installed at a building such as at or in a window.

[0192] The time delay Td may in embodiments of the present disclosure be at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes or at least 170 minutes from the time 0b an output from the photovoltaic module 13 has been provided, such as has been initiated. This may e.g. be controlled based on designing the criteria according to the specifications of the photovoltaic module and/or based on experimental data.

[0193] Fig. 3 illustrates schematically three graphs according to embodiments of the present disclosure, relating to usage of a predefined time delay Td as a trigger criteria. An uppermost scenario example graph SCG, and a lowermost mode example graph MG. The CGC graph as in fig. 2 is omitted in fig 2, but it is understood that the radio communication control arrangement 11b may be configured to run in the second mode M2 as e.g. illustrated in the CGC graph of fig. 2.

[0194] In fig. 3, three criteria, may also be called trigger criteria are provided.

Firstly the uppermost example SCG illustrates, as in fig 2, the power output PV_P over time t from the photovoltaic module 13, e.g. measured/defined in mW (milliwatt). The uppermost example SCG moreover illustrates the energy output PV_E over time t from the photovoltaic module 13, e.g. measured/defined in mWh (milliwatt-hours).

[0195] As can be seen, the photovoltaic panel/module 13 starts generating power at the time T0a. At t1 the power criteria THR_P is complied with, and at t2, the energy criteria THR_E is complied with. However, as can be seen, this may still not trigger the wake up command, since a predefined time delay Td has not been complied with.

[0196] In fig. 2, the time delay Td was provided by means of the power and energy thresholds THR_P and THR_E alone. In fig. 3, a predefined time delay Td threshold TMR_THR has been provided, and provides a criteria comprising a predetermined time threshold that needs to be complied with before the wake-up command WUC is allowed to be provided.

[0197] At time T0b, e.g. the next day or after system installation, the photovoltaic module starts generating power again. Here, at t3 the power criteria THR_P is complied with, and at t4, the energy criteria THR_E is complied with. However, the wake up command is first provided at time t5, T_wuc, when the time threshold TMR_THR, i.e. the predefined time delay Td has been complied with. This time delay may e.g. be counted based on a start time that is registered by measurement or by counting "active time" from start-up of the wake up controller. This may be provided by the wake-up controller 2.

[0198] The inventors have provides some simulations based on data from different geographical locations and installation scenarios:

- Seattle north roof pitch 23°
- Hamburg north roof pitch 45°
- Paris north roof pitch 45°

[0199] Based on this, the inventors have found the following trigger levels for the wake up command in Table 1 below to be relevant/acceptable, according to some embodiments of the present disclosure.

Table 1 - Trigger levels/criteria

Trigger levels	Max charge power (THR_P)	max charge energy per day (THR_E)	Run time (predefined time delay Td)
Indoor	15mW	60m Wh	3h
Outdoor	45mW	180mWh	3h

[0200] As can be seen, the above table provides two different settings for indoor and outdoor, respectively. "Indoor" may comprise the situation where the photovoltaic panel 13 is configured to be arranged and utilized indoor in a building, and hence receives sunlight through a window pane. This may e.g. comprise the situation of an interior blind, interior curtain or the like for a window.

[0201] "Outdoor" may comprise the situation where the photovoltaic panel 13 is configured to be arranged outdoor, and hence receives sunlight "directly" without the light first being "filtered" by a an insulated glass unit. This may e.g. cover situations such as for a shutter, an actuator for opening a window and/or the like.

[0202] The values in table one may result in that the wake up unit may not, sometimes, at some locations with low energy in sunlight, provide the wake up command at some few days each year, but the alternative may be that there may be a risk of undesired first activation of the radio communication control arrangement 11b.

[0203] It is understood, however that the suggested settings in table 1 may naturally be adapted/changed in further embodiments of the present disclosure.

[0204] In some embodiments, the predefined time delay Td may be at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes from a power output from the photovoltaic module is registered/initiated T0a, T0b. In some embodiments, the predefined time delay may be between 60 minutes and 300 minutes, such as between 120 minutes and 240 minutes, for example between 170 minutes and 190 minutes.

[0205] Generally, in some embodiments of the present disclosure, the predefined power threshold THR_P may be between 5mW and 50 mW such as between 10 mW and 25 mW, such as between 13mW and 17 mW for indoor installation

[0206] Generally, in some embodiments of the present disclosure, the predefined power threshold THR_P may be between 10mW and 100 mW such as between 20 mW and 70 mW, such as between 35 mW and 50 mW for outdoor installation.

[0207] Generally, in some embodiments of the present disclosure, the predefined energy threshold THR_P may be between 30 mWh and 200 mWh such as between 40 mWh and 120 mWh, such as between 50 mWh and 80 mWh for indoor installation.

[0208] Generally, in some embodiments of the present disclosure, the predefined energy threshold THR_P may be between 80 mWh and 500 mWh such as between 100 mWh and 300 mWh, such as between 150 mWh and 200 mWh for outdoor installation.

[0209] Fig. 4 illustrates a further embodiment of the present disclosure, where the criteria comprises a voltage threshold THR_V. When the output voltage PV_U from the photovoltaic module 13 gets above a voltage threshold, the voltage criteria is complied with (at t1). At time t2, the time delay criteria TMR_THR is complied with, and hence, the wake up command is provided by the wake up unit.

[0210] It is understood that a criteria may also or alternatively, in further embodiments, comprise the current provided from the photovoltaic module 13, and a current threshold THR_I may be provided (not illustrated).

[0211] Fig. 5 illustrates a still further embodiment of the present disclosure, where the criteria comprises a predefined time threshold TMR_THR. When the photovoltaic module 13 starts generating an output voltage PV_U (at time T0a) or alternatively the voltage or current supply from the panel 13 is above a desired level (not illustrated), a timer/counter is started. At time t1, the time delay criteria TMR_THR is complied with, and hence, the wake up command WUC is provided by the wake up unit. In this embodiment, the predefined time delay Td may be longer than the time thresholds mentioned/suggested above where also supplied power and/or energy should reach a threshold value THR_P, THR_E. For example more than three hours.

[0212] In some embodiments, If the voltage PV_U and/or supplied current gets below a certain threshold, such as a lower hysteresis, the timer/counter may reset. This may be done automatically if the processor CPR of the wake-up 2 unit shuts down due to lack of power supply, or by means of a monitoring unit for monitoring the time from the photovoltaic module started to produce power.

[0213] It is generally understood that in embodiments of the present disclosure, the timer/counter for controlling the predefined time delay may be reset when voltage, current and/or power from the photovoltaic panel 13 gets below a certain value, such as a predefined value. For example if the voltage from the panel 13 is substantially 0 V or below e.g. 1V or 2V.

[0214] In some further embodiments (not illustrated), the predefined time threshold TMR_THR may first be calculated form a time where one or more of panel 13 power PV_P, panel 13 energy PV_E, panel 13 voltage PV_U, and/or panel current PV_I, or derivatives thereof, is above a certain threshold such as a predefined threshold.

[0215] Fig. 6 illustrates a flow chart relating t operation of the wake-up unit according to embodiments of the present disclosure. It is noted that the flow chart is for explanatory purposes, and that one or more tests and/or steps illustrated may be provided as separate, parallel processes.

[0216] At initiation (INIT), the wakeup unit 2 starts analysing the output from the photovoltaic panel 13. This may e.g. be provided because the processor of the wake-up unit receives sufficient power and thereby is able to provide data processing of the output from the photovoltaic panel 13.

[0217] Hence, as the wake up unit receives power output from the photovoltaic panel 13, a timer, such as a time counter, is started (Step S61 - START TMR). That may be substantially corresponding to time T0a or T0b illustrated in some of figs. 2-5.

[0218] Optionally, the wake up unit may be configured to only provide certain power consuming tasks, such as calculations, with a predefined time interval defined by a timer TMR1, see test TE61 - TMR1? .

[0219] At step S62, the wake-up unit 2 receives and/or provides measurements of the output voltage (MEAS PV_U) and/or output current (MEAS PV_I). Measurement circuitry 16 may be involved in this, see fig. 1.

[0220] Then, further, the output power PV_P from the photovoltaic panel is calculated (C PV_P). Moreover, the output energy PV_E from the photovoltaic panel/module 13 is calculated (C PV_P), e.g. by means of an integration calculation or the like.

[0221] Then the wake-up unit proves a test of if the calculated panel power PV_P is above a max power value MAX_P stored in a data storage. If the calculated panel power PV_P is above the max power value MAX_P (see test TE63: PV_P > MAX_P?), the max power value MAX_P is at step S63 updated to comprise the new calculated value PV_P instead before continuing to test TE64. If the calculated panel power PV_P is not above the max power value MAX_P (test TE63), the wake up unit skips step S63 and continues to test TE64.

[0222] At test TE64, the wakeup unit tests if the maximum power value MAX_P is above a power threshold THR_P (MAX_P>THR_P?). If the maximum power value MAX_P is above the power threshold THR_P, the wake-up unit continues to test TE66. If the maximum power value MAX_P is not above the power threshold THR_P, the wake-up unit returns to awaiting timer TMR1 runout (if present).

[0223] At test TE65, the wakeup unit tests if the calculated output energy PV_E is above an energy threshold THR_E (PV_E>THR_E?). If the calculated output energy PV_E is above the energy threshold THR_E, the wake-up unit continues to test TE66. If the calculated output energy PV_E is not above the energy threshold THR_E, the wake-up unit returns to awaiting timer TMR1 runout (if present).

[0224] At test TE66, the wakeup unit tests if the Time started at step S61 is above a time threshold (TMR_THR?). If the time started at step S61 is not above the time threshold TMR_THR, the wake-up unit returns to awaiting timer TMR1 runout (if present). If, the time started at step S61 is above the time threshold TMR_THR, a sufficient, such as predetermined time delay has also been complied with.
Then, as all three criteria TE64, TE65, TE66 (relating to three different rules comprising different test criteria) based on the output from the photovoltaic panel have been complied with, and accordingly, the wake-up unit provides the wake up command WUC.

[0225] The radio communication control arrangement 11b is hence induced to enter the second, activated mode, as the criteria complied with indicates that the drive system has been installed at a building.

[0226] The radio communication control arrangement 11b may in some embodiments of the present disclosure be configured to never return to the first low-power mode M1 after it has entered the second, active mode M2. In other embodiments of the present disclosure, the system 1 may be designed so that special reset criteria (e.g. special reset criteria comprising a predefined series of button activations, disconnection and connection of photovoltaic module and/or the like) may, when complied with, provide that the drive system, or at least the radio communication control arrangement, is reset to a factory mode again. In this case, the radio communication control arrangement may in some embodiments enter the first low-power mode M1 again, and the wake up unit 2 may be configured again to operate according to one or more of figs. 2-6 and/or the description above relating thereto. Such a special reset criteria may e.g. comprise pressing a button 4 at the device or a remote control a specific number of times and/or or for a certain predetermined time period and/or the like.

[0227] Fig. 7 illustrates schematically a building aperture covering system 20 according to further embodiments of the present disclosure. Here, the drive system 1 comprises a boost converter 14 configured to step up/increase the output voltage of the photovoltaic panel 13 connected to the power supply connector 6b.

[0228] The processing unit CPR configured to provide the wake up command WUC and/or provide the above mention test(s) of whether the criteria for providing the wake up command may in embodiments of the present disclosure moreover be configured to act as a charging controller configured to control the recharging of the rechargeable battery unit 12 by controlling a switching device, such as a transistor arrangement, of the boost converter 14, and thereby control the duty cycle of the PWM signal for a PWM modulated switch of the boost converter, e.g. by adjusting duty cycle and/or period time of the boost converter 14.

[0229] The boost converter 14 powers 19 the battery 12 to recharge it.

[0230] The charging control system CPR may in embodiments of the present disclosure comprise a Maximum Power Point Tracking (MPPT) control system, such as including a "Perturb and Observe" feature.

[0231] The Maximum Power Point Tracking (MPPT) system is configured to adapt the load applied to the photovoltaic panel 13, such as by adapting the duty cycle, e.g. by adjusting period time and/or duty cycle value ("on time") of the PWM for a switching arrangement of the Boost converter 14. This is based on one or more measured output parameters of the photovoltaic power supply panel. These parameters may comprise a measured output voltage of the at least one photovoltaic power supply panel 13 and/or a measured output current of the at least one photovoltaic power supply panel 13. This is provided by the measurement circuitry 16 configured to provide measured voltage and/or current information 17 to the controller CPR. As can be seen, the charging controller 3, measuring circuitry 16 and boost converter 14 may be placed at the same PCB 15 in embodiments of the present disclosure.

[0232] The charging controller CPR is in embodiments of the present disclosure powered alone by the at least one panel 13, and not by the battery 11, and
is configured to enter a sleep mode, such as an idling sleep mode provided by the charging control system when not in operation, in order to save power.

[0233] The charging controller 3 is waken up automatically according to a predefine activation trigger parameter, such as with a predefined time interval, in order to execute the MPPT instructions/functionality based on new measured input information 17, and adjust the duty cycle of the switching arrangement of the boost converter 15 based on the MPPT result, before re-entering the idling sleep mode again. However, the sleep mode may not stop a main clock of the charging controller 3, as this may be used for controlling the switching arrangement of the boost converter, and thereby provide the PWM signal of the boost converter 14. This clock may hence be controlled by the Maximum Power Point Tracking (MPPT) system 18 to obtain the desired duty cycle and hence the desired pule width modulation (PWM) of the boost converter 14. This may be provide in order to obtain a load on the at least one panel 13a that provides that the panel 13 is loaded at or close to the Maximum Power Point (MPP) in the given situation at the installation site, while the charging controller CPR is in sleep mode.

[0234] Fig. 7 moreover illustrates an embodiment of the present disclosure where the actuator controller 11a and the radio communication control arrangement 11b of the actuator control system 11 are provided by the same control unit 11a, 11b, such as by means of the same computer processor such as a micro controller. This is different from the actuator control system 11 illustrated in fig. 1, where different computer processors 11a, 11b, such as different micro controllers, provides the radio communication control arrangement 11b and the actuator controller 11a, respectively.

[0235] Fig. 8 illustrates schematically a boost converter 14 controlled by means of a charging controller 2 according to embodiments of the present disclosure. The charging controller 2 may e.g. be provided by means of a processor of the wake up unit as previously disclosed.

[0236] The boost converter 14 comprises a boost converter circuitry comprising an inductor L1, a capacitor CA1, a diode D1 and a switching arrangement Q1 such as a transistor coupled as shown in fig. 8 in order to provide a DC-DC Pulse Width Modulated (PWM) Switch mode power supply boost converter 14. The boost converter 14 may also be referred to as a step-up converter.

Filters such as capacitor-implemented filters (not illustrated in fig. 8) may also be provided in further embodiments of the present disclosure at the load/battery side of the converter 14 and/or at the input/supply side of the converter 14, in order to e.g. reduce undesired voltage ripples.

[0237] The charging controller 2, such as the wake-up controller, is configured, when the radio communication control arrangement 11b is in the first low-power mode, to control the switch Q1 of the boost converter in order to provide a desired PWM at the boost converter 14. This is provided by the PWM control signal 28. The micro controller of the charging controller 2 may in embodiments of the present disclosure comprise a 5 to 45 MHz, such as a 10 to 30 MHz, e.g. an around 20Mhz central processing unit (CPU) (values given as max. clock frequency of the CPU).

[0238] The charging controller 2 microcontroller may in embodiments of the present disclosure be a Microcontroller with Core Independent Peripherals.

[0239] The CPU clock frequency may in embodiments of the present disclosure be reduced significantly compared to the max clock frequency, such as reduced with a factor of between 20 and 60, such as around 40. For example, the clock frequency of the CPU of the controller may be reduced to a clock frequency between 250 kHZ and 2 MHz, such as between 450 kHz and 750 kHz in order to save power.

[0240] A Microcontroller with Core Independent Peripherals may be advantageous to use as it may allow a PWM signal functionality to be implemented with a desired (and adjustable) duty cycle and period time/frequency to control the boost converter's switch, while the remaining part of the charging controller 3 can enter sleep mode so as to save power.

[0241] The charging controller 2 hence receives two inputs from measuring circuitries. The first input PV_U is a voltage measuring provided by a measuring circuitry 16a, and is indicative of the voltage at/of the output of the photovoltaic panel 13. The second input PV_I is a current measuring provided by a measuring circuitry 16b and is indicative of the electric current supplied by the photovoltaic panel13. These inputs PV_I, PV_U may also, in embodiments of the present disclosure, be provided and used in order for the wake-up unit 2 (which may be provided by means of the same processor as the one handling/controlling the PWM for the boost converter 14) so that the wake up unit can determine if one or more of the criteria for determining if the wake-up command (see description above) should be provided.

[0242] In fig. 8, the photovoltaic panel 13 is connected to the drive system 1 (a part of this is illustrated in fig. 8) by means of the connector 6 such as a plug/socket configuration.

[0243] The charging controller 2 provides a Maximum Power Point Tracking (MPPT) based on the measured inputs PV_I, PV_U and provides a control of the load on the photovoltaic panel or panels 13 based on the measured input. This load control may be provided by adjusting the PWM signal to the switch Q1.

[0244] As can be seen in fig. 8, the charging controller 2 may in embodiments of the present disclosure be powered VCC_pv by the at least one photovoltaic panel 13 and not the battery 12.

[0245] The charging controller 3 may in further embodiments of the present disclosure comprise a sleep mode which provides that the controller 3 enters a sleep mode, such as an "Idle sleep mode". Here, in the Idle sleep mode, the Central Processing Unit of the controller 2 stops executing code, and an interrupt, such as a timer interrupt, can wake up the CPU again to execute stored program code for implementing the MPPT functionality.

[0246] However, even in sleep mode, a Main Clock of the charging controller 2 will run in order to control the switch by a switching frequency during sleep mode, which is set by the MPPT function before entering the sleep mode. This is done in order to provide a PWM of the boost controller 14 that fits or is near the Maximum Power Point of the photovoltaic panel, and that is provided automatically by the MPPT function.

[0247] Figs. 9-13 illustrates a building aperture covering system 20 comprising a drive system 1 for controlling a movable building aperture covering unit 5, according to various embodiments of the present disclosure.

[0248] Fig. 9 illustrates schematically an embodiment of the present disclosure where the building aperture covering system 20 is a roof window with a shutter 8 mounted thereon. The shutter 8 may also in further embodiments be omitted.

[0249] The shutter 8, such as a roller shutter, comprises a movable unit 5b for shading purposes when unrolled, to reduce the amount of sunlight entering through the insulated glass unit 6 of the roof window. A drive system 1 according to various embodiments of the present disclosure as e.g. described above is arranged to control the covering unit 5b of the shutter. The photovoltaic panel 13 is in the illustrated example placed in a rail 8a at the top part of the shutter. If the roof window does not comprise a shutter 8, the drive system for the shutter is also not present at the roof window. The drive system 1 for the shutter may e.g. be placed at the top of the roof window.

[0250] The roof window 20 moreover comprises a further drive system for operating a movable unit 5a of the roof window. This movable unit 5a comprises a movable frame supporting an insulated glass unit 6. The insulated glass unit 6 may comprise two or more glass sheets with one or more heat insulating gas filled or evacuated gaps between the glass sheets. For example, the insulated glass unit 6 may comprise two glass sheets with a gap between these glass sheets, or a triple panel pane glass unit comprising an intermediate glass sheet with an insulating gap at both sides of the intermediate glass sheet. The roof window in fig. 9 is of the centre hung type, and hence, the movable frame 5a is connected to a fixation frame 7 of the roof window by means of a hinge system (not illustrated) placed at a location between top and bottom of the roof window. The movable frame 5 a of the roof window 1 is configured to be moved between a closed position and an open position by means of a drive system 1 according to embodiments of the present disclosure.

[0251] The drive system 1for controlling the frame 5a may be powered by a photovoltaic panel that may also be placed at the rail 8a. If the shutter is omitted, the photovoltaic panel for powering the drive system that controls the frame 5a may be arranged in e.g. a rail, such as a top rail, of the roof window (not illustrated)

[0252] Fig. 10 illustrates a window such as a roof window or a "vertical window" comprising a building aperture covering system 20 according to embodiments of the present disclosure. In fig 10, the building aperture covering system 20 comprises blind, such as a roller blind, comprising a movable covering unit 5c for shading purposes by being adjusted to cover a part of the insulated glass unit 6. The position of the movable covering unit 5c is controlled by a drive system 1 according to embodiments of the present disclosure.

[0253] The drive system 1 is placed inside a housing 30 such as a tubular housing, and also, a roll or the like for storing (and hiding) the movable covering unit when e.g. rolled up may be covered by the cover 30. If the window is a roof window, guiding rails may be placed at the window sides for guiding the movable covering unit 5c. In this embodiment, the photovoltaic panel 13 (not illustrated in fig. 10) may be placed at or in e.g. the housing 30 or at an external covering of the blind. Fig. 10a illustrates the blind 20 before installation.

[0254] Fig. 11 illustrates a top hung roof window 20 comprising a drive system 1 for moving a movable frame 5a, according to embodiments of the present disclosure.

[0255] Fig. 12 illustrates a chain actuator 20 according to embodiments of the present disclosure. The drive system 1 according to embodiments of the present disclosure is arranged inside a chain actuator housing 30 that may be mounted at a window so as to control a movable frame of the window as e.g. previously disclosed. The chain actuator comprises a movable actuator unit 10a comprising a push-pull chain. The housing 30 may also comprise a storage for storing an un-extended part of the push-pull chain 10a. The actuator comprises an electric motor 10b and a gear 10c for driving the push-pull chain. The battery is also placed in the housing 30 but is not illustrated.

[0256] Fig. 13 illustrates schematically a building aperture covering system 20 comprising a drive system 1 for controlling a movable building aperture covering unit 5. Here, the building aperture covering 20 system comprises a tubular housing 30, and the drive system 1 is arranged inside the housing 30. As can be seen, a plug 6a for the photovoltaic panel 13 may be placed at the end of the housing, e.g. together with the button 4, if present.

[0257] Fig. 14 illustrates schematically a transportation package 50 comprising a building aperture covering system 20 according to various embodiments of the present disclosure. The building aperture covering system 20 is enclosed by the transportation package 50. The transportation package may e.g. be a cellulose based transportation package and/or a transportation package made from or comprising cardboard, plastic or the like or other suitable materials for enclosing and protecting a building aperture covering system 20 during transport. The radio communication control arrangement 11b is arranged in the first low-power mode from factory while enclosed by said transportation package 50.

[0258] Hence, the wake-up unit 2 is configured to provide the wake-up command WUC as e.g. described previously, after the building aperture covering system 20 has been unpacked from the transportation package 50, has installed at e.g. a building opening/aperture and/or a window, and the one or more criteria is complied with.

[0259] The photovoltaic panel (not visible in fig. 14) may in embodiments of the present disclosure be pre-connected to the system 1 inside the transportation package 50. For example, the pre-connected photovoltaic panel 13 may be arranged in the transportation package so as to be substantially unexposed to light such as sunlight or electrically powered light, thereby ensuring that it does not trigger the wake up command if the transportation package is exposed to light.

[0260] The pre-connection of the photovoltaic panel may provide that an installer will not need to connect the photovoltaic panel by a plug 6a/6b (see e.g. fig. 1) or the like during or after installation of the system 20.

[0261] The transportation package 50 may comprise /enclose a unit 5a-5c to be controlled by the actuator, such as an awning, a shutter, a blind or a window.

Items

[0262] Various embodiments of the present disclosure are described in the following items.

1. A building aperture covering system (20) comprising a drive system (1) for controlling a movable building aperture

covering unit (5a-5c), wherein the drive system (1) comprises:

- an electrically powered actuator (10),
- an actuator control system (11) configured to control the electrically powered actuator (10), wherein the actuator control system (11) comprises a radio communication control arrangement (1 1b) comprising one or more radio communication controllers,
- a rechargeable battery (12) configured to supply power to the radio communication control arrangement (11b) and the electrically powered actuator (10),
- a photovoltaic panel (13) connected so as to charge the rechargeable battery (12),
- a wake-up unit (2) configured to provide a wake-up command (WUC),

wherein the radio communication control arrangement (11b) is configured to switch from a first low-power mode (M1) to a second activated mode (M2) in response to the wake-up command (WUC), so as to execute one or more radio communication tasks,
wherein the wake-up unit (2) is configured to receive electric power from the photovoltaic panel (13) while the radio communication control arrangement (11b) is arranged in the first low-power mode (M1),
wherein the wake-up unit (2) is configured to provide the wake-up command (WUC) when one or more criteria is complied with.

2. A building aperture covering system (20) according to item 1, wherein the wake-up unit (2) is configured so as to provide the wake-up command (WUC) automatically based on the one or more criteria (THR_P, THR_E, TMR_THR) without human interaction, after the drive system (1) has been installed at a building.

3. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up-unit (2) is configured to provide initiation of the wake-up command (WUC) so as to provide a first wake-up of the radio communication control arrangement (11b) from the first low-power mode.

4. A building aperture covering system (20) according to any of the preceding items, wherein the first low-power mode is a factory setting mode.

5. A building aperture covering system (20) according to any of the preceding items, wherein the one or more criteria (THR_P, THR_E, TMR_THR) is configured so as to postpone (Td) the providing of the wake-up command (WUC) based on the output from the photovoltaic panel to a time (T_wuc) after the time (TOb) output to the wakeup unit (2) from the photovoltaic module (13) has been provided.

6. A building aperture covering system (20) according to any of the preceding items, wherein said one or more criteria comprises one or more thresholds (THR_P, THR_E) relating to the power output (PV_P) and/or energy output (PV_E) from the photovoltaic module (13).

7. A building aperture covering system (20) according to any of the preceding items, wherein said one or more criteria comprises at least one time delay threshold (TMR_THR), such as a predefined time delay (Td) threshold.

8. A building aperture covering system (20) according to any of the preceding items, wherein the criteria (THR_P, THR_E, TMR_THR) is configured so as to postpone (td) the wake-up command (WUC).

9. A building aperture covering system (20) according to any of the preceding items, wherein the criteria (THR_P, THR_E, TMR_THR) is configured so as to postpone (td) the wake-up command (WUC) for at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes or at least 170 minutes from the time (TOb) an output from the photovoltaic module (13) has been provided, such as has been initiated.

10. A building aperture covering system (20) according to any of the preceding items, wherein the criteria (THR_P, THR_E, TMR_THR) is configured so as to postpone (td) the wake-up command (WUC) for at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes or at least 170 minutes from the time (TOb) an output from the photovoltaic module (13) has been initiated.

11. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up unit (2) comprises a computer processor (CPR) configured to process one or more parameters (PV_U, PV_I, PV_P, PV_E), which one or more parameters are based on the output (PV_U, PV_I) from the photovoltaic panel (13).

12. A building aperture covering system (20) according to item 11, wherein the criteria (THR_P, THR_E, TMR_THR) requires fulfilment one or more rules (TE64, T645, T646), such as one or more rules relating to one or more thresholds (THR_P, THR_E, TMR_THR), and wherein the computer processor (CPR)is configured to determine, based on said processing, when the one or more rules is complied with.

13. A building aperture covering system (20) according to item 11 or 12, wherein the processing comprises one or more calculations, such as one or more calculations configured to be initiated with a time interval such as a predefined time interval (TMR1).

14. A building aperture covering system (20) according to any of items 11-13, wherein the processing of one or more parameters is based on one or more measurements of voltage (Upv) and/or current (Ipv) supplied by the photovoltaic panel, such as wherein said system comprises measurement circuitry (16, 2) for providing (17) one or more of said measurements to the processor.

15. A building aperture covering system (20) according to any of items 11-14, wherein the processing comprises determining, such as calculating, the power output (PV_P) and/or the energy output (PV_E) from the photovoltaic module (13).

16. A building aperture covering system (20) according to any of items 11-15, wherein the computer processor (CPR) is configured to be powered by electric power output provided from the photovoltaic panel.

17. A building aperture covering system (20) according to any of items 11-17, wherein the computer processor (CPR) is configured to be unpowered and/or inactive when insufficient power is available from the photovoltaic panel (13), and wherein the computer processor (CPR) is configured so as to provide said processing when sufficient power is available from the photovoltaic module (13),

18. A building aperture covering system (20) according to item 17, as wherein content of one or more data storages comprising data relating to the output (PV_U, PV_I, PV_P, PV_E) from the photovoltaic module is configured to be deleted, reset or overwritten if a situation with insufficient power from the photovoltaic module (13) has occurred.

19. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up unit (2) is configured to provide an integration, such as an integration calculation, based on one or more output parameters (PV_U, PV_I, PV_P) of the photovoltaic panel (13).

20. A building aperture covering system (20) according to any of the preceding items, wherein the drive system (1) furthermore comprises a button (4) configured to be pressed by a user, and wherein the wake-up command (WUC) is configured to be provided if the button (4) is pressed,
such as wherein the switch from the first low-power mode (M1) to the second activated mode (M2) is configured to be activated by means of software based on the input from the button (4).

21. A building aperture covering system (20) according to any of the preceding items, wherein the criteria (THR_P, THR_E, TMR_THR) comprises one or more thresholds related to the output (PV_U, PV_I, PV_P) from the photovoltaic panel (13).

22. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up unit and the radio communication control arrangement (11b) comprises separate units, such as separate processors, such as separate computer processors.

23. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up unit and the radio communication control arrangement (11b) are, separate units, such as separate processors, such as separate computer processors.

24. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up unit (2) and the radio communication control arrangement (11b) is arranged at a printed circuit board (PCB), such as a common printed circuit board (PCB) (15).

25. A building aperture covering system (20) according to any of the preceding items, wherein the radio communication control arrangement (11b) is configured to consume at least four times less, such as at least seven times

less, such as at least nine times less energy from the rechargeable battery in the first low-power mode (M1) when compared to the energy consumption in the second mode (M2),
or
wherein the radio communication control arrangement (11b) is configured to be substantially turned off in the first low-power mode.

26. A building aperture covering system (20) according to any of the preceding items, wherein the actuator control system (11) moreover comprises an actuator controller (11a), wherein the actuator controller (11a) is configured to control the electrically powered actuator (10) based on a predefined set of rules.

27. A building aperture covering system (20) according to item 26, wherein the actuator controller (11a) is configured to provide control of the electrically powered actuator (10) based on radio signals received by means of the radio communication control arrangement (11b).

28. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up command (WUC) comprises or consists of an interrupt signal configured so as to cause one or more controllers of the radio communication control arrangement (11b) to switch to the second activated mode (M2).

29. A building aperture covering system (20) according to any of the preceding items, wherein the wake-up unit (2) is moreover configured to provide charging control so as to control the charging of the rechargeable battery (11), such as wherein said charging control comprises a Maximum Power Point Tracking (MPPT) feature which when executed is configured to retrieve one or more output parameters (V_pv, I_pv) from the photovoltaic panel (13) and adapt a pulse width modulation (PWM) of a boost converter based thereon.

30. A building aperture covering system (20) according to any of the preceding items, wherein the building aperture covering system (20) comprises a sun covering device (5b, 5c) for a window, such as a blind, an awning or a shutter (5a-5c), or
wherein the building aperture covering system (20) comprises a window such as a roof window and wherein the movable unit comprises a movable unit (5a) of the window comprising an insulated glazing (6).

31. A building aperture covering system (20) according to any of the preceding items, wherein the at least one photovoltaic power supply panel (13) has a maximum output voltage that is below 10V DC, such as below 8V DC, for example
below 6V DC, such as around 4.2V DC.

32. A building aperture covering system (20) according to any of the preceding items, wherein the photovoltaic panel (13) comprises between 3 and 15 solar cells, such as between 4 and 10 solar cells (both end points included).

33. A building aperture covering system (20) according to any of the preceding items, wherein the at least one photovoltaic panel (13) has a maximum output voltage that is at least 1.3 times lower, such as at least 2 times lower, for example at least 2.5 times lower than the maximum output voltage of the rechargeable battery, and wherein the drive system comprises a boost converter (14).

34. A building aperture covering system (20) according to any of the preceding items, wherein the radio communication control arrangement (11b):

- in the second activated mode (M2) is configured so as to execute one or more radio communication tasks, such as listening for radio signals from a remote control (3),
- in the first low-power mode is configured so that the one or more radio communication tasks (LI) is unexecuted or reduced.

35. A building aperture covering system (20) according to any of the preceding items, wherein the radio communication control arrangement (11b), when in the second activated mode, is configured, to enter a third sleep mode between execution of consecutive power consuming tasks.

36. A building aperture covering system (20) according to any of the preceding items, wherein the first low-power mode (M1) is a factory setting mode.

37. A building aperture covering system (20) according to any of the preceding items, wherein the overall surface area of the cells of the photovoltaic module is less than 0.1 m^2.

38. A building aperture covering system (20) according to any of the preceding items, wherein said rechargeable battery unit (12) has a rated power between 5Wh and 50Wh, such as between 10 Wh and 35 Wh, such as between 14Wh and 26 Wh.

39. A building aperture covering system (20) according to any of the preceding items, wherein a device comprises a housing (30) enclosing said drive system (2, 10, 12, 11b, 11a, 14).

40. A building aperture covering system (20) according to any of the preceding items, wherein the one or more criteria (THR_P, THR_E, TMR_THR) is based on the output from the photovoltaic panel (13).

41. A building aperture covering system (20) according to any of the preceding items, wherein the one or more criteria (THR_P, THR_E, TMR_THR) is configured so as to provide that the wake-up command (WUC) is provided at a time (T_wuc) after the photovoltaic module provides output to the wake-up unit (2).

42. A building aperture covering system (20) according to any of the preceding items, wherein a device (20) comprises said movable building aperture covering unit (5a-5c) and a housing (30) enclosing said drive system (2, 10, 12, 11b, 11a, 14).

43. A transportation package (50) comprising a building aperture covering system (20) according to any of the preceding items, wherein the building aperture covering system (20) is enclosed by the transportation package, such as a cellulose based transportation package and/or a cardboard transportation package,
wherein the radio communication control arrangement (11b) is arranged in said first low-power mode from factory while the building aperture covering system (20) is enclosed by said transportation package.

44. A transportation package (50) according to item 43, wherein the wake-up unit (2) is configured to provide the wake-up command (WUC) after the building aperture covering system (20) has been unpacked from the transportation package and the one or more criteria is complied with.

45. A transportation package according to item 43 or 44, wherein the photovoltaic panel (13) is pre-connected to the drive system (1) in said transportation package, such as wherein the pre-connected photovoltaic panel (13) is arranged in the transportation package so as to be substantially unexposed to light such as sunlight or electrically powered light.

46. A transportation package according to any of items 43-45, wherein the transportation package comprises a unit, such as a covering unit, configured to be controlled by the actuator, such as wherein said unit is an awning, a shutter, a blind or a window.

47. A window comprising one or more building aperture covering systems (20) according to any of the preceding items, wherein the one or more building aperture covering systems (20) is/are installed so as to control a movable building aperture covering unit (5a-5c).

48. A device comprising a housing (30), wherein the device is configured to be installed at a building window, wherein the device comprises a building aperture covering system (20) according to any of the preceding items.

49. A method of providing an automatic first activation of a radio communication control arrangement (11b) of a drive system (1), after installation of the drive system at a building, wherein the radio communication control arrangement (11b) comprises one or more radio communication controllers,

wherein the radio communication control arrangement (11b) and the electrically powered actuator (10) are configured to be powered by a rechargeable battery (12), wherein the rechargeable battery is configured to be charged by a photovoltaic panel (13),
wherein the radio communication control arrangement (11b) is configured to switch from a first low-power mode (M1) to a second activated mode (M2) in response to a wake-up command (WUC), so as to execute one or more radio communication tasks,
wherein the drive system (1) comprises a wake-up unit (2) providing the wake-up command (WUC) so as to

initiate the first activation of the radio communication control arrangement (11b),
wherein the method comprises,
installing the drive system (1), such as at a window, such as a roof window, so that the installed drive system (1) is configured to control a movable building aperture covering unit (5a-5c), such as a blind, awning, shutter or window, of a building aperture covering system (20), by means of the electrically powered actuator (10),
wherein the wake-up unit (2) of the installed drive system (1) receives electric power from the photovoltaic panel (13) while the radio communication control arrangement (11b) is arranged in the first low-power mode (M1),
wherein the photovoltaic panel (13) is arranged at the building aperture cover system (20),
wherein the wake-up unit (2) provides the wake-up command (WUC) when one or more criteria (THR_P, THR_E, TMR_THR) is complied with, wherein the one or more criteria (THR_P, THR_E, TMR_THR) is based on output (PV_I, PV_U) from the photovoltaic panel (13) and wherein the one or more criteria is configured so that the wake-up command (WUC) is provided at a time (T_wuc) after (Td) the photovoltaic module (13) has started (TOb) to provide the power (PV_U, PV_I) to the wake-up unit (2).

50. A method according to item 49, wherein the drive system (1) is provided to an installation site to be installed at a building, wherein the provided drive system (1) is enclosed by a housing (30), and wherein the housing (30) is arranged in a transportation package (50),

wherein the radio communication control arrangement (11b) is arranged in said first low-power mode (M1) from factory while enclosed by said transportation package,

wherein the drive system (1) is unpacked from the transportation package and installed at the building, and wherein the wake-up unit (2) provides the wake-up command (WUC) automatically based on the one or more criteria, without human interaction, after the unpacked drive system (1) has been installed at the building.

51. A method according to item 49 or 50, wherein the photovoltaic module (PV) is pre-connected to the drive system (1) in said transportation package.

52. A method according to any of items 49-51, wherein the transportation package (50) moreover encloses the movable building aperture covering unit (5a-5c) such as an awning, shutter, blind or window.

53. A method according to any of items 49-52, wherein the radio communication control arrangement (11b) consumes energy from the rechargeable battery (12) in said in the first low-power mode (M1).

54. A method according to any of items 49-53, wherein the energy consumption from the rechargeable battery in the first low-power mode (M1) is at least four times less, such as at least seven times less, such as at least nine times less the energy consumption in the second mode (M2),
or
wherein the radio communication control arrangement (1 1b) is configured to be substantially turned off in the first low-power mode.

55. A method according to any of items 49-54, wherein the drive system (1) is retrofitted onto an existing, installed window (20).

56. A method according to any of items 49-55, wherein the first low-power mode (M1) is a factory setting mode, such as a factory setting mode for energy conservation to conserve energy of the rechargeable battery (12).

57. A method according to any of items 49-56, wherein the method is provided at a building aperture covering system (20) for controlling a window, an awning, a blind or a shutter.

58. A method according to any of items 49-57, wherein the method is provided at a building aperture covering system (20) according to any of items 1-42.

[0263] In general, it is to be understood that the present disclosure is not limited to the particular examples described above but may be adapted in a multitude of varieties within the scope of the invention as specified in e.g. the items and/or claims. Accordingly, for example, one or more of the embodiments described above may be combined to provide further embodiments of the present disclosure.

Claims

1. A building aperture covering system (20) comprising a drive system (1) for controlling a movable building aperture covering unit (5a-5c), wherein the drive system (1) comprises:

   - an electrically powered actuator (10),
   - an actuator control system (11) configured to control the electrically powered actuator (10), wherein the actuator control system (11) comprises a radio communication control arrangement (1 1b) comprising one or more radio communication controllers,
   - a rechargeable battery (12) configured to supply power to the radio communication control arrangement (11b) and the electrically powered actuator (10),
   - a photovoltaic panel (13) connected so as to charge the rechargeable battery (12),
   - a wake-up unit (2) configured to provide a wake-up command (WUC),

   wherein the radio communication control arrangement (11b) is configured to switch from a first low-power mode (M1) to a second activated mode (M2) in response to the wake-up command (WUC), so as to execute one or more radio communication tasks,
   wherein the wake-up unit (2) is configured to receive electric power from the photovoltaic panel (13) while the radio communication control arrangement (11b) is arranged in the first low-power mode (M1),
   wherein the wake-up unit (2) is configured to provide the wake-up command (WUC) when one or more criteria is complied with,
   wherein the one or more criteria (THR_P, THR_E, TMR_THR) is based on the output from the photovoltaic panel (13), and wherein the one or more criteria (THR_P, THR_E, TMR_THR) is configured so as to provide that the wake-up command (WUC) is provided at a time (T_wuc) after the photovoltaic module provides output to the wake-up unit (2).

2. A building aperture covering system (20) according to claim 1, wherein the wake-up unit (2) is configured so as to provide the wake-up command (WUC) automatically based on the one or more criteria (THR_P, THR_E, TMR_THR) without human interaction, after the drive system (1) has been installed at a building.

3. A building aperture covering system (20) according to claim 1 or 2, wherein the wake-up-unit (2) is configured to provide initiation of the wake-up command (WUC) so as to provide a first wake-up of the radio communication control arrangement (11b) from the first low-power mode.

4. A building aperture covering system (20) according to any of the preceding claims, wherein the first low-power mode is a factory setting mode.

5. A building aperture covering system (20) according to any of the preceding claims, wherein the one or more criteria (THR_P, THR_E, TMR_THR) is configured so as to postpone (Td) the providing of the wake-up command (WUC) based on the output from the photovoltaic panel to a time (T_wuc) after the time (TOb) output to the wakeup unit (2) from the photovoltaic module (13) has been provided.

6. A building aperture covering system (20) according to any of the preceding claims, wherein said one or more criteria comprises one or more thresholds (THR_P, THR_E) relating to the power output (PV_P) and/or energy output (PV_E) from the photovoltaic module (13).

7. A building aperture covering system (20) according to any of the preceding claims, wherein said one or more criteria comprises at least one time delay threshold (TMR_THR), such as a predefined time delay (Td) threshold.

8. A building aperture covering system (20) according to any of the preceding claims, wherein the criteria (THR_P, THR_E, TMR_THR) is configured so as to postpone (td) the wake-up command (WUC) for at least 10 minutes, such as at least 60 minutes, such as at least 120 minutes or at least 170 minutes from the time (T0a, T0b) an output from the photovoltaic module (13) has been provided, such as has been initiated.

9. A building aperture covering system (20) according to any of the preceding claims, wherein the wake-up unit (2) comprises a computer processor (CPR) configured to process one or more parameters (PV_U, PV_I, PV_P, PV_E), wherein the one or more parameters is based on the output (PV_U, PV_I) from the photovoltaic panel (13).

10. A building aperture covering system (20) according to claim 9, wherein the criteria (THR_P, THR_E, TMR_THR)

requires fulfilment one or more rules (TE64, T645, T646), such as one or more rules relating to one or more thresholds (THR_P, THR_E, TMR_THR), and wherein the computer processor (CPR)is configured to determine, based on said processing, when the one or more rules is/are complied with.

11. A building aperture covering system (20) according to any of claims 9-10, wherein the processing comprises determining, such as calculating, the power output (PV_P) and/or the energy output (PV_E) from the photovoltaic module (13).

12. A building aperture covering system (20) according to any of claims 9-11, wherein the computer processor (CPR) is configured to be powered by electric power output provided from the photovoltaic panel.

13. A building aperture covering system (20) according to any of the preceding claims, wherein the drive system (1) furthermore comprises a button (4) configured to be activated by a user, and wherein the wake-up command (WUC) is configured to be provided if the button (4) is pressed,
preferably so that the switch from the first low-power mode (M1) to the second activated mode (M2) is activated by means of software based on the input from the button (4).

14. A building aperture covering system (20) according to any of the preceding claims, wherein the radio communication control arrangement (11b):

- in the second activated mode (M2) is configured so as to execute one or more radio communication tasks, such as listening for radio signals from a remote control (3),
- in the first low-power mode is configured so that the one or more radio communication tasks (LI) is unexecuted or reduced.

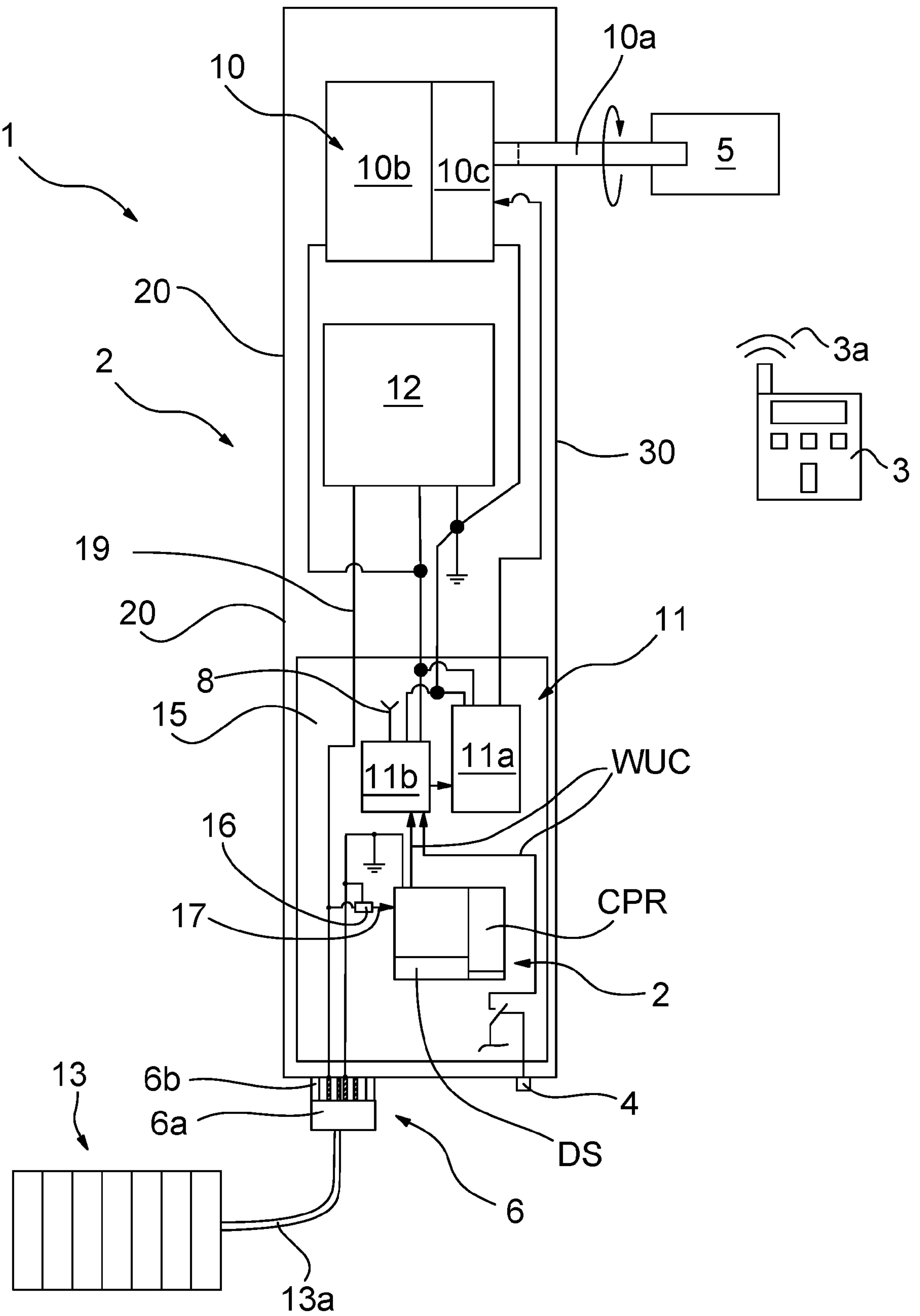
15. A transportation package (50) comprising a building aperture covering system (20) according to any of the preceding claims, wherein the building aperture covering system (20) is enclosed by the transportation package, such as a cellulose based transportation package and/or a cardboard transportation package,

wherein the radio communication control arrangement (11b) is arranged in said first low-power mode (M1) from factory while the building aperture covering system (20) is enclosed by said transportation package (50),
wherein the wake-up unit (2) is configured to provide the wake-up command (WUC) after the building aperture covering system (20) has been unpacked from the transportation package (50) and the one or more criteria is complied with.

16. A method of providing an automatic first activation of a radio communication control arrangement (1 1b) of a drive system (1), after installation of the drive system at a building, wherein the radio communication control arrangement (11b) comprises one or more radio communication controllers,

wherein the radio communication control arrangement (11b) and the electrically powered actuator (10) are configured to be powered by a rechargeable battery (12), wherein the rechargeable battery is configured to be charged by a photovoltaic panel (13),
wherein the radio communication control arrangement (11b) is configured to switch from a first low-power mode (M1) to a second activated mode (M2) in response to a wake-up command (WUC), so as to execute one or more radio communication tasks,
wherein the drive system (1) comprises a wake-up unit (2) providing the wake-up command (WUC) so as to initiate the first activation of the radio communication control arrangement (11b),
wherein the method comprises,
installing the drive system (1), such as at a window, such as a roof window, so that the installed drive system (1) is configured to control a movable building aperture covering unit (5a-5c), such as a blind, awning, shutter or window, of a building aperture covering system (20), by means of the electrically powered actuator (10),
wherein the wake-up unit (2) of the installed drive system (1) receives electric power from the photovoltaic panel (13) while the radio communication control arrangement (11b) is arranged in the first low-power mode (M1),
wherein the photovoltaic panel (13) is arranged at the building aperture cover system (20),
wherein the wake-up unit (2) provides the wake-up command (WUC) when one or more criteria (THR_P, THR_E, TMR_THR) is complied with, wherein the one or more criteria (THR_P, THR_E, TMR_THR) is based on output (PV_I, PV_U) from the photovoltaic panel (13) and wherein the one or more criteria is configured so that the wake-up command (WUC) is provided at a time (T_wuc) after (Td) the photovoltaic module (13) has started

(TOb) to provide the power (PV_U, PV_I) to the wake-up unit (2).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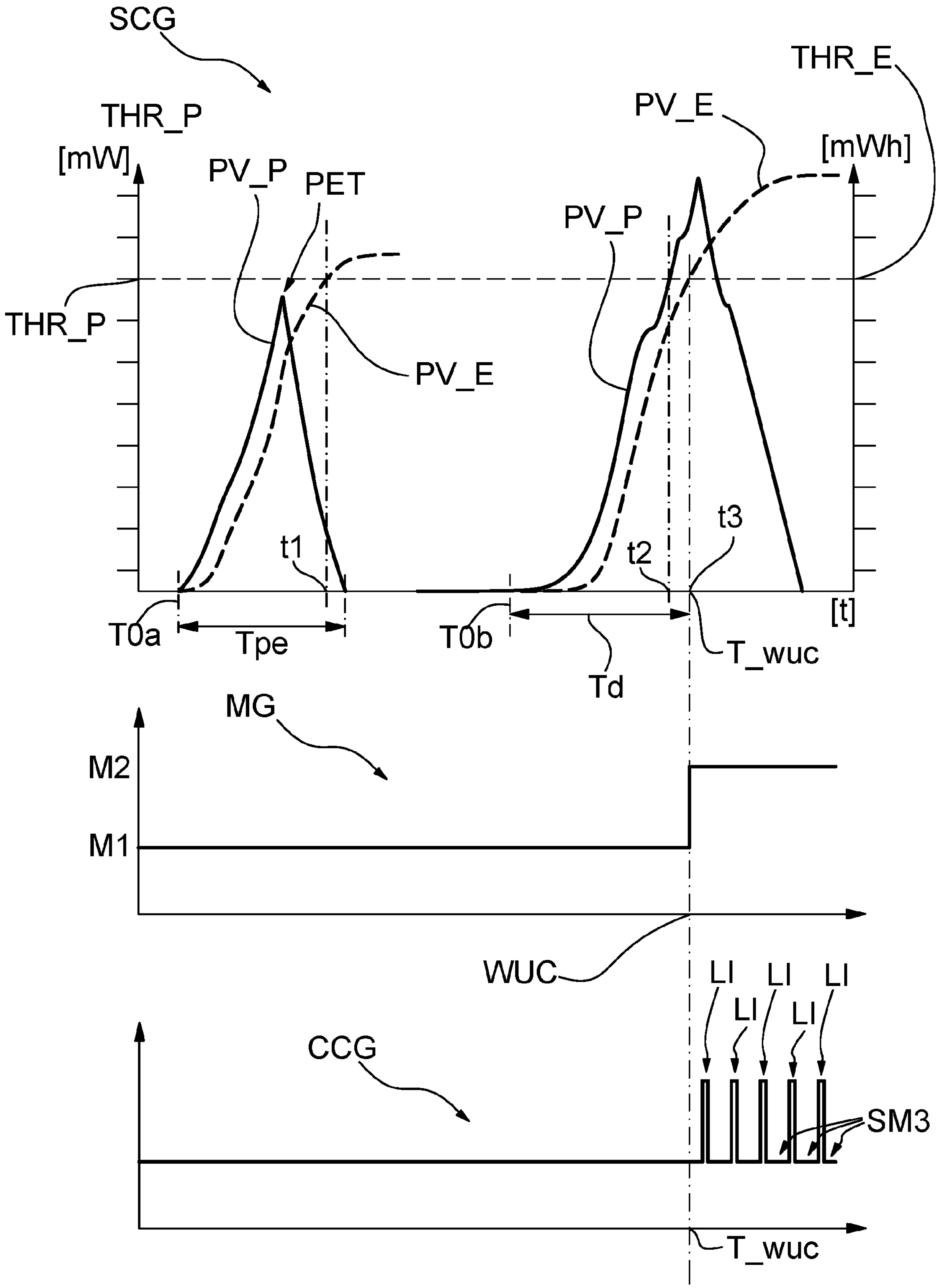
10
10a
10b
10c
5
20
2
12
30
3a
3
19
20
11
8
15
11b
11a
WUC
16
17
CPR
2
13
6b
6a
4
DS
6
13a

Fig. 1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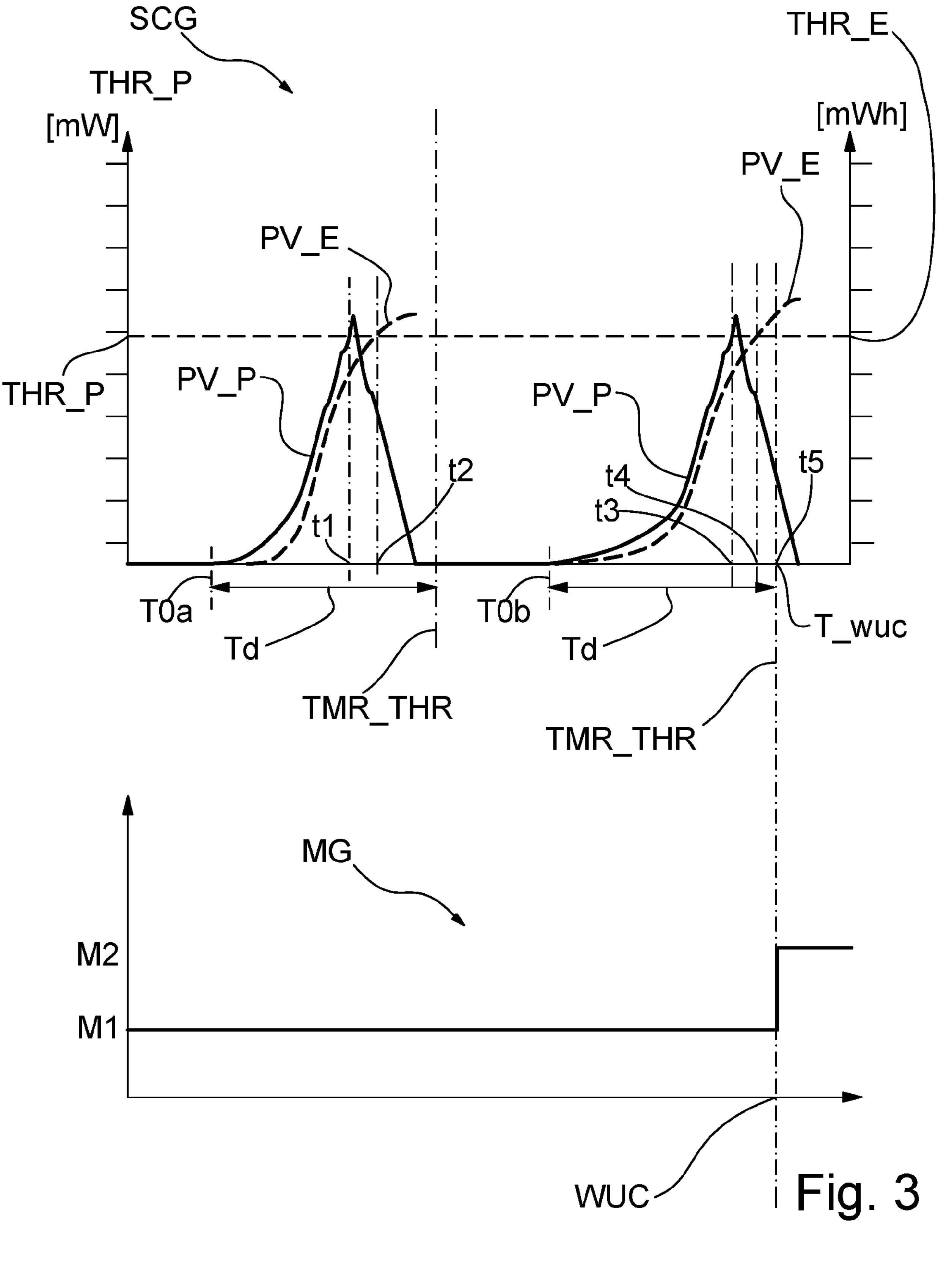
PV_P
PET
THR_P
PV_E
PV_P
PV_E
THR_E
[mWh]
t1
t2
t3
T0a
Tpe
T0b
Td
T_wuc
[t]
MG
M2
M1
WUC
LI
LI
LI
LI
LI
CCG
SM3
T_wuc

Fig. 2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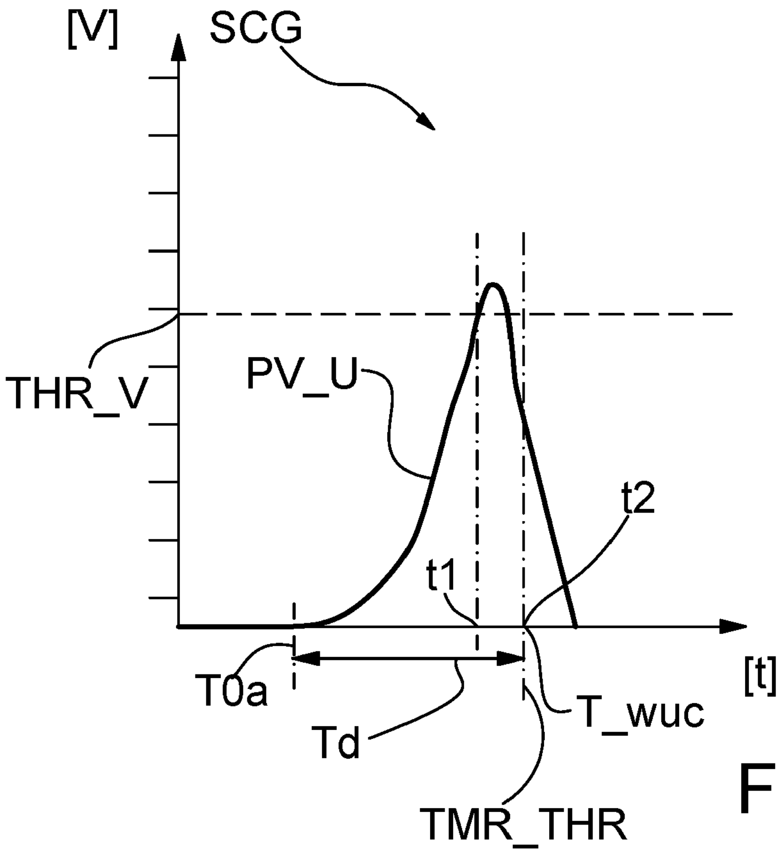
THR_P
[mW]
THR_E
[mWh]
PV_E
PV_E
PV_P
PV_P
THR_P
t1
t2
t3
t4
t5
T0a
T0b
Td
Td
T_wuc
TMR_THR
TMR_THR
MG
M2
M1
WUC

Fig. 3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SCG
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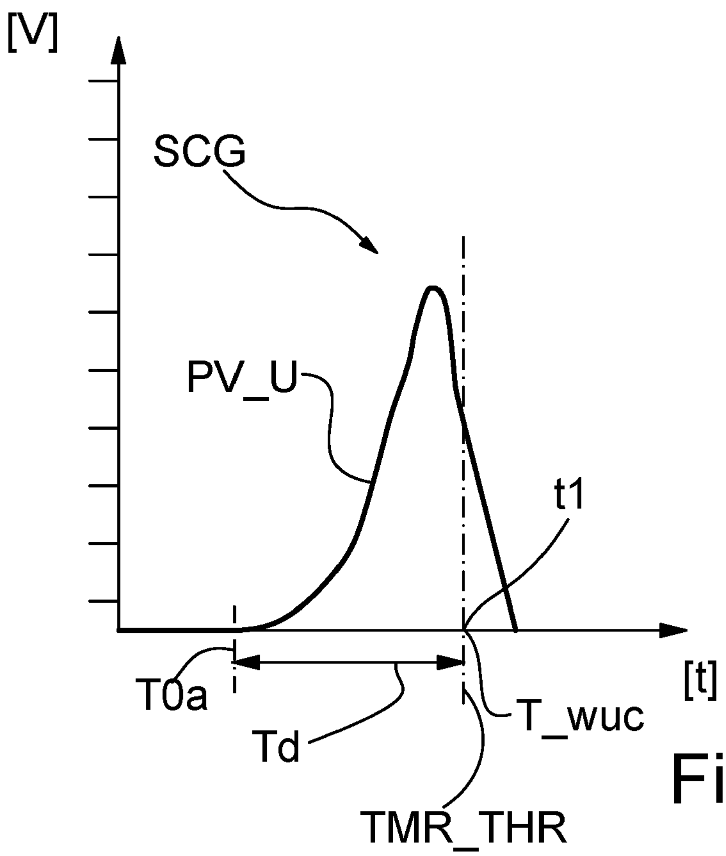
PV_U
t2
t1
T0a
[t]
Td
T_wuc
TMR_THR

Fig. 4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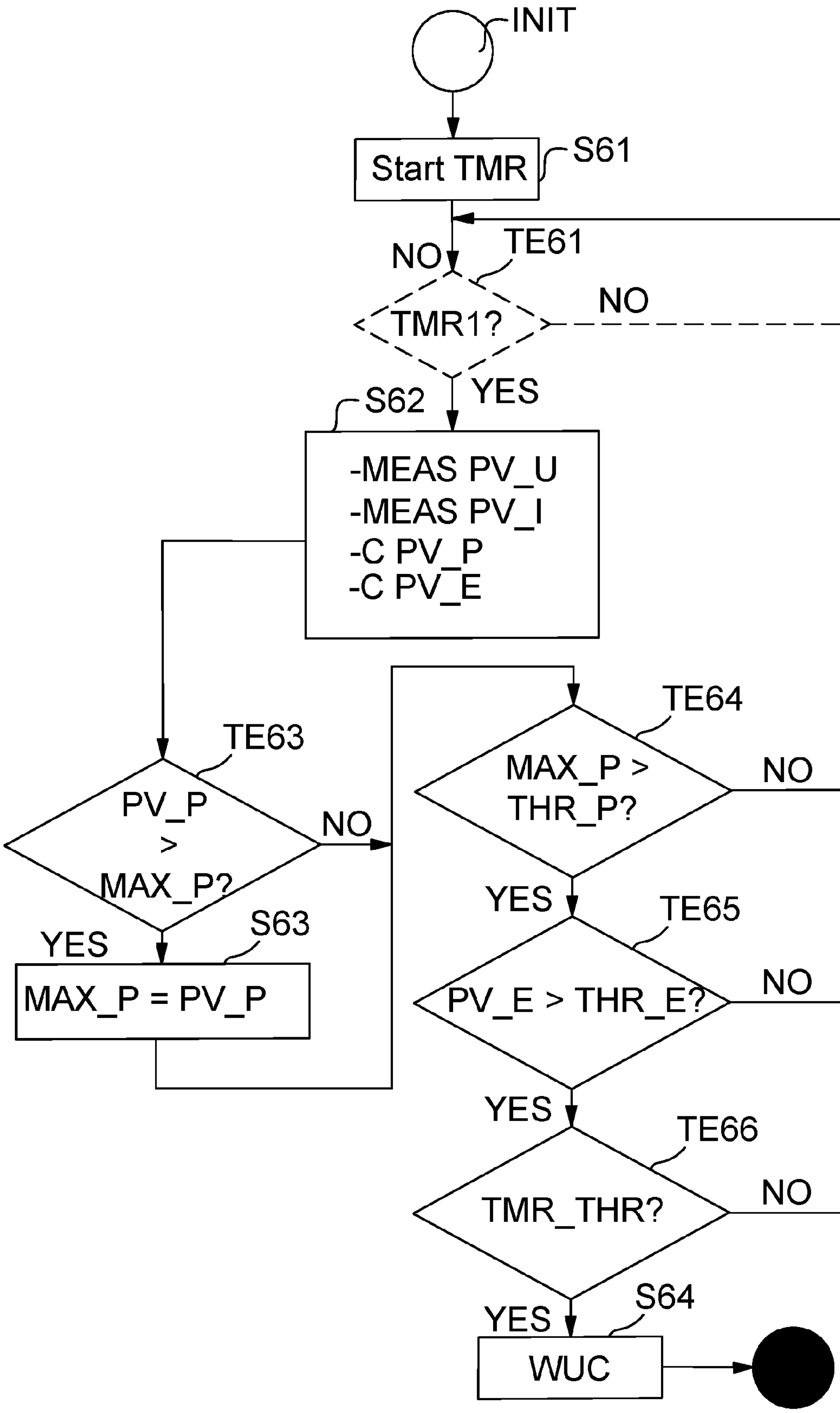
SCG
PV_U
t1
T0a
[t]
Td
T_wuc
TMR_THR

Fig. 5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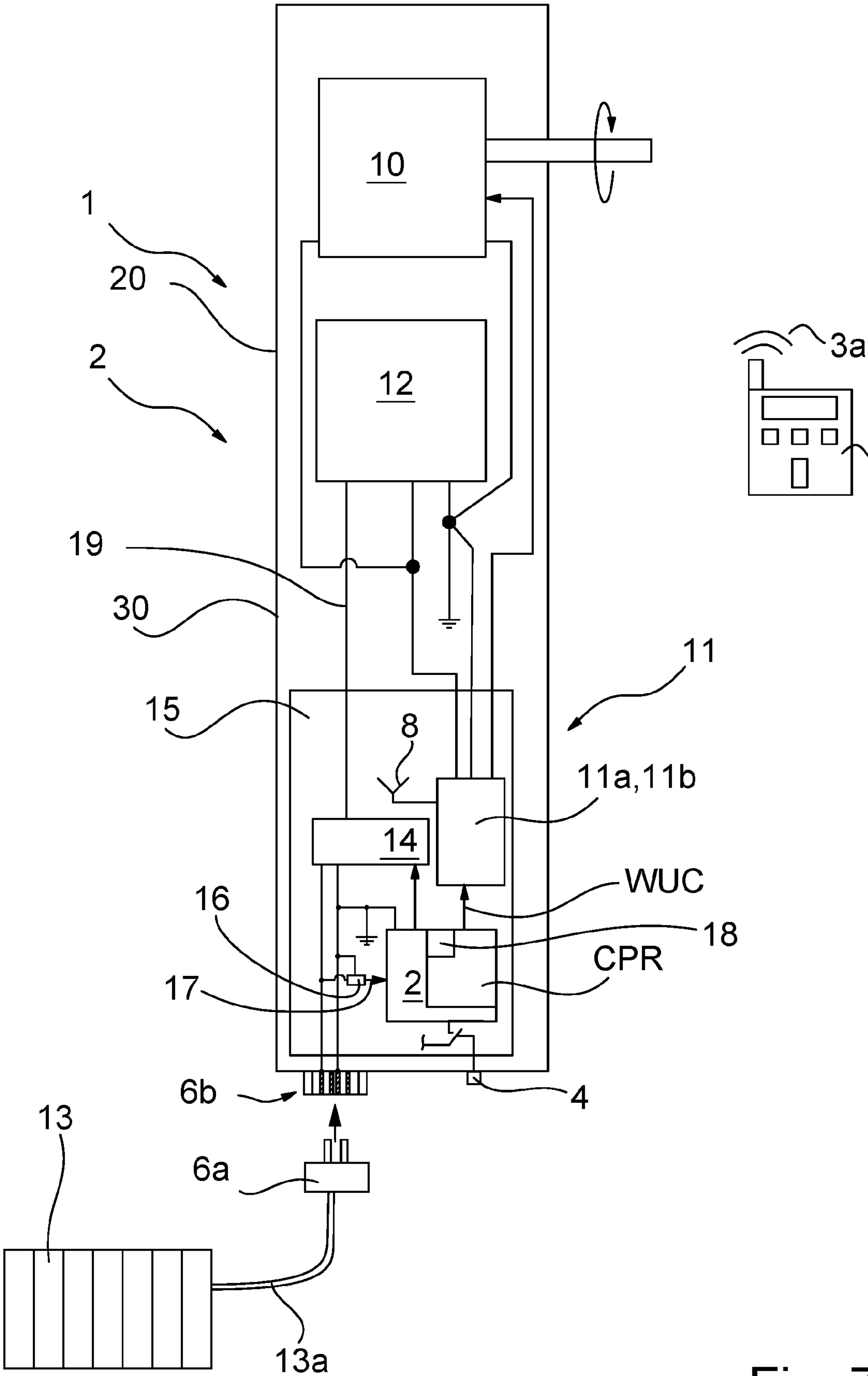
Start TMR
S61
NO
TE61
TMR1?
NO
YES
S62
-MEAS PV_U
-MEAS PV_I
-C PV_P
-C PV_E
TE64
MAX_P > THR_P?
NO
TE63
PV_P > MAX_P?
NO
YES
TE65
YES
S63
MAX_P = PV_P
PV_E > THR_E?
NO
YES
TE66
TMR_THR?
NO
YES
S64
WUC

Fig. 6


10
1
20
12
2
3a
3
19
30
11
15
8
11a,11b
14
WUC
16
18
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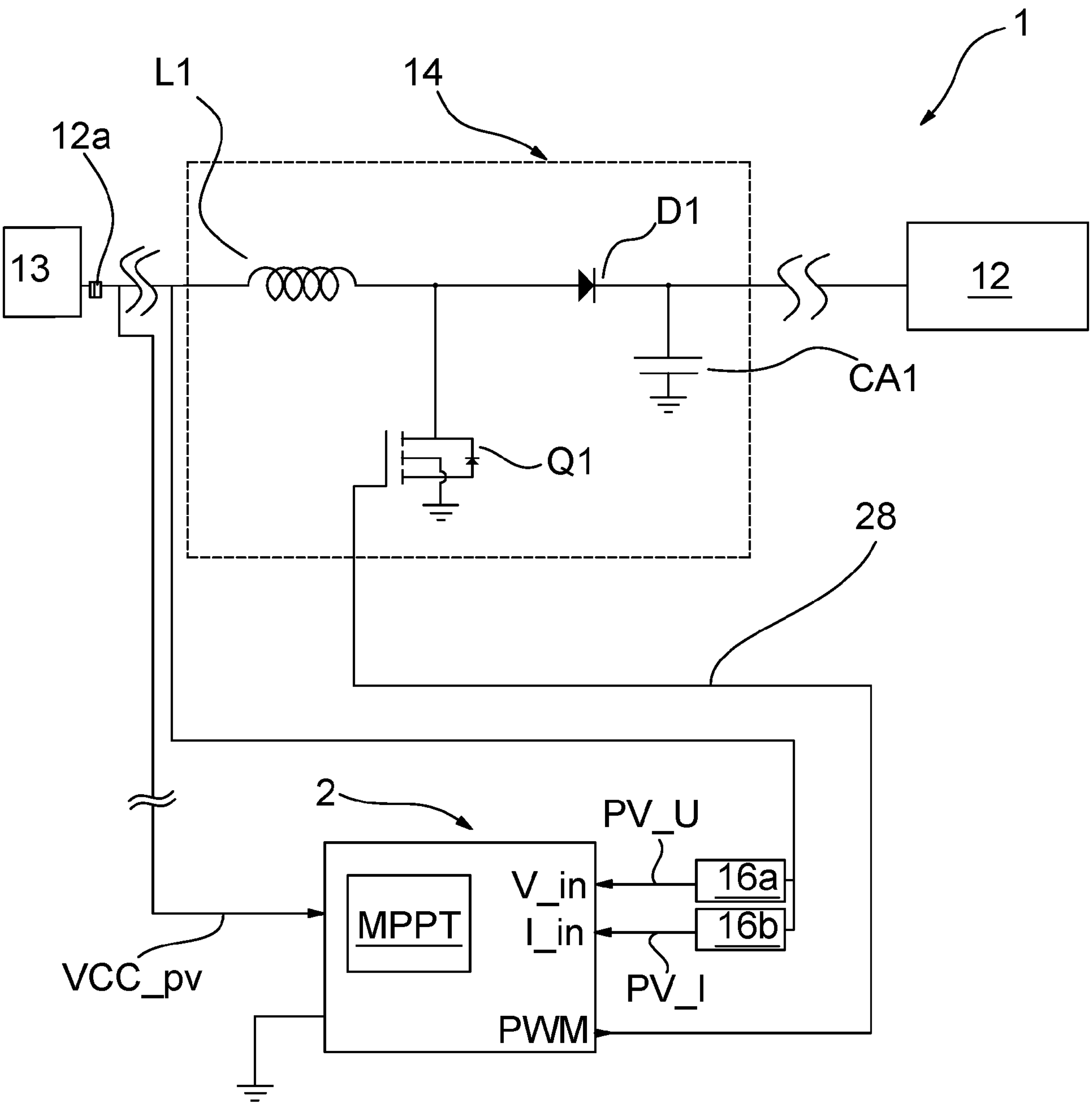
2
6b
4
13
6a
13a

Fig. 7


1
L1
14
12a
13
D1
12
CA1
Q1
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2
PV_U
V_in
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MPPT
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VCC_pv
PV_I
PWM

Fig. 8

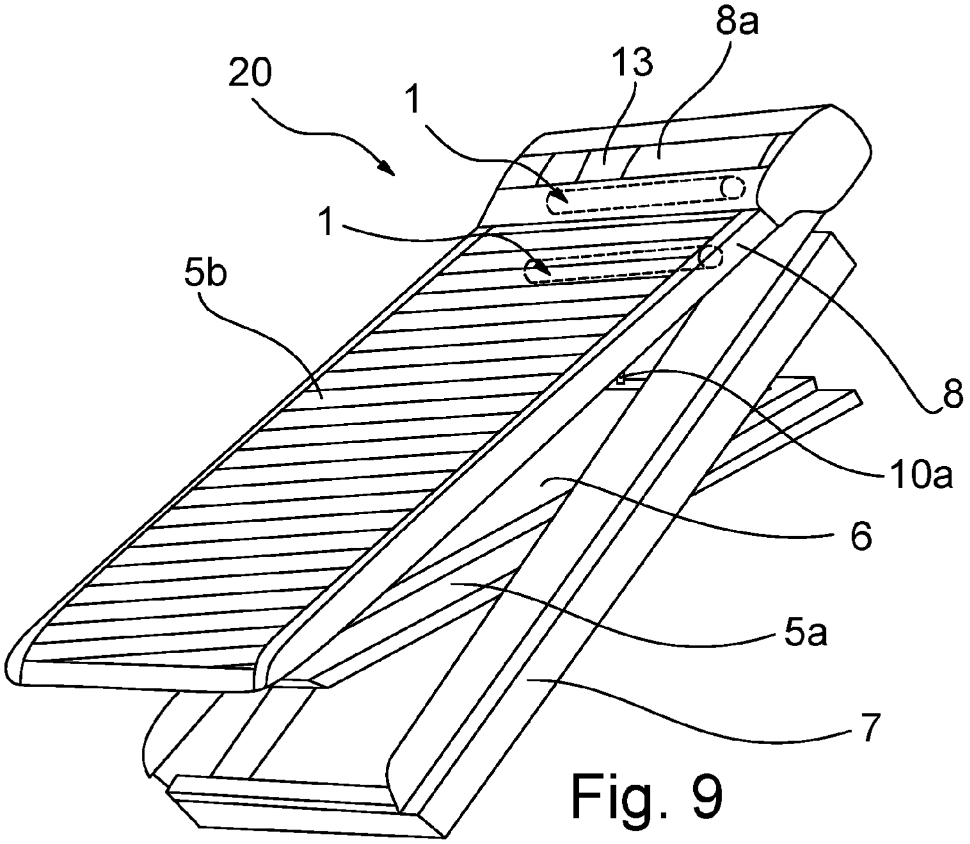

Fig. 9

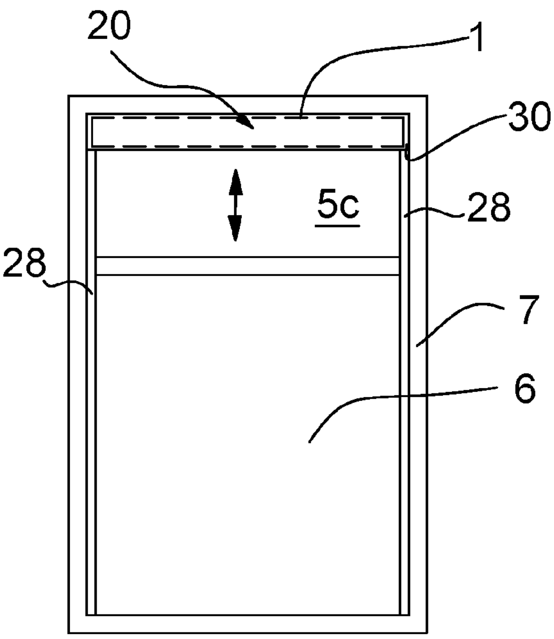

Fig. 10

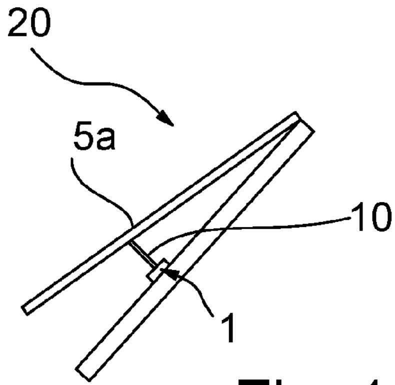

Fig. 11

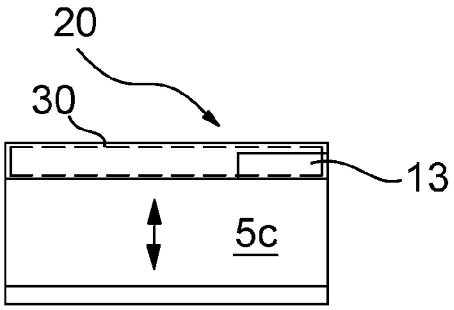

Fig. 10a

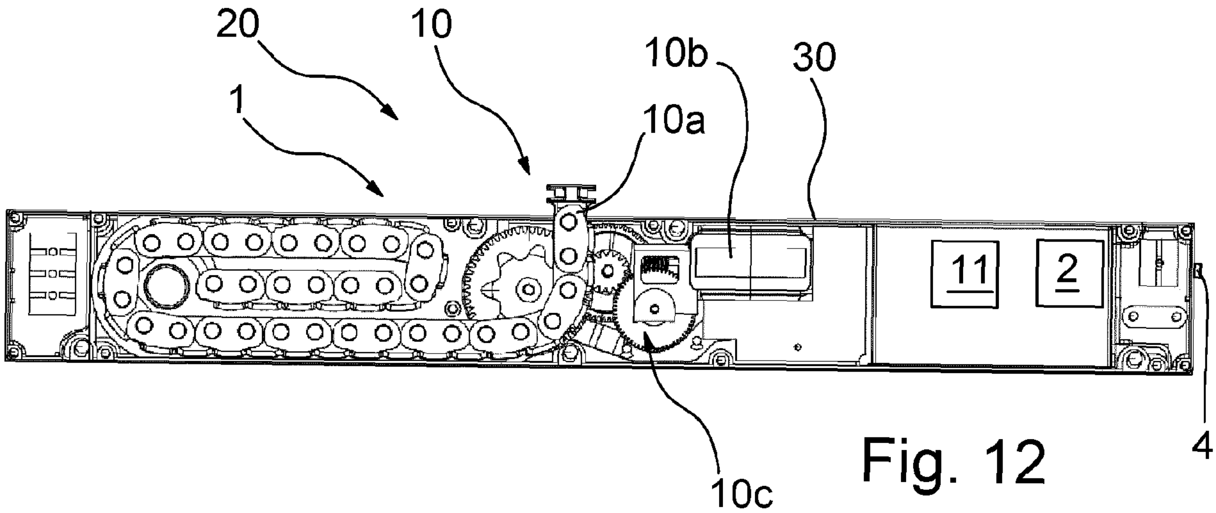

Fig. 12

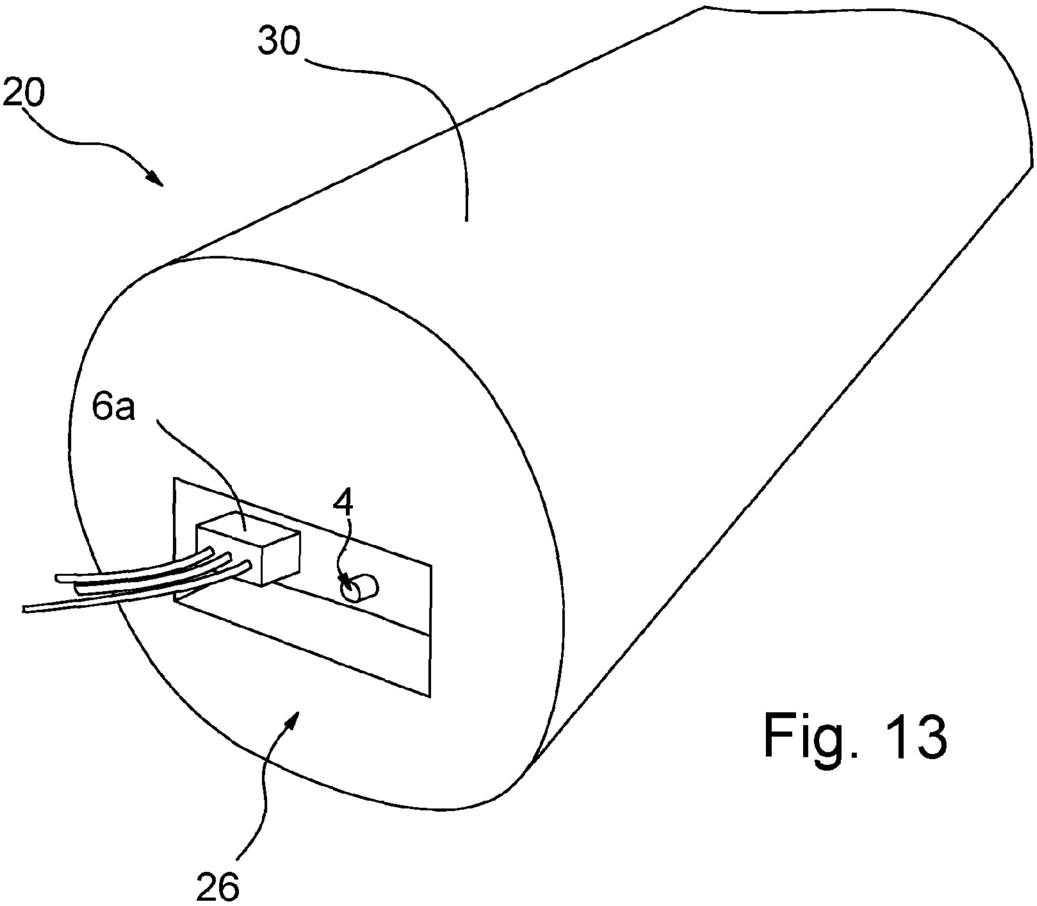

Fig. 13

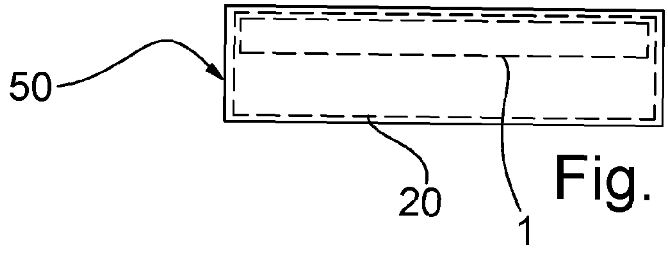

Fig. 14

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 3897

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 July 2023	Rémondot, Xavier

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