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(54) Title: GENERATOR FOR A TRAIN WHEEL

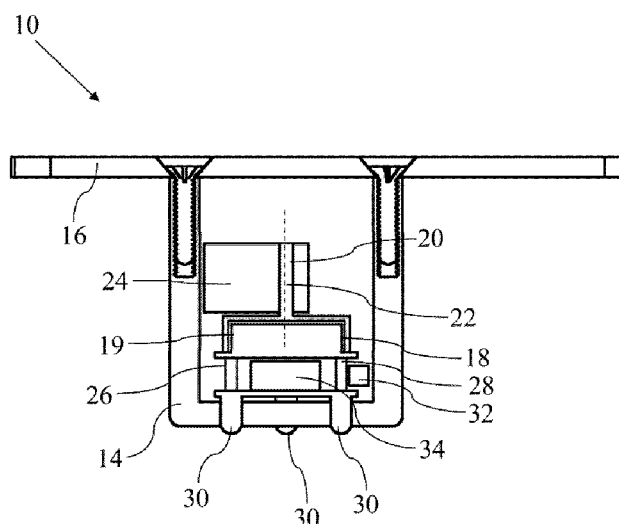


FIG. 2

(57) Abstract: A generator for use with a train wheel is provided, which has a housing having a mounting surface for fixedly mounting the housing to a train wheel, a stator fixedly attached to the housing, a rotor rotatably mounted to the stator, a counterweight attached to the rotor with its centre of gravity offset from the axis of rotation of the rotor, the weight of the counterweight acting to maintain the rotor in a stationary position as the stator rotates with the housing. The movement of the stator relative to the rotor generates a potential difference and at least one of a light and a bearing monitoring system is connected to the generator and is powered by the potential difference.

GENERATOR FOR A TRAIN WHEEL

TECHNICAL FIELD

[0001] This relates generally to generators of electricity, and more specifically to
5 generators for recovering energy from a train wheel.

BACKGROUND

[0002] Trains are provided with lights at the front and end of the train to provide visibility
to the train occupants, as well as to other vehicles that may cross paths with the train in order
10 to avoid collisions. However, lights are not provided along the sides of trains, such that their
visibility is limited, which may make it difficult for to pedestrians and vehicles to see the
trains at night. Problems with the wheel bearings or brakes of the train can be detected by
temperature sensors placed on the wheels of the train. However, providing electrical power to
the exterior of trains, especially the wheels, is made challenging by the layout of the train and
15 the configuration of the wheels.

SUMMARY

[0003] According to an aspect, there is provided a generator for use with a train wheel,
the generator comprising a housing having a mounting surface for fixedly mounting the
20 housing to a train wheel, a stator fixedly attached to the housing, a rotor rotatably mounted to
the stator, the rotor having an axis of rotation, and a counterweight attached to the rotor, the
counterweight having a centre of gravity at a point offset from the axis of rotation of the rotor,
the weight of the counterweight acting to maintain the rotor in a stationary position as the
stator rotates with the housing, wherein the movement of the stator relative to the rotor
25 generates electrical energy through the stator, and at least one of a light and a bearing
monitoring system being electrically connected to the stator and powered by the electrical
energy.

[0004] According to another aspect, the stator may comprise an armature and the rotor
30 may comprise a permanent magnet, the rotation of the armature relative to the permanent
magnet generating the electrical energy.

[0005] According to another aspect, the generator may further comprise an electricity

storage device electrically connected to the stator and supplied by the electrical energy.

[0006] According to another aspect, both of the light and the bearing monitoring system may be electrically connected to the stator and powered by the electrical energy.

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[0007] According to another aspect, the bearing monitoring system may comprise a temperature sensor.

[0008] According to another aspect, the generator may further comprise a notification
10 indicator connected to the temperature sensor.

[0009] In other aspects, the features described above may be combined together in any reasonable combination as will be recognized by those skilled in the art.

15 BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other features will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to be in any way limiting, wherein:

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FIG. 1 is a perspective view of a train wheel having an electrical generator attached.

FIG. 2 is a cross-sectional view in isolation of the electrical generator shown in FIG. 1.

FIG. 3 is a front elevation view in section in isolation of the electrical generator shown in FIG. 1.

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FIG. 4 is a perspective view in isolation of the mounting side of the electrical generator shown in FIG. 1.

FIG. 5 is a perspective view in isolation of the generator side of the electrical generator shown in FIG. 1.

FIG. 6 is a flow diagram of an application of the electrical generator.

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DETAILED DESCRIPTION

[0011] A generator generally identified by reference numeral 10, will now be described with reference to FIG. 1 through 5.

5 [0012] Referring to FIG. 1, generator 10 for use with train wheel 12 has a housing 14 with a mounting surface 16 for fixedly mounting housing 14 to train wheel 12. Referring to FIG. 4 and 5, the depicted example shows a suitably type of mounting, where mounting surface 16 is a flange that extends outward from housing 14 with holes that allow the flange to be pin connected to train wheel 12, as shown in FIG. 1. Other types of mountings may also
10 be used.

[0013] Referring to FIG. 2, a stator 18 is provided within housing 14 that is fixedly attached to housing 14. A rotor 20 is rotatably mounted to stator 18 and has an axis of rotation 22. A counterweight 24 is attached to rotor 20, counterweight 24 having a centre of gravity 40 (shown in FIG. 3) at a point offset from axis of rotation 22 of rotor 20. The weight
15 of counterweight 24, due to gravity, acts on counterweight 24 to maintain rotor 20 in a stationary position as stator 18 rotates with housing 14. The shape of counterweight 24 may be selected to offset the centre of gravity 40 from rotor 20 as far as possible in order to provide more resistance against the movement of rotor 20. It will be understood that the terms
20 “stator” and “rotor” generally refer to a stationary element and a rotating element. However, this designation will depend on the frame of reference. In the depicted embodiment, rotor 20 is held stationary by counterweight 24, while stator rotates with train wheel 12.

[0014] The movement of stator 18 relative to rotor 20 generates electrical energy that can
25 be electrically transmitted to power connected devices. In one embodiment, rotor 20 may be provided as a permanent magnet that rotates relative to stator 18, which may, for example, have an armature 19 such as a wire coil that rotates with stator 18. Rotor 20 may be designed to be outside of stator 18 as shown, or within stator 18. As rotor 20 is held stationary by counterweight 24, the rotation of the armature 19 relative to the permanent magnet generates
30 electrical energy in armature 19. It will be understood that the potential difference may also be generated by the rotation of a first electrical connection 26 connected to stator 18 and a

second electrical connection 28 connected to rotor 20. In this example the movement of stator 18 relative to rotor 20 generates a potential difference between first and second electrical connections 26 and 28. The electrical energy generated by the movement of stator 18 relative to rotor 20 can be used to do power lights 30, a bearing monitoring system 32, charge an electrical storage device 34, or any combination of these functions. Electrical storage device 34 may be used in combination with the other features to allow the various components continue operating even after the train has stopped. In the depicted embodiment, bearing monitoring system 32 is a temperature sensor that is connected to lights 30, which are also used as a notification indicator to warn against bearing failure. The notification indicator 30 may take various forms, and may be visual, auditory, or may have a wireless transmission function to communicate temperature warnings to remote devices. For example, a processor may be used that causes lights 30 to display a different colour, or a particular pattern if an alarm condition is detected. In another example, there may be a wireless transmission function such as a BluetoothTM connection or a short range radio frequency module. Bearing monitoring system 32 may be provided in order to provide a warning if the temperature of the wheel hub exceeds a predefined temperature, which may indicate a problem with a wheel bearing or brake. As shown, both light 30 and bearing monitoring system 32 are electrically connected to stator 20 and powered by the electrical energy generated by the device rotation. An electricity storage device 34 may also be supplied by the electrical energy.

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[0015] In one example, referring to FIG. 6, generator 10 may be used to provide self-generated power a Railway Collision Avoidance System (RCAS) connected to the bearing cover bolts of a train car wheel. In this case a microcontroller 42 is provided that is powered by generator 10 and electricity storage device 34. Generator 10 may provide electricity through an AC/DC converter 44 and a regulator 46. Warning indicator lights 30 may be provided along the train cars to provide a visual warning system to other vehicles for collision avoidance. The microcontroller controls a predefined oscillation of the warning indicator lights 30 as well as monitoring the wheel bearing house temperature as measured by temperature sensor 32. Lights 30 may be high intensity LED lights. A clock 48 may also be provided to control the oscillation frequency of the lights 30 and the sampling interval of temperature sensor 32. The microcontroller may control a microcontroller brown out voltage

and have brown out detector 50, and may further be programmed to use a low power sleep mode and watchdog timers to conserve electrical storage. The microcontroller may also use either an analogue to digital converter or a serial interface temperature monitor.

5 [0016] In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the elements is present, unless the context clearly requires that there be one and only one of the elements.

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[0017] The scope of the following claims should not be limited by the preferred embodiments set forth in the examples above and in the drawings, but should be given the broadest interpretation consistent with the description as a whole.

15

What is Claimed is:

1. A generator for use with a train wheel, the generator comprising:
a housing having a mounting surface for fixedly mounting the housing to a train
5 wheel;
a stator fixedly attached to the housing;
a rotor rotatably mounted to the stator, the rotor having an axis of rotation;
a counterweight attached to the rotor, the counterweight having a centre of gravity at a
point offset from the axis of rotation of the rotor, the weight of the counterweight acting to
10 maintain the rotor in a stationary position as the stator rotates with the housing;
wherein the movement of the stator relative to the rotor generates electrical energy
through the stator; and
at least one of a light and a bearing monitoring system being electrically connected to
the stator and powered by the electrical energy.
15
2. The generator for use with a train wheel of claim 1, wherein the stator comprises an
armature and the rotor comprises a permanent magnet, the rotation of the armature relative to
the permanent magnet generating the electrical energy.
- 20 3. The generator for use with a train wheel of claim 1, further comprising an electricity
storage device electrically connected to the stator and supplied by the electrical energy.
4. The generator for use with a train wheel of claim 1, wherein both of the light and the
bearing monitoring system are electrically connected to the stator and powered by the
25 potential difference.
5. The generator for use with a train wheel of claim 3, wherein the bearing monitoring
system comprises a temperature sensor.
- 30 The generator for use with a train wheel of claim 4, further comprising a notification indicator
connected to the temperature sensor.

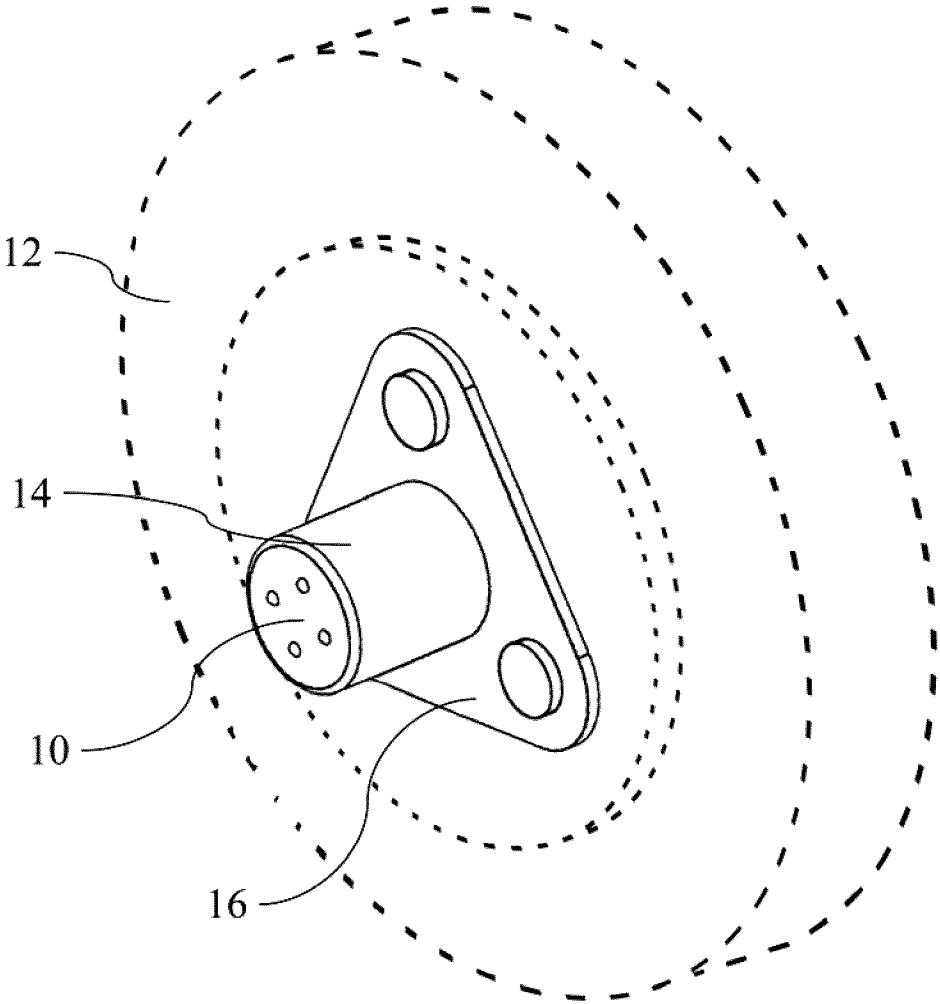


FIG. 1

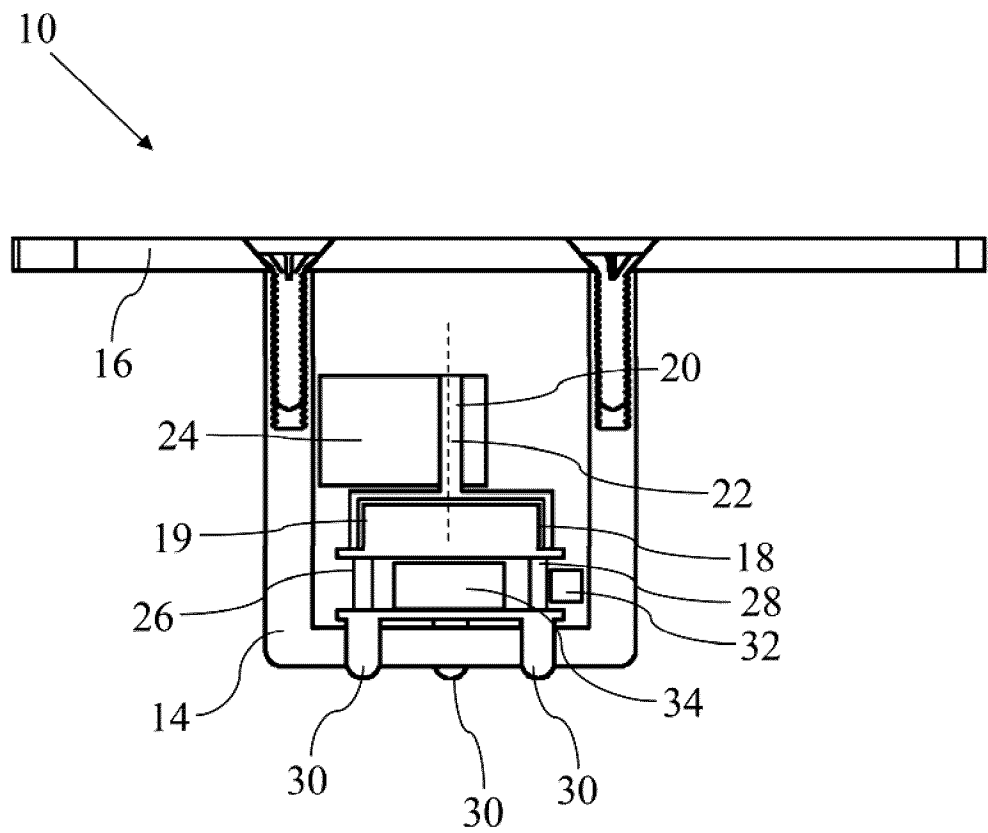


FIG. 2

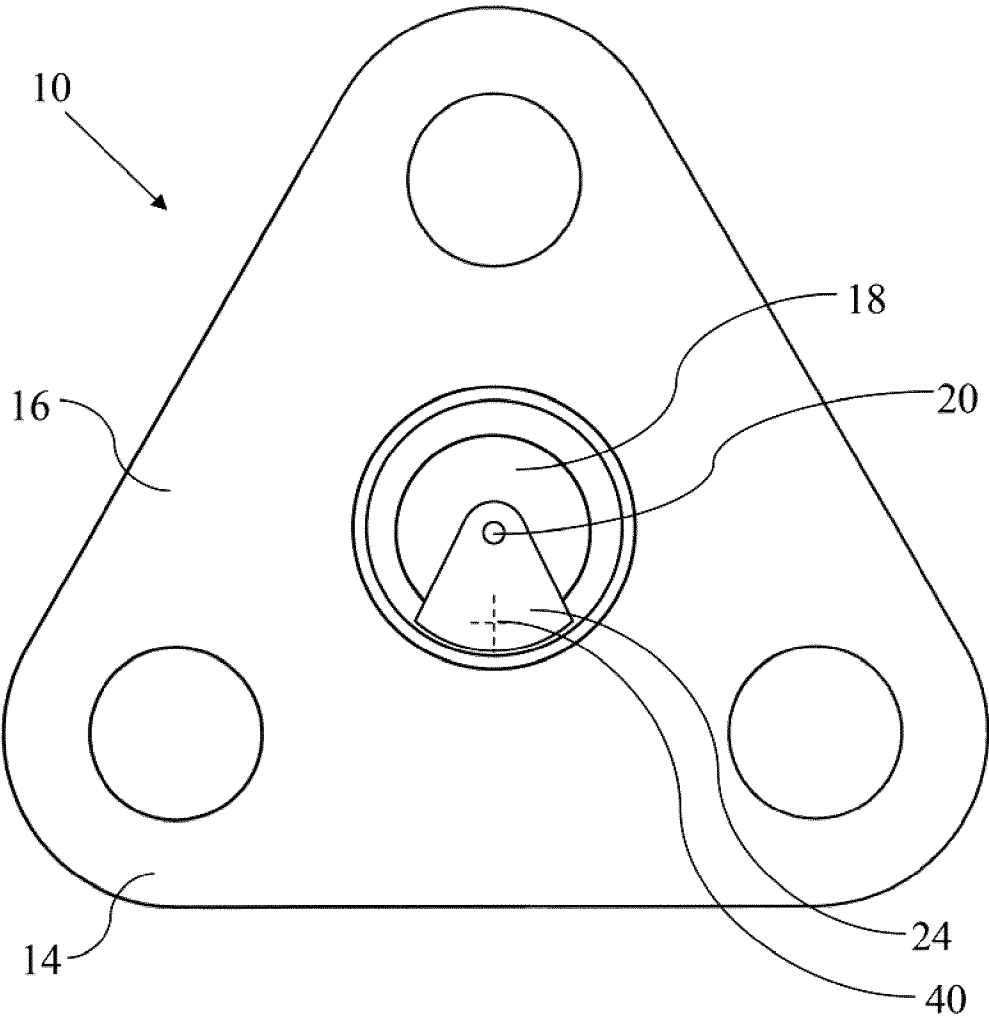


FIG. 3

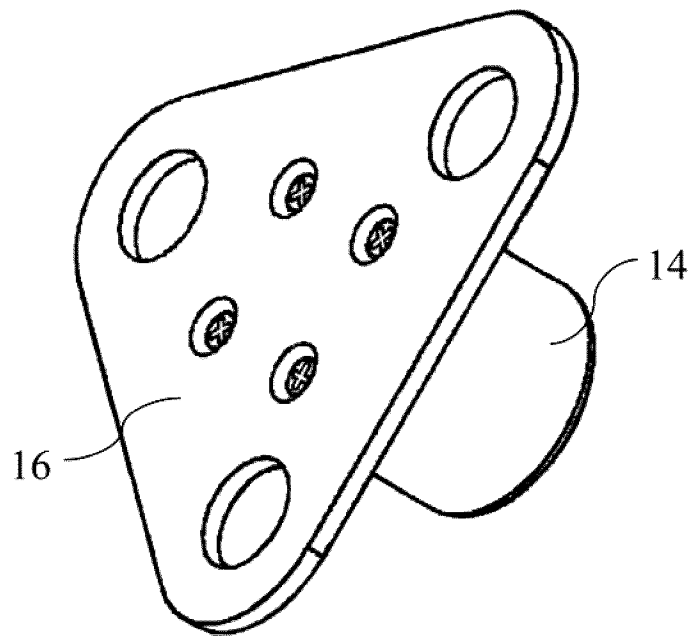


FIG. 4

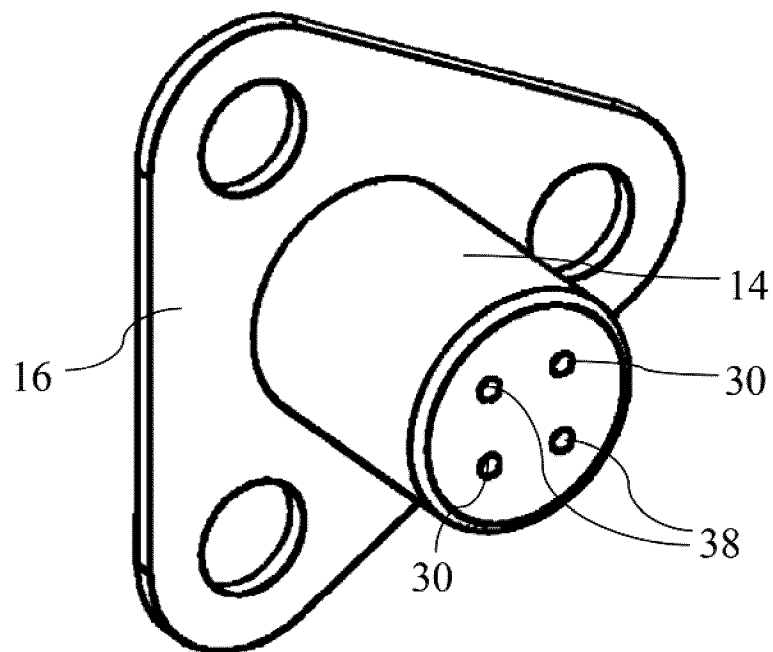


FIG. 5

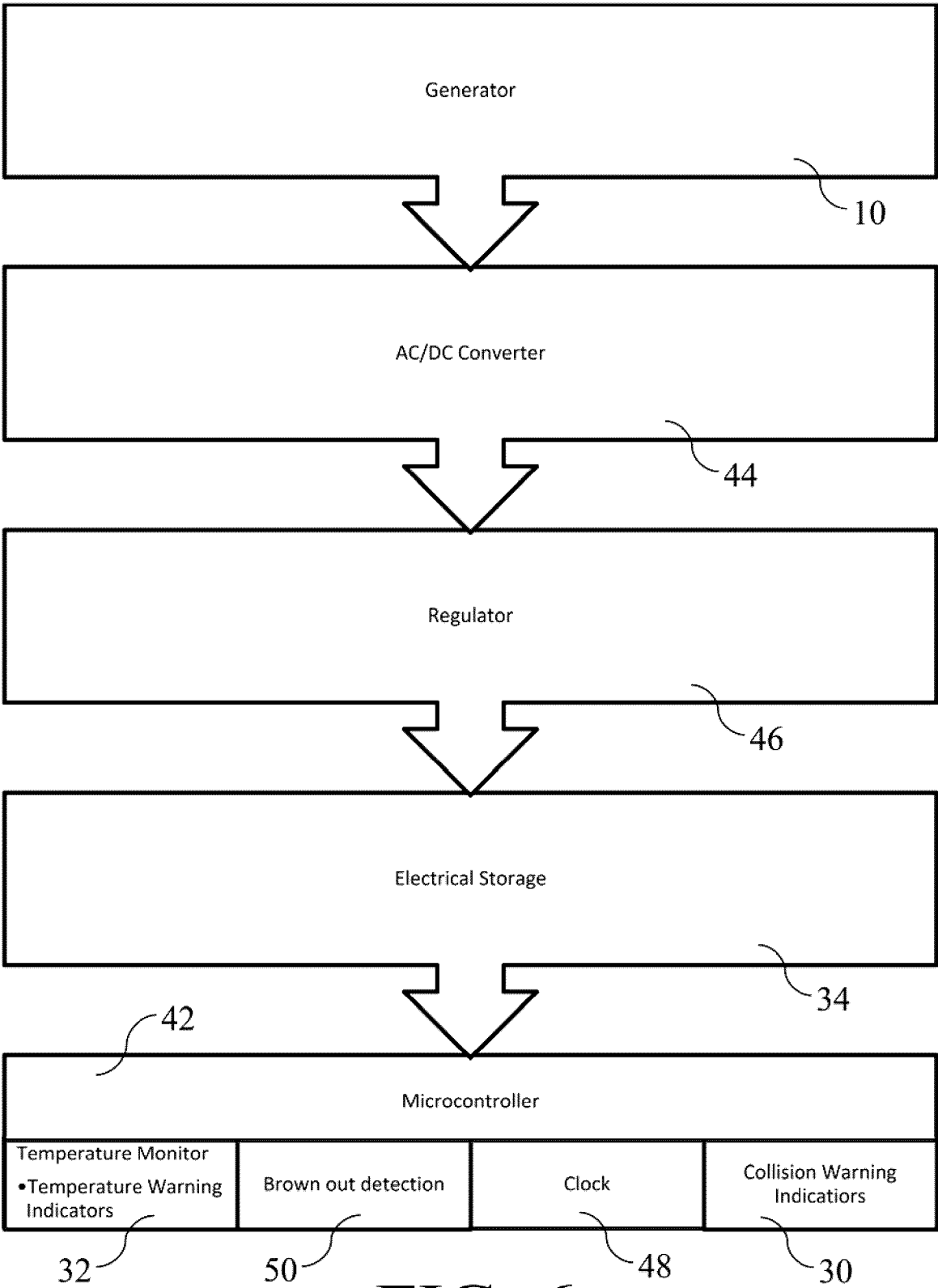


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2016/050366

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **B61L 15/00** (2006.01), **B61F 99/00** (2006.01), **B61K 13/00** (2006.01), **H02K 7/04** (2006.01),
H02K 7/18 (2006.01), **H05B 37/00** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B61L 15/00 (2006.01), B61F 99/00 (2006.01), B61K 13/00 (2006.01), H02K 7/04 (2006.01),
H02K 7/18 (2006.01), H05B 37/00 (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Intellect (generator, rail, wheel, counterweight, pendulum), Espacenet (wheel, axle, generator, counter*, pendulum), Orbit (generator, rail, wheel, counterweight, pendulum), Google patent (generator, rail, wheel, counterweight, pendulum), leexplore (GENERATOR AND RAIL * AND wheel and (COUNTERWEIGHT or pendulum)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2001000305A1, Murray, 19 April 2001 (19-04-2001) *the whole document.	1-5
A	US2006164225A1, Pearman, 27 July 2006 (27-07-2006) *the whole document.	1-5
A	US2014152025A1, Renga et al, 05 June 2014 (05-06-2014) *Abstract, Fig. 1	1-5
A	Y. J. Wang, C. D. Chen and C. K. Sung, "System Design of a Weighted-Pendulum-Type Electromagnetic Generator for Harvesting Energy From a Rotating Wheel," in IEEE/ASME Transactions on Mechatronics, vol. 18, no. 2, pp. 754-763, April 2013. *the whole document.	1-2

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* "A" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance earlier application or patent but published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	"T" "X" "Y" "&"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art document member of the same patent family
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08 June 2016 (08-06-2016)

Name and mailing address of the ISA/CA
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CA2016/050366

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		EP2738934B1	12 August 2015 (12-08-2015)
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