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(54) **Wireless, energy-saving electronic candle**

(57) An electronic candle (1) comprising a boxed frame (2) with an elongated shape defining the visible external body of the electronic candle (1); a light source (3); some photovoltaic panels (4) stably fixed on the external side wall (5) of the boxed frame (2), and is adapted to generate a first electric current (I1); a battery (6) generating a second electric current (I2); and an electronic control circuit (7) which provides a current supply (I3) to the light source (3) and is configured in such a way to switch to a rated power status, wherein it regulates the current supply (I3) in such a way that the latter has a first given value (I3a), when said first current (I1) has a value greater than zero; or alternatively, to a reduced power status, wherein it generates the current supply (I3) in such a way that the latter has a second constant given value (I3b) less than the first value (I3a), when the first current (I1) has a value equal to zero.

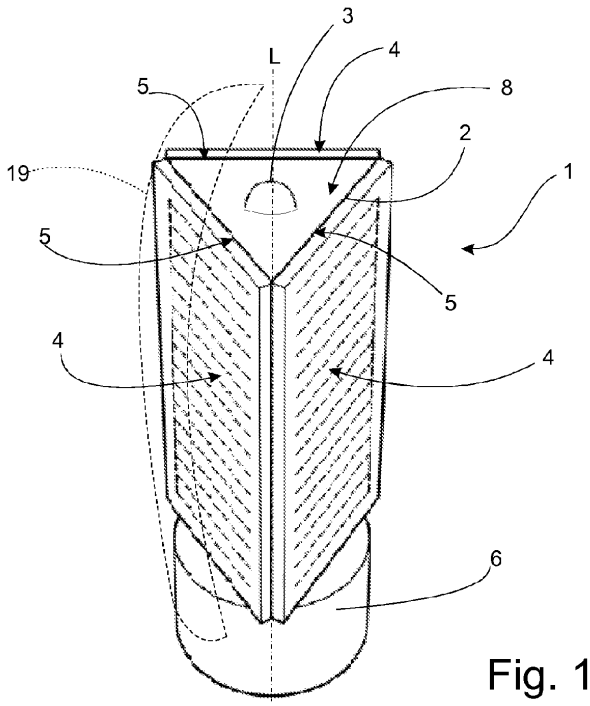

Fig. 1

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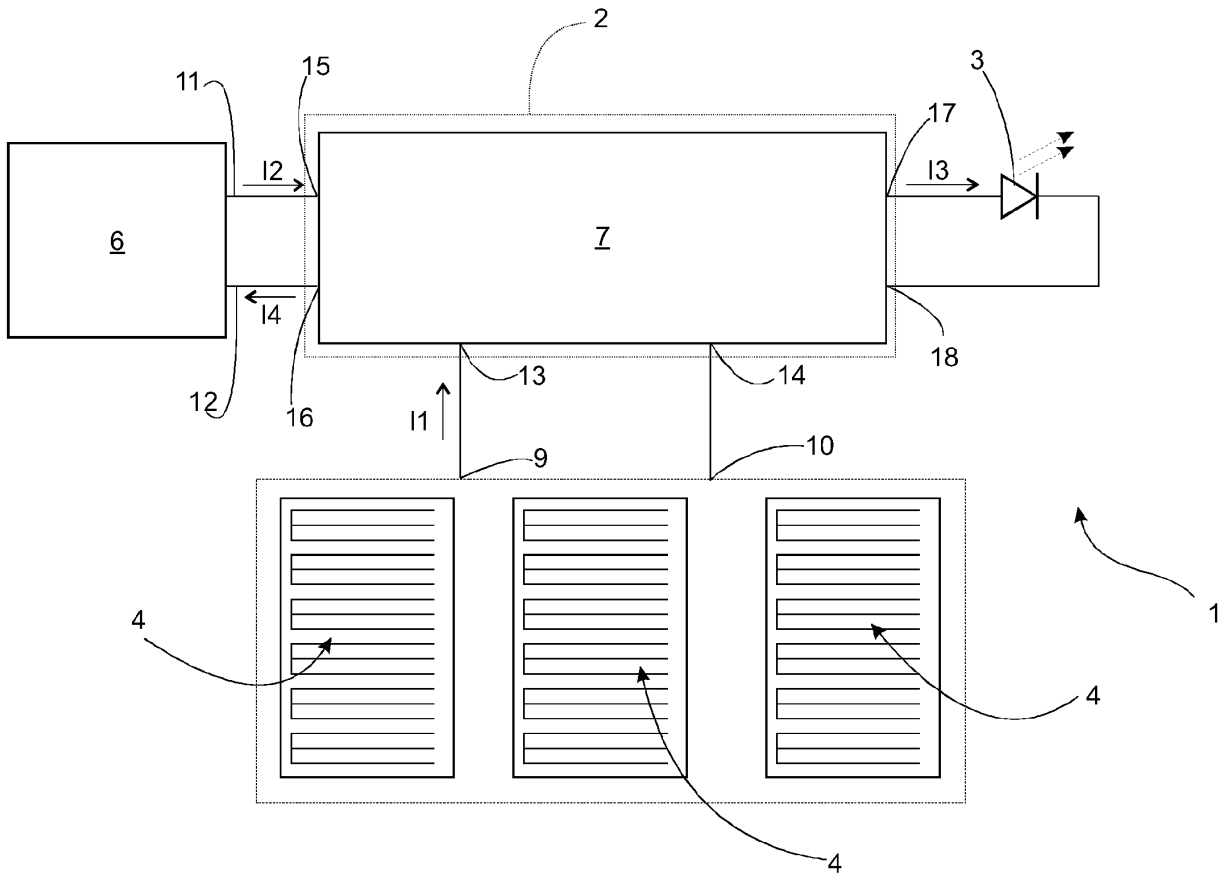

Fig. 3

Description

[0001] The present invention relates to a wireless, energy-saving electronic candle.

[0002] In particular, the present invention relates to an electronic candle configured to be employed in applications/uses completely similar to those of a traditional light; to which explicit reference will be made in the following description without therefore loosing in generality.

[0003] The use is known of arranging candles, hereinafter indicated with the term votive lights, at tombs in cemeteries.

[0004] Moreover, votive lights are known essentially comprising a plastic container containing wax inside of which a fuse or wick is embedded which can be lit with fire.

[0005] The above-described votive lights are particularly disadvantageous as they have an extremely limited life and accordingly require frequent replacement.

[0006] Electrically-supplied votive lights were created for the purpose of overcoming the aforesaid drawback, which typically comprise a support frame, a lampholder connected to the support frame, an electric incandescent lamp coupled with the lampholder, and an electric circuit which connects the electric lamp to a power supply network.

[0007] The electric votive lights of the above-described type have the drawback of being difficult to move from one place to another, and of requiring both the presence of a main electric line at the tomb, and the provision of electrical wiring; both these conditions heavily affect the overall installation costs of the electric votive light.

[0008] It is thus the object of the present invention to provide a votive light, i.e. an electronic candle which is capable of overcoming the above-described technical drawbacks.

[0009] According to the present invention, an electronic candle is made as defined in claim 1 and preferably, but not necessarily, in any one of the claims directly or indirectly depending on claim 1.

[0010] The present invention will now be described with reference to the accompanying drawings, which illustrate a non-limiting embodiment thereof, in which:

- figure 1 is a schematic and perspective view with parts removed for clarity, of an electronic candle made according to the present invention;
- figure 2 is a schematic, front elevation view of the electronic candle shown in figure 1; while
- figure 3 schematically shows the electronic control circuit in the electronic candle shown in figures 1 and 2.

[0011] With reference to figures 1 and 2, numeral 1 denotes an electronic candle as a whole, configured to preferably, but not necessarily, perform the function of votive light.

[0012] The electronic candle 1 essentially comprises a boxed frame 2 defining the case or external body of the electronic candle 1, at least one light source 3 arranged on the boxed frame 2 in such a way to generate an outward directed light beam, one or more photovoltaic panels 4, which are stably fixed on the external side wall 5 of the boxed frame 2 and are configured to generate a first electric power magnitude, an accumulator device 6 generating a second electric power magnitude, and an electronic control circuit 7, which is configured to receive as input the first and the second electric power magnitudes and to provide as output a third electric power magnitude to the light source 3 to be supplied.

[0013] With reference to figure 1, the boxed frame 2 has a substantially elongated shape along a longitudinal axis L and has a substantially triangular cross section.

[0014] In this case, in the example shown in figure 1, the boxed frame 2 has a substantially equilateral triangular-shaped cross section, and hence has three rectangular side surfaces having the same sizes on each of which a photovoltaic panel 4 is stably fixed.

[0015] It is suitable to point out that according to a variant (not illustrated), the boxed frame 2 has a cross section substantially in the shape of an isosceles triangle, while the electronic candle 1 comprises two photovoltaic panels stably fixed on the two larger surfaces of frame 2, the third surface, i.e. the smallest side surface having no panels.

[0016] With regards to the light source 3, it advantageously comprises at least one LED, which is positioned on the top wall 8 of the boxed frame 2.

[0017] With reference to the schematic example shown in figure 3, the photovoltaic panels 4 are connected to each other in such a way to preferably have two common output terminals 9 and 10, through which they provide a first current 11.

[0018] With regards to the accumulator device 6, it preferably comprises a battery and has a pair of terminals 11 and 12 through which they generate a second current I2.

[0019] With reference to the example shown in figure 3, the electronic control circuit 7 has: two inputs 13 and 14 connected to the outputs 9 and 10, respectively, of the photovoltaic panels 4 to receive the first current I1; two inputs 15 and 16 connected to the outputs 11 and 12, respectively, of the accumulator device 6 to receive the second current I2; two outputs 17 and 18 connected to the light source 3, that is to the LED, to provide the latter with a current supply I3.

[0020] In particular, the electronic control circuit 7 is configured to switch to a rated power status, in which it regulates the current supply 13 in such a way that the latter has a given rated value I3a when the first current I1 has a value greater than zero.

[0021] In greater detail, the electronic control circuit 7 is configured to switch to a rated power status when the photovoltaic panels 4 provide a preset electric supply power of the light source 3, this latter condition being satisfied in presence of light, i.e. during the day.

[0022] Moreover, the electronic control circuit 7 is con-

figured to pass from the rated power status to a reduced, energy-saving power status, in which it generates the current supply I3 in such a way that the latter has a constant, reduced given value I3b lower than the rated value I3a, when the first current I1 has a value equal to zero, i.e. when I1=0.

[0023] In greater detail, the electronic control circuit 7 is configured to pass from the rated power status to the reduced power status, when the photovoltaic panels 4 do not generate any electric power output, this latter condition occurring in the absence of light, i.e. typically at night.

[0024] Moreover, the electronic control circuit 7 is configured in such a way that, during the rated power status, when the current difference ΔI between the first current I1 and the rated current I3a is positive, i.e. $I1-13=\Delta I>0$, the electronic control circuit 7 itself supplies a recharging current $I4=\Delta I=I1-I3b$ to the accumulator device 6, in which 14 has a value equal to the current difference ΔI itself.

[0025] In particular, during the status of rated power, when the value of the first current generated by the photovoltaic panels is greater than the reduced value I3b of the current supply I3, the electronic control circuit 7 charges the accumulator device with the recharging current $I4=\Delta I$ precisely corresponding to the excess current I1-I3b.

[0026] Moreover, the electronic control circuit 7 may be configured to regulate the current supply I3 according to a substantially intermittent profile such as to generate an intermittent light through the light source 3.

[0027] With reference to figure 2, the electronic candle 1 also comprises an electric connector 21 (shown in figure 2 with a dashed line), for example a female connector which is arranged on the bottom wall 18 of the boxed frame 2 and is adapted to house an electric connector 22, for example a male connector of the accumulator device 6 in such a way to make the electric connection between the latter and the electronic control circuit 6.

[0028] Also, the electronic candle 1 preferably, but not necessarily, comprises an external lampshade 19 preferably, but not necessarily, made with transparent material, such as for example plastic or glass or any other type of similar material, which is shaped in such a way to preferably be stably coupled to, but easily removable from, the boxed frame 2.

[0029] In this case, in the example illustrated in figures 1 and 2, the external lampshade 19 has a bulb of preferably, but not necessarily, rounded shape equipped with a central opening sized in such a way to be fitted into the boxed frame 2.

[0030] The electronic candle 1 also comprises fixing means (not illustrated) for stably fixing the external lampshade 19 to the boxed frame 2.

[0031] When in use, during the day, i.e. in the presence of light, the photovoltaic panels 4 generate a first current I1 other than zero. In this condition, the electronic control circuit 7 is then switched to the rated power status and generates the current supply 13 with the rated value I3a. In this case, the light source 3 generates a rated light power sized in such a way to allow the light source 3 itself to be turned on by an observer.

[0032] In this step, when peaks of lighting occur, the electronic control circuit 7 also supplies the accumulator device 6 with the recharging current 14 determined by the excess current generated by the photovoltaic panels 4, thus recharging the same.

[0033] In absence of light, the photovoltaic panels 4 interrupt the generation of the first current I1, which accordingly has a value equal to zero.

[0034] When this condition occurs, the electronic control circuit 7 then switches to the reduced rated power status and generates the current supply I3 with the reduced rated value I3a.

[0035] In this case, the light source 3 generates a given light power which is less than the rated power but is sized in such a way to allow the light source itself to be turned on by an observer in conditions of low lighting.

[0036] In this step, the electronic control circuit 7 generates the current supply I3 by completely taking advantage of the contribution of the second current 12 generated by the accumulator device 6.

[0037] The above-described electronic candle has various advantages.

[0038] Firstly, in addition to being movable as one pleases from one place to another, it does not require electric supply networks and/or any type of electrical wiring thus in fact eliminating the installation costs.

[0039] Moreover, the presence of photovoltaic panels configured to supply both the battery and the light source allows the usage time of the battery to be significantly lengthened as it determines consumption optimization.

[0040] Lastly, the arrangement of the three photovoltaic panels on the three sides of the boxed frame allows the same to be capable of generating current in any position taken by the candle itself.

[0041] Finally, it is clear that modifications and variants may be made to the above-described electronic candle without deporting from the scope of the present invention as defined by the appended claims.

Claims

1. An electronic candle (1) **characterized in that** it comprises:

   - a boxed frame (2) having elongated shape defining the visible external body of said electronic candle (1);
   - at least one light source (3) arranged on said boxed frame (2);
   - at least one photovoltaic panel (4), which is stably fixed on the external side wall (5) of said boxed frame (2) and is structured to generate a first electric current (I1);
   - energy accumulation means (6) configured to

generate a second electric current (I2); and
- electronic control means (7), which receive said inlet first (I1) and second current (I2) and provide a current supply (13) to said light source (3); said electronic control means (7) being configured to switch to a rated power status, wherein they regulate said current supply (I3) in such a way that the latter has a first given value (I3a), when said first current (I1) has a value greater than zero; or alternatively, in a reduced power status, wherein they generate said current supply (13) in such a way that the latter has a second constant given value (I3b) lower than said first value (I3a), when said first current (I1) has a value equal to zero.

2. An electronic candle according to claim 1, wherein during said rated power status, said electronic control means (7) are configured so that when the current difference (ΔI) between said first current (I1) and said current supply (I3b) is positive, they supply said energy accumulation means (6) with a recharging current (I4) having a value equal to the current difference (ΔI) itself.

3. An electronic candle according to claim 2, wherein said electronic control means (7) are configured in such a way that during said reduced power status, said current supply (I3) has a value (I3b) equal to said second current (I2).

4. An electronic candle according to any one of the preceding claims, wherein said boxed frame (2) is shaped in such a way to have a triangular cross section; said candle comprising at least two photovoltaic panels (4) fixed on two side surfaces of said boxed frame (2); said light source (3) being fixed on the top wall (8) of said boxed frame (2).

5. An electronic candle according to claim 4, wherein said cross section of said boxed frame (2) has the shape of an equilateral triangle; said candle comprising three photovoltaic panels (4) fixed on the three side surfaces of said boxed frame (2).

6. An electronic candle according to claims 4 or 5, comprising a first electric connector (21) arranged on the bottom wall (18) of said boxed frame (2); said energy accumulation means (6) being provided with a second connector (22) structured to be stably coupled to, but easily removable from, said first electric connector (21).

7. An electronic candle according to any one of the preceding claims, wherein said light source (3) comprises at least one LED.

8. An electronic candle according to any one of the preceding claims, wherein said electronic control means (7) are configured to intermittently vary said current supply (I3).

9. An electronic candle according to any one of the preceding claims, comprising an external lampshade (19) made with transparent material coupled to said boxed frame (2).

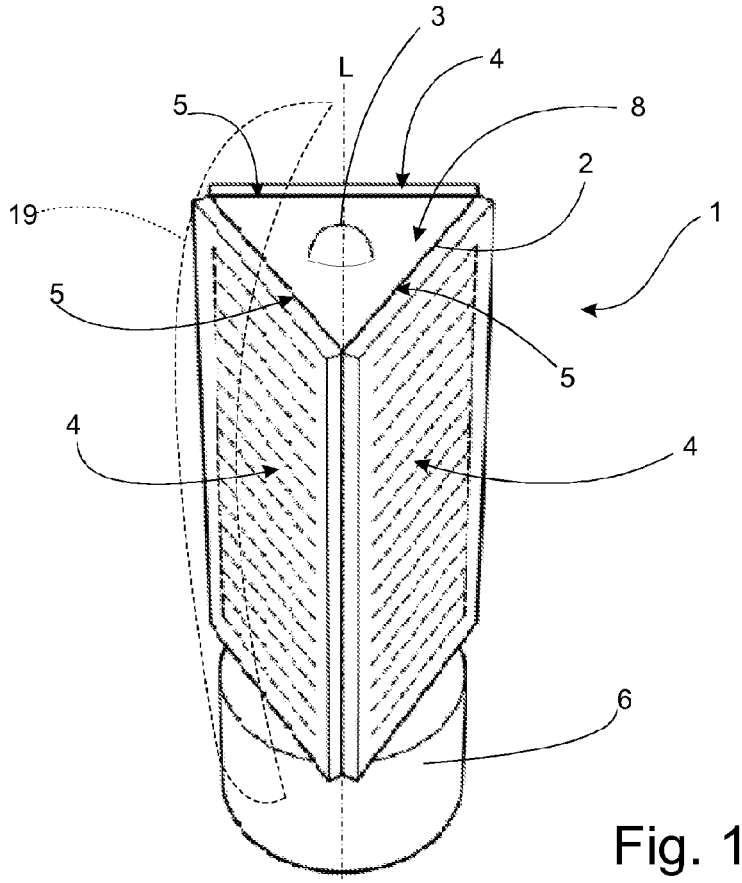

Fig. 1

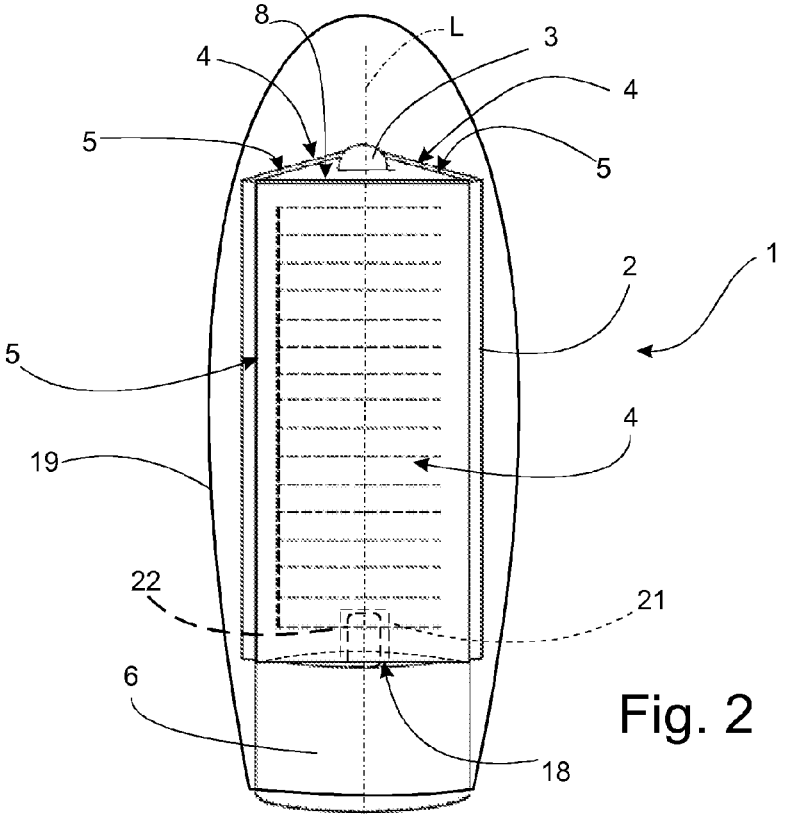

Fig. 2

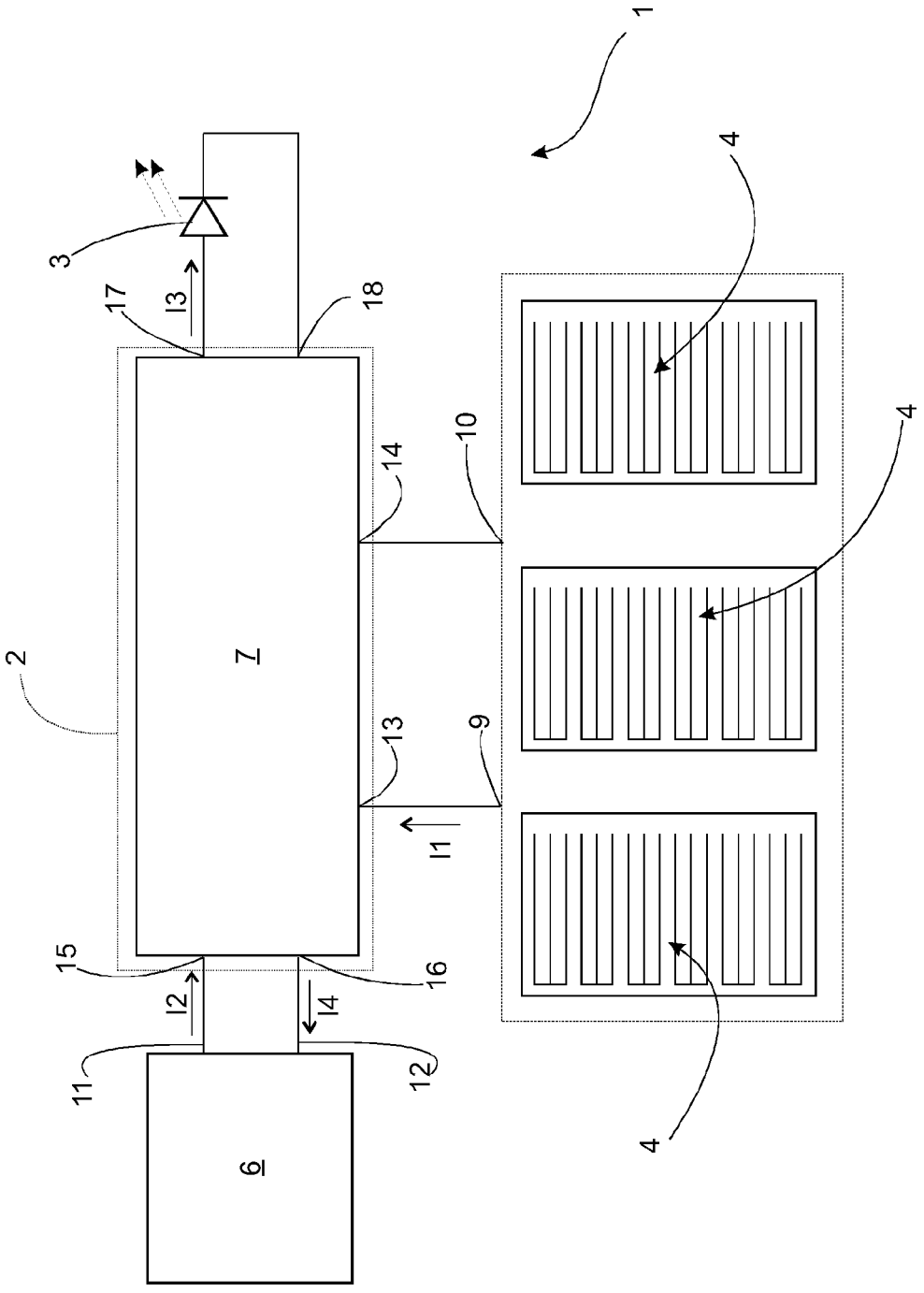

Fig. 3