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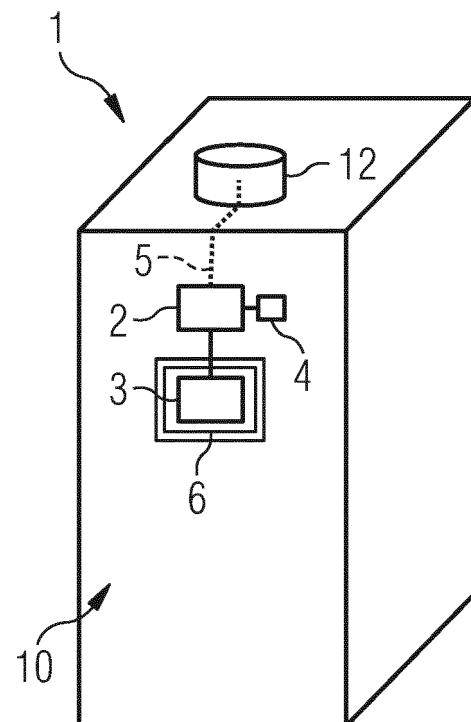
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(54) **A PACKAGE, CORRESPONDING TAG, MULTI-LAYERED PACKAGING MATERIAL AND PACKAGING LINE**

(57) There is described a package (1), comprising:
- a displaying device (2), configured to display data indicative of the package (1) and/or a content thereof, and
- an energy harvester (3) connected to the displaying device (2) and configured to provide power thereto.

FIG 1



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Description

Technical Field

[0001] The present invention relates to packages, e.g. containing a semi-liquid or liquid (food) product. The packages are produced in an automated packaging line comprising e.g. a filling machine for forming and filling the packages.

Background Art

[0002] Packaging lines are known that produce packages. For example, packaging lines are known for producing packages made of sterilized packaging material configured to receive pourable food products, such as fruit juice, UHT (ultra-high temperature-treated) milk, wine, tomato sauce, etc.

[0003] These packages are normally produced in fully automatic packaging lines, e.g. in which a continuous tube is formed from a web of packaging material fed to such packaging assembly or in which blanks are formed, filled and then closed in a known manner.

[0004] Printed information may be present on the package, e.g. information on the best before date. A disadvantage of this type of information is that it is static and cannot be changed after production of the packaging material. A need is felt to display to the user further information, indicative of a life of the package and/or product after production thereof. For example, a need is felt to facilitate the consumer in knowing when the content of a package is safe to consume. This may be done for food safety reasons as well as for reducing food waste.

Summary of the invention

[0005] It is therefore an object of the present invention to provide a package which can facilitate achieving one or more of the above-mentioned needs in a straightforward and low-cost manner. Such an object is achieved by means of a package having the features set forth in the claims that follow. Such an object may be achieved by means of a corresponding tag attachable to the package, a multi-layered packaging material forming the package, e.g. in the form of a web or in the form of blanks, and a packaging line configured to produce the packages.

[0006] The disclosed embodiments may achieve one or more advantages, e.g. thanks to the updated information provided by the package, the consumer is able to assess whether the product within the package is safe to consume.

[0007] In particular, e.g. in case of food products, when a package is opened, a finite number of days exist before the product spoils. Oftentimes, a user might forget the day when the package has been opened. As such, the product may be consumed when it is not safe or the product may be thrown away even if safe.

[0008] Advantageously, one or more embodiments may improve food safety and/or reduce food waste.

Brief description of the drawings

[0009] Embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

- figure 1 is a schematic illustration of a package according to one or more embodiments,
- figures 2 is a schematic illustration of an energy harvester according to a preferred embodiment,
- figure 3 illustrates a tag attachable to the package and a packaging material according to one or more embodiments, and
- figure 4 illustrates a packaging material forming the package according to one or more embodiment.

Description of the invention

[0010] Figure 1 shows an example of a package 1 for containing a product, e.g. a liquid or semi-liquid (food) product. The package 1 comprises:

- a displaying device 2, configured to display data indicative of the package 1 and/or a product within the package 1, and
- an energy harvester 3 connected to the displaying device 2 and configured to provide power thereto.

[0011] Advantageously, information on the package and/or on the product contained into the package may be readily available to the user, e.g. on a surface of the package itself. No need for an external device is needed, in addition to the package, to read the displayed data. The displayed data may comprise data in addition to the data printed on the package, e.g. the best before date.

[0012] According to one or more possible embodiments, the displaying device 2 may be configured to display information on a remaining lifetime of the product contained within the package. For example, in case of food products, after first opening the package 1 the displaying device may display a countdown of the remaining time of safe consumption of the product.

[0013] Advantageously, the use of an energy harvester 3 may avoid use of a battery. Accordingly, the displaying device 2 may operate even after a long time after production.

[0014] One or more possible energy harvester 3 may be used, configured to generate power, e.g. directly or indirectly, as a function of an environment surrounding the package 1 and/or a direct contact, e.g. direct thermal contact, with a user.

[0015] For example, the energy harvester 3 is a photovoltaic cell configured to provide power by means of environmental light. That is, a photovoltaic cell may be positioned at a surface 10 of the package 1, e.g. a front

surface, that may be exposed to light in order to generate energy.

[0016] For example, the energy harvester 3 is a thermoelectric energy harvester, as shown in figure 2, having a first and second interface 30, 32, the thermoelectric energy harvester configured to generate power when the first thermal interface 30 is exposed to a first temperature and the second thermal interface 32 is exposed to a second temperature, different from the first temperature.

[0017] In particular, the first thermal interface 30 and the second thermal interface 32 may be positioned on a same surface of the energy harvester 3 or on opposite surfaces of the energy harvester 3 (as exemplified in figure 2).

[0018] The first and second thermal interface 30, 32 may be, respectively, thermally couplable with a product contained into the package 1 and an external environment surrounding the package. In particular, the product may have a lower temperature, e.g. in case the package 1 is stored in a refrigerated environment such as a fridge. When the package 1 is extracted from the refrigerated environment for use, a difference in temperature between the surrounding environment and the product may generate energy.

[0019] The first and second thermal interface 30, 32 may be, respectively, thermally couplable with a product contained into the package and a user. Similarly to the case previously disclosed, the product may be stored in a refrigerated environment. When extracted for use, a user may come into direct (e.g. thermal) contact with the second thermal interface 32, e.g. a finger or a hand of the user may be positioned above the second thermal interface 32. Accordingly, energy may be generated thanks to a temperature difference between the product and the user.

[0020] The first and second thermal interface 30, 32 may be, respectively, thermally couplable with an external environment surrounding the package 1 and a user. When extracted for use, a user may come into direct (e.g. thermal) contact with the second thermal interface 32. For example, in case the package is stored in a warm environment, a temperature difference may be present between a user, e.g. a hand or a finger thereof, and the colder surrounding environment.

[0021] The package 1 may comprise an energy storage 4, e.g. connected to the displaying device 2 and the energy harvester 3. The energy storage 4 may be configured to store energy received from the energy harvester 3 and to provide the stored energy to the displaying device 2.

[0022] The energy storage 4 may comprise a capacitor. The capacitor may be charged by the energy harvester 3. The energy storage 4 may power the displaying device 2, e.g. when the energy harvester 3 does not generate energy.

[0023] Advantageously, this way the displaying device may continue operating even after the energy is not produced by the energy harvester 3.

[0024] For example, when the package 1 is opened, a countdown may start. Advantageously, thanks to the energy storage 4 and the energy harvester 3, the displaying device 2 may be powered and the countdown may continue even when the energy harvester 3 does not generate power.

[0025] There are different possible ways for detecting if the package 1 is first opened. For example, at first opening the user may activate the energy harvester 3 or the user may pull a tab.

[0026] In alternative, the package 1 may comprise a tamper-proof device 5, configured to detect a first opening of the package 1. The displaying device 2 may be configured to display data as a function on the detected first opening.

[0027] The package 1 comprises a cap 12, configured to open or close the package 1. The tamper-proof device 5 may be positioned at the cap. The tamper-proof device 5 may be positioned at least partially underneath the cap 12.

[0028] For example, the tamper-proof device 5 may comprise a continuous metallic line, extending between a surface of the package 1, e.g. at a base of the cap 12, and the cap 12. Once the cap 12 is first turned, the line breaks and the first opening of the package 1 may be detected.

[0029] The package 1 may comprise a visual indicator 6 configured to show a position of the energy harvester 3 on the package 1. For example, the visual indicator 6 may comprise a print in a certain color and/or written indication of the position of the energy harvester 3.

[0030] Advantageously, in case of a photovoltaic cell, knowing the position of the energy harvester 3 may allow the user to expose such portion to environmental light.

[0031] For example, the visual indicator 6 may indicate a position of the first and/or second thermal interface 30, 32. Advantageously, the user may be able to easily locate the portion where his finger or hand should touch the package 1 in order to generate energy. Accordingly, it may also indicate where to avoid touching in order to maintain a temperature difference.

[0032] Preferably, as exemplified in figures 3 and 4, the package 1 may comprise a multi-layered packaging material 14 comprising at least a first layer 140 and a second layer 142. The packaging material 14 may thus have a multilayer structure, and may comprise a layer of fibrous material, e.g. paper, covered on both sides with respective layers of heat-seal plastic material, e.g. polyethylene. In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material may also comprise a layer of gas-and-light barrier material, e.g. aluminum foil or ethylene vinyl alcohol (EVOH) film, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material, the latter forming the inner face of package 3 eventually contacting the pourable product.

[0033] For example, the first layer 140 may comprise a transparent material, i.e. visible light-transparent ma-

terial.

[0034] The first layer 140 may be in closer proximity to an external environment with respect to the second layer 142. Accordingly, the second layer 142 may be in closer proximity to an inner environment of the package 1, e.g. containing the product, with respect to the first layer 140.

[0035] According to an embodiment as shown in figure 3, the first layer 140 may comprise an external layer of the packaging material 14 and the displaying device 2 as well as the energy harvester 3 may be positioned at the first layer 140, e.g. on an external surface thereof. Also, the tamper-proof device 5 may be positioned on the surface of the first layer 140.

[0036] In particular, the energy harvester 3 and the displaying device 2 and optionally also the tamper-proof device 5 may be printed on or attached to the first layer 140.

[0037] For example, one or more embodiments may relate to a tag 7 attachable to a package 1 according to one or more embodiments as exemplified previously, e.g. for containing a liquid or semi-liquid (food) product. The tag 7 may comprise the displaying device 2 and the energy harvester 3, e.g. a photovoltaic cell or a thermoelectric energy harvester. In particular, the displaying device 2 and the energy harvester 3 may be embedded in the tag 7. The tag 7 has an adhesive surface configured to attach to the external surface 10 of the package 1. The tag 7 may be made of (visible light) transparent material.

[0038] The tag 7 may further comprise the tamper-proof device 5 and/or the energy storage 4, e.g. embedded in the tag 7.

[0039] According to an embodiment as shown in figure 4, the displaying device 2 and the energy harvester 3 may be embedded into the multi-layered packaging material 14. That is, the displaying device 2 and the energy harvester 3 may be positioned between the first and second layer 140, 142. Furthermore, also the tamper-proof device 5 may be embedded into the multi-layered packaging material 14, e.g. between the first and second layer 140, 142.

[0040] It will be appreciated that, even though the energy harvester 3 and the displaying device 2 are illustrated positioned at the same layer, it may be possible that one of the displaying device 2 or the energy harvester 3 may be positioned between the first layer 140 and the second layer 142, with the other being attached to an external surface of the first layer 140.

[0041] One or more embodiments may relate to a multi-layered packaging material 14 for forming the package 1, comprising the displaying device 2 and/or the energy harvester 3 and optionally also the tamper-proof device 5 positioned between the first and the second 142 layer of the multi-layered packaging material 14. The multi-layered packaging material 14 may be in the form of a web or in the form of blanks. In particular, the web may be stored in reels of packaging material 14. For example, the packages 1 may be produced from a tube of packaging material formed from the web, in a known manner.

[0042] According to a preferred embodiment, at least

one of the energy harvester 3 and the displaying device 2 may be printed, preferably with an organic ink and/or a bendable ink after curing. That is, the energy harvester 3 and/or the displaying device 2 may be bendable. The printing may occur during a production of the multi-layered packaging material 14 or a production of the tag 7 or during the production of the package 1. In particular, in case a tag 7 is used, the energy harvester 3 and the displaying device 2 may be printed on the tag 7 that can then be attached on a surface of the finished or semi-finished package 1. In alternative, the energy harvester 3 and the displaying device 2 may be printed on the package and the tag 7 may be applied thereon. In case the energy harvester 3 and/or the displaying device 2 are positioned between layers 140, 142 of the multi-layered packaging material 14, the energy harvester 3 and the displaying device 2 may be printed on the layers 140, 142 during a production thereof.

[0043] It will be appreciated that also the tamper-proof device 5 and/or the energy storage 4 may be printed in a similar manner.

[0044] Advantageously, the presence of an organic ink may permit the generation of a more sustainable product. The use of a bendable ink may permit use on packages 1 that may be bended during use.

[0045] One or more embodiments may also relate to a packaging line, configured to produce a plurality of packages 1 e.g. containing liquid or semi-liquid (food) product.

[0046] The packaging line comprises a filling machine for forming and filling the packages 1. The packages 1 may be formed from a web of packaging material folded into a tube and filled with pourable product or cut in blanks. The packages 1 may be formed from blanks that are folded, filled and closed.

[0047] In particular, the filling machine may receive the multi-layered packaging material 14 comprising the displaying device 2 and/or the energy harvester 3.

[0048] In alternative, the filling machine may receive the multi-layered packaging material 14. The packaging line may further comprise a tag applicator configured for applying tags 7 to the multi-layered packaging material 14. The tag applicator may be positioned downstream of the filling machine. The tag applicator may be positioned upstream of a cap applicator configured to apply caps 12. The tag 7 (e.g. comprising the tamper-proof device 5) may be positioned partially underneath the cap 12 of the package 1. Advantageously, this way it is possible to couple the tamper-proof device 5 and the cap 12 during production of the packages 1.

Claims

1. A package (1), comprising:

- a displaying device (2), configured to display data indicative of the package (1) and/or a con-

- tent thereof, and
- an energy harvester (3) connected to the displaying device (2) and configured to provide power thereto.
2. The package (1) according to claim 1, wherein the energy harvester (3) is configured to generate power as a function of an environment surrounding the package (1) and/or a direct contact with a user.
 3. The package (1) according to claim 1 or claim 2, wherein the energy harvester (3) is:
 - a photovoltaic cell configured to provide power by means of environmental light, or
 - a thermoelectric energy harvester having a first (30) and second (32) interface, the thermoelectric energy harvester configured to generate power when the first interface (30) is exposed to a first temperature and the second interface (32) is exposed to a second temperature, different from the first temperature.
 4. The package (1) according to claim 3, wherein the first interface (30) and the second interface (32) are, respectively, thermally couplable with:
 - a product contained into the package (1) and an external environment surrounding the package (1),
 - a product contained into the package (1) and a user, or
 - an external environment surrounding the package (1) and a user.
 5. The package (1) according to any of the previous claims, comprising a tamper-proof device (5), configured to detect a first opening of the package (1), the displaying device (2) configured to display data also as a function on the detected first opening.
 6. The package (1) according to any of the previous claims, comprising a visual indicator (6) configured to show a position of the energy harvester (3) on the package (1), preferably a position of the first (30) and/or second (32) interface.
 7. The package according to any of the previous claims, comprising a multi-layered packaging material (14) comprising at least a first layer (140) and a second layer (142), wherein:
 - the first layer (140) is an external layer and the displaying device (2) as well as the energy harvester (3) are positioned at the first layer (140), or
 - the displaying device (2) and the energy harvester (3) are embedded into the multi-layered
- packaging material (14) .
8. The package (1) according to any of the previous claims, wherein the energy harvester (3) and/or the displaying device (2) are printed.
 9. The package (1) according to claim 8, wherein the ink is an organic ink and/or the energy harvester (3) and/or the displaying device (2) are bendable.
 10. The package (1) according to any of the previous claims, comprising an energy storage (4) connected to the displaying device (2) and the energy harvester (3), the energy storage (4) being configured to store energy received from the energy harvester (3) and to provide the stored energy to the displaying device (2).
 11. A tag (7), attachable on a package (1), the tag (7) comprising a displaying device (2) selectively activatable to display data indicative of the package (1) and/or a content thereof, and an energy harvester (3) configured to provide power to the displaying device (2).
 12. The tag (7) according to claim 11, wherein the energy harvester (3) is a photovoltaic cell configured to provide power by means of environmental light or a thermoelectric energy harvester having a first (30) and a second interface (32), the thermoelectric energy harvester configured to generate power when the first interface (30) is exposed to a first temperature and the second interface (32) is exposed to a second temperature, the second temperature different from the first temperature.
 13. A multi-layered packaging material (14), comprising at least a first layer (140) and a second layer (142), the multi-layered packaging material (14) further comprising at least one of a displaying device (2) selectively activatable to display data, and/or an energy harvester (3), wherein the displaying device (2) and/or the energy harvester (3) are positioned between the first (140) and second (142) layer.
 14. A packaging line, configured to produce a plurality of packages (1) according to any of claims 1 to 10.
 15. The packaging line according to claim 14, further comprising:
 - a filling machine, configured to produce the packages (1) from a multi-layered packaging material (14) according to claim 13, or
 - a filling machine, configured to produce the packages (1) from a multi-layered packaging material (14) and a tag applicator configured for applying tags (7) according to claims 11 or 12

to the multi-layered packaging material (14) .

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FIG 1

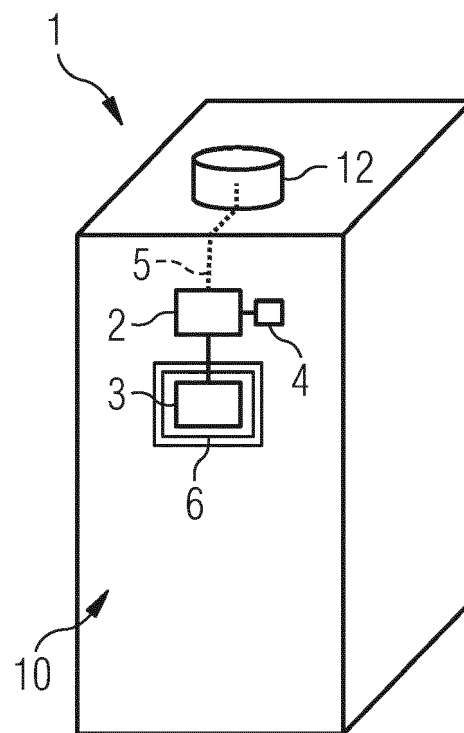


FIG 2

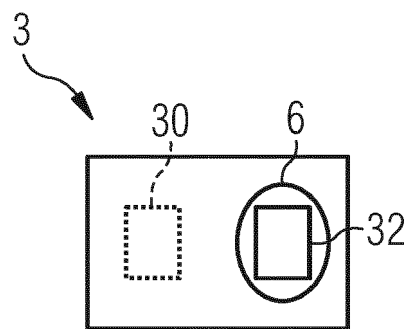


FIG 3

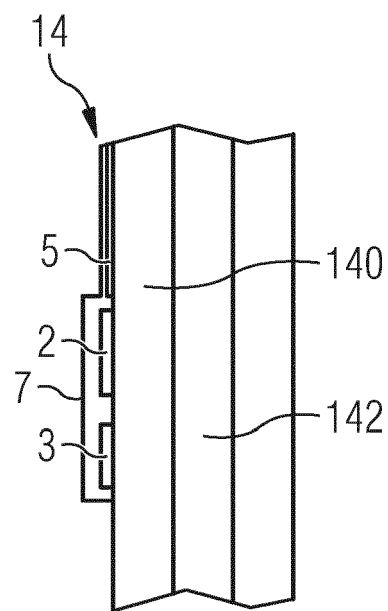
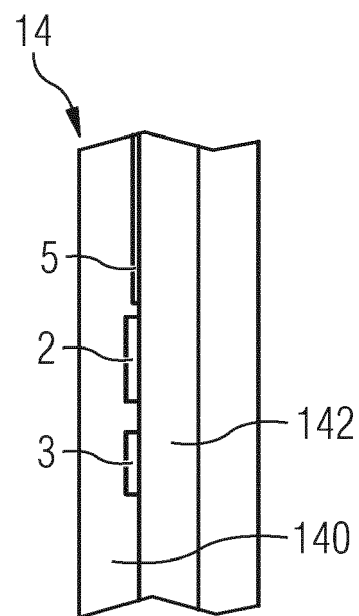


FIG 4





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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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