mentioned physical contact. Measuring at a distance is not possible, and the measurement result is obtained ex post. Based on the determination, the object may eventually to be destroyed. At that point in time it might be too late to order a replacement product.

Summary

[0015a] In an aspect, there is provided a transport container (100) for transporting an object (105), the transport container (100) comprising:

an object location (104) being adapted to receive the object (105);

at least one vacuum insulation panel (102-i), hereinafter VIP, being adapted to thermally insulate the object location (104);

at least one sensor unit (120-i) assembled with the VIP (102-i), the sensor unit being adapted to provide a panel condition signal (125-i) that corresponds to a measurement value (Vij) for at least one physical property of the VIP (102-i), wherein the physical property influences the temperature of the object (θ OBJECT);

at least one short-distance transmitter unit (130-i) being adapted to transmit a first coding (135-i) of the panel condition signal (125-i) inside the transport container (100);

a long-distance transmitter unit (140) being adapted to receive the first coding (135-i) of the panel condition signal (125-i) from the short-distance transmitter unit (130-i) and to transmit a second coding (145) of the panel condition signal to a remote server computer (200) for processing the panel condition signal to determine a representation of an operation state of the transport container, wherein the operation state is related to the temperature of the object (θ OBJECT), and wherein depending on the transmission interval - being the time interval between subsequent transmissions of the second coding (145) of the panel condition signal (125-i) from the long-distance transmitter unit (140) to the remote server computer (200) - the transmission selectively is

- a periodic transmission with the transmission interval having a predefined duration, and

a non-period transmission with the transmission interval having a maximum duration.

[0015b] In another aspect, there is provided a method (1000) for operating a transport container (100) as defined above, the method comprising:
replacing (1010) a first VIP (102-i) that has been manufactured by using a first material with a second VIP (102'-i) that has been manufactured by using a second material, wherein both materials cause the VIPs to have different thermal conductivity; and
modifying (1040) technical parameters relating to the transmission of the second coding (145) of the panel condition signal to the remote server computer (200).

[0015c] In another aspect, there is provided a remote server computer (200) adapted to receive the second coding (145) of the panel condition signal from a transport container (100) as defined above, the remote server computer (200) **being characterized** by a rule module (250) that is adapted

- to receive the second coding (145) of the panel condition signal in a sequence of samples (T SAMPLE),
- to determine the state value of the operation state (S) of the transport container (100) according to a set of re-defined rules (R1, R2, R3, R4), upon receiving a new sample, and
- to store representations (NORMAL-FUNCTION*, PRE-FAILURE-FUNCTION*, FAILURE*) of that state values,

wherein the set of predefined rules comprises:
a first rule (R1) to determine that the operation state of the transport container (100) is a normal function state (NORMAL-FUNCTION*);
second rule (R2) to determine that the operation state of the transport container (100) is a pre-failure state, upon detecting the occurrence of an event in relation to the VIP, hereinafter VIP event;
a third rule (R3) to identify a time interval from the VIP event until a predefined condition at the an object location (104) is reached, hereinafter an object event and that sets the representation of the state value to a failure state (FAILURE*) when the time interval (T LIMIT) has lapsed, wherein the third rule identifies a time interval for a particular transport container (100) depending on the material of the VIP (102-i).

[0015d] In another aspect, there is provided a method (700) for operating a transport container (100) that is adapted to transport an object (105), the method (700) comprising:
locating (710) the object (105) into an object location (104) inside the transport container (100), wherein the object location (104) is thermally insulated by a vacuum insulation panel (102-i), hereinafter VIP;
by a sensor unit (120-i) that is assembled with the VIP (102-i), **providing (720)** a panel condition signal (125-i) that corresponds to a measurement value (Vij) for at least one physical property of the VIP (102-i), wherein the physical property influences the temperature of the object (θ OBJECT);
by a short-distance transmitter unit (130-i), **transmitting (730)** a first coding (135-i) of the panel condition signal (125-i) inside the transport container (100);
by a long-distance transmitter unit (140), **receiving (740)** the first coding (135-i) of the panel condition signal (125-i) from the short-distance transmitter unit (130-i) and **transmitting (750)** a second coding (145) of the panel condition signal to a remote server computer (200) for processing the panel condition signal to determine a state value of an operation state (S) of the transport container (100), and
upon determining a pre-failure state of the transport container (100), providing for corrective action (760) comprising an action selected from the following:
replacing (1010) the VIP (102-i) by a new VIP, and changing the object temperature (θ OBJECT).

[0015e] In another aspect, there is also provided a computer program product, comprising instructions that when loaded into a memory of a computer and being executed by at least one processor of the computer cause the computer to participate in performing the method steps as defined above.

[0015f] In another aspect, there is also provided a computer-implemented method (800) for operating a remote server computer (200), wherein the remote server computer (200) is adapted to receive a coding (145) of a panel condition signal (125-i) from a transport container (100) that comprises vacuum insulation panels (102-i) that thermally insulate an object location (104) and wherein the panel condition signal (125-i) corresponds to a measurement value (Vij) for at least one physical property of the VIP (102-i) that influences

the temperature of an object at the object location (104),

the method (800) comprising:

receiving (810) a sample of the coding (145) of the panel condition signal;

determining (820) the state value of the operation state (S) of the transport container (100) according to a set of pre-defined rules (R1, R2, R3, R4),

- with a first rule (R1) to determine that the operation state of the transport container (100) is a normal function state (NORMAL-FUNCTION*),
- with a second rule (R2) to determine that the operation state of the transport container (100) is a pre-failure state, upon detecting the occurrence of an event in relation to the VIP, hereinafter VIP event,
- with a third rule (R3) to identify a time interval from the VIP event until a predefined condition at the an object location (104) is reached, hereinafter an object event and that sets the representation of the state value to a failure state (FAILURE*) when the time interval (TLIMIT) has lapsed; and

storing (830) representations (NORMAL-FUNCTION*, PRE-FAILURE-FUNCTION*, FAILURE*) of that state values.

[0016] Determining the performance of the VIP and checking the conditions of the container prior to arrival becomes possible. According to examples of the present disclosure, a transport container is not only equipped with VIPs and with sensors at the VIP, but also equipped with transmitter units to forward a panel condition signal (PCS) to a remote server computer. This allows continuous surveillance and monitoring of the conditions and of the VIP performance. The state of the container is determined remotely, and the remote server can keep a representation of the conditions and of the state substantially all of the time during transport. In other words, this approach enables real-time tracking of the VIP performance independent of the location of the container.

[0017] The transport container has an object location into which a temperature-sensitive object, such as a medicinal product, can be inserted. In other words, the object location is adapted to receive the object. The object location is thermally insulated by at least one VIP to the surroundings of the container. Physical properties of the VIP, such as the internal gas pressure, influence the temperature of the object. Property-to-temperature-relations can be

determined and estimated in advance, by applying formulas in thermodynamics and/or by applying empirical data.

[0018] The property-to-temperature-relations can be simplified to the occurrence of events and to a time interval between the events. A first event - the VIP event - refers to a change of a physical property, such as the change of the air pressure inside the VIP. A second event - the object event - refers to a condition of the object location in that the temperature goes above or below a threshold.

[0019] The VIP event causes the object event. Multiple VIP events can occur in combination for one or for more VIPs, and the occurrence of multiple VIP events usually shortens the time interval between the events.

[0020] Depending on the occurrence of the events, the transport container has an operation state: The container is in FUNCTION until the object event, and the container is in

maintenance of the container.

[0029] The selection of the VIP materials influences a variety of technical parameters. The parameters relate to the transmission of the PCS inside the container, the transmission of the PCS outside the transport container and the rule-based processing of the PCS in the remote server computer. For VIP with materials having higher performance (i.e. materials in a higher performance class), it can be advantageous that the transmission and processing requires less energy, and that - in case of failure - corrective actions are simplified.

[0030] It is possible that containers with different VIP materials will co-exist. As a consequence, the technical parameters have to be differentiated. To keep the computational overhead low for such as differentiation, the VIPs can optionally be classified into (or assigned to) material classes (i.e. material performance classes), and the transport containers can optionally be categorized into (or assigned to) material categories. In units that transmit or process the PCS, the material-to-parameter relation is therefore represented by data structures that indicate the class (or the category).

[0031] The present disclosure not only relates to the container, but also to methods for operating the transport container and for operating the remote server computer, as well as to a computer program product. There are also aspects of computer-implemented method steps so that methods are at least partially implemented by computers.

Brief Description of the Drawings

[0032] FIG. 1 illustrates a side-view of the transport container for transporting an object, the container being illustrated with a vacuum-insulation panel (VIP), with a sensor-transmitter arrangement and with a transmitter unit;

[0033] FIG. 2 illustrates the transport container with multiple VIPs and multiple sensor-transmitter arrangements;

[0034] FIG. 3 illustrates a block diagram of the transport container that communicates with a remote server;

[0035] FIG. 4 illustrates a usage scenario of the transport container that is being transported;

[0036] FIG. 5A illustrates a simplified time-diagram of the thermal insulation, for VIPs using different materials;