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(54) Title: A SEALING SYSTEM FOR SEALING OF DOORS OF TRANSPORT VEHICLES

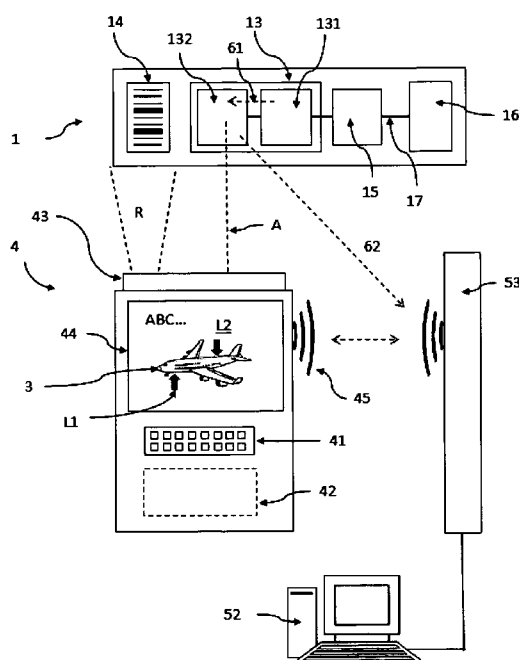


Fig.3

(57) Abstract: The invention relates to a seal (1), preferably having a tape-like shape, for sealing of doors (2) of transport vehicles (3), preferably aircrafts, attachable to the doors (2) to indicate the closure of the door (2) comprising a first area (11) to be positioned onto the door (2) and a second area (12) to be positioned onto an area (21) around the door (2), wherein the seal (1) further comprises an indication means (13) suitable to be activated (A) after attaching the seal (1) to the transport vehicle (3) and suitable to send-out a warning signal (62) in case of the detached or damaged seal (1) after activation of the indication means (13). The invention further relates to a portable logging device (4) for sealing of doors of transport vehicles (3) comprising a data insert unit (41) to insert a particular type of the transport vehicles (3) and to insert the executed attachment of a seal (1) according to claim 1 to a certain door (2) to record the sealing of the door (2), and a data unit (42) suitable to store the inserted data, and to a sealing system using said seal and portable logging device.



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DESCRIPTION

A sealing system for sealing of doors of transport vehicles

FIELD OF THE INVENTION

The invention relates to a sealing system for sealing of doors of transport vehicles, a
5 seal and a portable logging device used by the system and to a method to operate such a
system

BACKGROUND OF THE INVENTION

The doors of a transport vehicle are often sealed after closure of the doors during a
10 checking procedure (clearance) for this transport vehicle with a seal applied to each of
the doors. The seals provide visual indications that the doors are closed at a certain
point of time and not have been opened later on. In logistic centers, seals may be
applied to doors of trucks, train wagons etc. to provide a visible sign to the receiving
center, that the transport vehicle (at least the storage volume for the transported freight)
15 was not opened during transport in case of unbroken seals. The seals shall prevent non-
authorized opening of doors to secure the freight loaded to the transport vehicle and/or
the sealing procedure is part of a release procedure in case of transports requiring higher
security standards. As an example aircrafts have to be released for being allowed to
leave the airport. Open doors during take-off and during the flight are a severe safety
20 problem. Therefore, all doors of the aircraft must be closed and must be checked before
releasing the aircraft for taking-off (clearance). Currently one or more airport employees
visually check all doors of each aircraft and attach an adhesive tape across each closed
door at the outer side. The adhesive tape provides a visual indication that the particular
door is checked and closed. In parallel the airport employee fills out a paper check list
25 to record in writing the executed check procedure. After completing the check
procedure, the paper check lists are archived. The airport has to provide an adapted
check list per aircraft type, since the number and the location of doors differs between
different aircraft types, which require an enormous administrative effort. Furthermore to

find the location of all doors can be difficult for some aircraft types, because the checking procedure does not support the finding of doors. Already checked doors with attached tape might be opened later. Such re-opened doors may stay open unnoticed. The checking procedure is time-consuming. Eventual doubts about the correct execution
5 of the check procedure requires a repeated second check procedure leading to time delays in the clearance of aircrafts for subsequent take-off. The listed disadvantages also apply to other transport vehicles.

SUMMARY OF THE INVENTION

10 It is an object of the present invention to provide a sealing system, a seal and a portable logging device and a corresponding sealing method to operate the sealing system avoiding the disadvantages of the state of the art. In particular, it is an object of the present invention to provide a seal and a portable logging device improving the security of the transported freight and the transport vehicle, which enables easy handling and
15 recording of the sealing procedure.

The object is solved by a seal, preferably having a tap-like shape, for sealing of doors of transport vehicles, preferably aircrafts, attachable to the doors to indicate the closure of the door comprising a first area to be positioned onto the door and a second area to be
20 positioned onto an area around the door, wherein the seal further comprises an indication means suitable to be activated after attaching the seal to the transport vehicle and suitable to send-out a warning signal in case of the detached or damaged seal after activation of the indication means.

25 The seal according to the present invention provides on one hand a visual indication that the particular door is checked and closed. On the other hand any re-opening of the door will be detected by the indication means measuring at least one characteristic parameter, which value indicates either the closed status of the door or the non-authorized re-opening of the door. Therefore the seal according to the recent invention improves the
30 security of the transported freight and the transport vehicle. In case of re-opened doors,

the freight of the transport vehicle can be checked again to detect any burglary and additionally any security risk to operate the transport vehicle can be avoided.

Furthermore in case of any doubts, whether a door might be re-opened or not, the seal provides a secure prove of the history happened to the door. If no warning signal was
5 send-out, there was no re-opening of the door. Therefore a time-consuming second check can be avoided preventing time delays in the clearance of transport vehicles, e.g. aircrafts for subsequent take-off. A seal simply attachable to door and the area around the door is easy to handle. The sealing procedure (attaching the seal to a door) is executed by an operator.

10

In the context of the present invention transport vehicles denote any transport vehicle or essential components of the transport vehicles suitable for applying the seal. The term “transport vehicles” comprises trucks, cars, train wagons, ships, container for container trucks, aircrafts such as airplanes or helicopters etc. The term “doors” comprises any
15 opening, which can be closed and re-opened such as conventional doors (e.g. doors of trucks, cars, and aircrafts), scuttles, portholes, hatchways, tailboards etc. The term “attachable” denotes any property of the seal, which enables the fixation of the seal at a certain position on the door and on the area around the door, which could be the door frame, the area surrounding the door frame or the wall, where the door is fixed to. The
20 attachable seal might be glued, clamped or otherwise fixed at its desired position. The term “indicate the closure” may denote any suitable measure to inform other people, that this door is checked that it is closed and that the door was not opened again after checking the door. Any visual inspection shows, whether the seal is present and undamaged. Furthermore the seal might send-out signals providing the status of the
25 seal, e.g. a warning signal in case of a re-opened door. The signals might be visual, audible or detectable electromagnetic high frequency or infrared signals. The term “onto the door/area around the door” denotes the attachment of the seal to the surface of the door and the area around the door. The surface of the door or area around the door can be the outer surface (e.g. in case of doors of aircrafts etc.) or for other purposes the inner
30 surface of the wall of a transport vehicle. The area around the door can be the frame of

the door or the wall, where the door is mounted to. In case of a door frame as the area around the door the surface, where the seal is attached to, can be the inner or outer surface or the surface of the frame facing towards the door in a closed status. For some embodiments of doors, there might be no separate frame. In case of double wing doors, the seal might be attached over both wings of the door, where the wing closed first is denoted as the area around the door, while the other door wing closed later is denoted as the door. Alternatively, double wing doors might be sealed by applying one seal according to the present invention for each wing of the double wing door. In this case the seal can be applied onto each of the doors and onto the areas around the doors.

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The term “seal” denotes a seal of any shape which can be attached to a door as listed above. Preferably the seal has a tape-like shape with lateral dimensions significantly larger than the thickness of the seal. The advantage of a tape-like seal is the possibility to attach the seal to non-flat areas (doors and/or the door frames or door surroundings).

15 The seal may be made of a piece of material such as rubber, metal or plastic or combinations thereof with further embedded components. The seal may comprise a combination of elastic and inelastic materials. The seal may comprise elastic components or elastic parts of the seal in order to be usable for different kind of doors having different shapes and sizes. The material of the seal may comprise electrical wires or electrically conductive layers arranged at the surface of the seal or close to the surface of the seal, especially at the first and second areas of the seal. These wires and/or electrically conductive layers may serve as a sensing component for determining the status of the door (closed or open), e.g. via determining its resistance or capacitance values.

25

The activation of the seal denotes the action required to start a control procedure of the seal, where the seal recognizes any re-opening of the door. The indication means of the seal can be activated manually via a switch, automatically as a response of being attached to a surface or via an external signal. The activation starts a continuous or periodic measurement of a certain parameter, where the value of the parameter

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corresponds to the status of the door (closed or open). In case of re-opening of the door, the sent-out warning signal could be any type of warning signals suitable of being recognized by either a control system, e.g. a computer system, and/or present people. Depending on the embodiment of the seal, the activation of the indication means might
5 be reversible or non-reversible. In case of non-reversible activation, the seals are intended for one-time use. Indication means able to be de-activated by authorized people can be used multiple times. However, it has to be prevented that seals can be de-activated by non-authorized persons. This could be achieved by a suitable positioning of the seals, e.g. at the outside of aircrafts when the doors can only be re-opened from the
10 inside of the aircraft. However, it is advantageous if the de-activation is only possible for authorized persons, e.g. by a certain mandatory identification procedure authorized people have to perform before being able to de-activate the seal.

In another embodiment the first and second areas are arranged to apply an adhesive
15 and/or magnetic force to the door and the area around the door in order to be attached. An adhesive force can be applied to the door and/or the area around the door, if a layer of glue is on top of the first and/or second areas. Alternatively the first and second areas might be arranged as self-adhesive areas, e.g. as an adhesive tape such as a scotch tape. People skilled in the art may consider other adhesive means arranged on said first and
20 second areas to securely attach the seal to the doors and areas around the doors. The first and/or second areas of the seal can be arranged as a magnet applying a magnetic force to any surface, which is metallic as being the case for the majority of transport vehicles. First and/or second areas arranged as a magnet provide a tight fixation of a seal on randomly shaped surfaces of doors and areas around the doors. The advantage of
25 attaching seals by applying adhesive and/or magnetic forces is the easy handling and the possible reversible use of the seals. If a door already sealed has to be opened by an authorized person, the indication means can be de-activated and the seal can be removed and re-used later.

30 In another embodiment the seal further comprises an identification means providing a

machine-readable code suitable to be read by a portable logging device after attaching the seal at least to the door. The advantage is an easy logging of the checked doors with applied seals. The operator attaching the seals to the doors does not have to fill in check lists manually to log the sealing procedure, but can log the code of each seal applied to a door simply by a logging device reading the seal identification. The machine-readable code can be any kind of code able to identify the seal (= to distinguish a particular seal from all other seals) and to be read by the logging device. The identification means can be a separate component of the seal or can be part of the indication means. For example, the machine-readable code may be a barcode label applied (glued) to the outer surface of the seal (outer surface = surface facing away from the door) or the machine-readable code can be provided as electromagnetic signal send-out by a RFID chip as part of the indication means inside the seal.

In another embodiment the indication means comprises a control means to detect a detaching or damaging of the seal and to subsequently provide a detection signal, preferably an electronic signal. The control means is the unit executing the measurement of a certain parameter, which value corresponds to the status of the door (closed or open). The seal may be equipped with a conductive layer, which breaks during the re-opening of the door. The change of the electrical properties (e.g. the capacity of this layer) is sensed and a corresponding signal is provided, a so-called detection signal after detection of the re-opening of the door. Alternatively the control means comprise a closed electrical circuit, which breaks during re-opening of the door resulting in a steep increase of the resistance of this closed circuit. The change of the resistance triggers the control means to provide the detection signal. The detection signal is preferably an electrical signal to other components of the indication means. Alternatively, the attaching procedure may close an electrical circuit by providing an electrical contact between two contact pins arranged at the first and/or second areas, which is established through the metal surface of the door and the area surrounding the door. The first and second areas may comprise two contact pins each with an electrical contact between the contact pins of the first area establish by the conductive surface of

the door and between the contact pins of the second area establish by the conductive surface of the area around the door. The detection signal will only be provided, when the seal is in an activated status. People skilled in the art may consider alternative control units in order to detect a detaching or damaging of the seal within the scope of
5 this invention.

In another embodiment the indication means comprises a sending means, preferably a RFID chip, suitable to send out the warning signal as a response to the detection signal provided by the control means. The sending means may be any means suitable to send
10 out a warning signal. There are very small and/or flat chips available as sending means on the market today suitable to be integrated into a seal, e.g. a tape-like seal. An eventually required additional antenna can be arranged as a flat antenna inside the seal. As an example, RFID transponders (RFID chips) are able to provide signals with a large possible operating distance up to 100m. The indication means comprising an RFID chip
15 may be activated (= activation of the seal) by receiving an external activation signal, for example provided by the portable logging device. The required power, e.g. for active RFID tags, to operate the seal may be received from a flat battery embedded in the seal. In a preferred embodiment, the indication means comprises a clock to record the time, when the detection signal is received. It is even more preferable that the warning signal
20 comprises the time, when the detection signal was provided from the control means. The warning signal may have any suitable format to be able to be received from a receiving station, e.g. having a Bluetooth or ZigBee format, comprising the code of the broken seal, preferably together with the time, when the control means detected the break or damage of the seal. People skilled in the art may consider other sending means
25 within the scope of this invention. The range of operation depends on transmitting power, frequency and receiver sensitivity. People skilled in the art will choose the appropriate sending technology within the scope of this invention.

In another embodiment the seal further comprises a lighting unit to emit light after
30 activation. The lighting components may be a LED or another electroluminescent light

source as part of the seal. A light emitting seal enables a fast check from a longer distance of the present seals of a transport vehicle, especially during night.

In another embodiment the seal further comprises a power source, e.g. a flat battery, to provide power to the lighting unit and/or to the indication means to operate the control unit and/or the sending unit and/or the identification unit.

The invention further relates to a portable logging device for sealing of doors of transport vehicles comprising a data insert unit to insert a particular type of the transport vehicles and to insert the executed attachment of a seal according to the present invention to a certain door to record the sealing of the door, and a data unit suitable to store the inserted data. The portable logging device replaces any paper check lists to record the executed sealing procedure. The sealing procedure can be executed much faster due to the avoided manually filling of forms. Eventual doubts about the correct execution of the check procedure can be resolved by checking the recorded sealing data avoiding a time-consuming second check procedure, which formally led to time delays in the clearance of transport vehicles, e.g. aircrafts for subsequent take-off.

The logging device is portable, e.g. as a hand-held device. The data insert unit can be any suitable array of buttons or keys to insert data, e.g. a key board or an array of keys for multiple characters, numbers and/or symbols. The transport vehicles can be very different. Even in the same class of transport vehicles, e.g. aircrafts, there are many different types of transport vehicles, e.g. small aircrafts, large aircrafts, aircrafts of any size from different manufactures etc. having a different number and location of doors. After inserting the type of the transport vehicle the portable logging device may provide the number of doors to be checked for this particular transport vehicle. Alternatively, the portable logging device may count the inserted executed attachments and compares the number to the expected number of doors and to be checked for this particular type of transport vehicle. The inserted data are stored in a suitable data unit, e.g. a memory chip, or a memory card. People skilled in the art may choose other data units within the

scope of this invention.

In an embodiment, where the seal comprises an identification means providing a machine-readable code and the portable logging device further comprises a reading unit
5 to read a machine-readable code of the identification means and to store the machine-readable code in the data unit. The reading unit may be any suitable reading unit adapted to the machine-readable code of the seal. In case of a barcode as the machine-readable code, the reading unit is a barcode scanner. If the machine-readable code is coded electronically, the reading unit is an adapted receiver of the send-out code of the
10 seal. This machine-readable code together with a portable device able to read the code of the seal will significantly reduce the required time for the sealing procedure. The operator only has to attach the seal to the door and place the portable logging device for a short moment in a suitable position in front of the seal in order to record the executed sealing for this door. This action requires only a minimum of time compared to sealing
15 procedures according to prior art.

In a preferred embodiment the portable logging device further comprises a display unit for displaying the location of each door of the particular type of the transport vehicles, where the seal has to be attached, and for correlating the location of the door with the
20 machine-readable code of the identification means of the seal attached to this door. This support for the operator to find the doors is strongly preferred, because the large number of different types of transport vehicles makes it very difficult for the operators executing the sealing procedure to quickly find the doors to be checked. A door difficult to find may lead to a delay in the clearance of a transport vehicle. Furthermore the operators do
25 not have to be instructed to find doors in beforehand, which requires an enormous administrative effort.

The display unit may be any suitable display of a suitable size to support the operator to find all the doors of the transport vehicle in a short time period. The location of the
30 doors may be display as marker of a displayed lay-out or blueprint of the transport

vehicle. The portable device may further comprise a GPS module in order to provide distance and orientation information to the operators in case of very large transport vehicles, such as aircrafts, ships or trains. The combination of marked doors and distance between the current position of the operator and the next door will improve the support to the operator how to find the next door. The location of the door on the layout or blueprint can be correlated to the code of the seal. This correlation will decrease the required time and effort to check a seal in case of receiving the warning signal from the seal, because the location of the particular seal is known.

10 In another embodiment the portable logging device comprises a data connection unit suitable to transfer the data to a computer system and/or update the data stored in the data unit, preferably via a wireless data connection. The data connection unit may be a data port suitable to be inserted in a corresponding reading device connected to the computer system. The wireless connection may be provided by a WLAN system present
15 in the environment of the portable device, where the computer system is connected to. The possibility of transmitting the recorded data via a data connection to a computer system makes archiving of sealing data very easy and fast. Eventual doubts about the correct execution of the sealing procedure can be proven by checking the archived sealing data avoiding a time consuming second sealing procedure.

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The invention further relates to a sealing system for sealing of doors of transport vehicles comprising multiple seals according to the present invention, at least one portable logging device according to the present invention and a clearance system comprising a computer system for receiving and storing data from the portable logging
25 device, suitable to receive the warning signal from the seal and to provide an alarm signal at least inside a clearance area as a response of the received warning signal. The clearance system denotes the system for releasing the transport vehicle to transport the freight to the desired destination. The freight comprises goods of any kind and/or people transported by the transport vehicle. As an example, for aircrafts as the transport
30 vehicle, the clearance system comprises all necessary steps and components for

permitting the aircraft to take-off. Correspondingly the clearance area could be the airport terminal, any other parking area for the aircraft, a hall or the entire airport. In case of other transport vehicles, the clearance area might be a logistic center (e.g. for trucks), a harbor, a train station, a switching yard station or other parts of the previously
5 listed areas. The alarm signal can be a visible, audible signal or a signal provided by the computer system to a certain security operator of the clearance area. For example, the alarm signal may be send-out by an alarm signal means such as a horn, a loudspeaker, a flashlight or other alarm signal means. The advantage of such a sealing system is the easy and fast logging of the sealing procedure, the availability of the logged data to any
10 person having a need to know, the easy archiving of any sealing procedure and the improved security for the transport vehicle and the loaded freight by fast and reliable detection of any non-authorized re-opening of a sealed door.

In an embodiment the clearance system further comprises multiple receiving stations
15 arranged at different suitable places within the clearance area to receive the warning signal from any location in the clearance area accessible for transport vehicles.

Depending on the range of operation of the sending unit of the seals and the size of the clearance area, multiple receiving stations are required to receive an eventual warning signal from any possible part of the clearance area. The receiving stations may be
20 connected to the computer system via a data connection established by data cables or wireless applying a data transmission technology with a larger range of operation or by forwarding the received data from one receiving station to the neighbored receiving stations until the transmitted data can be received by the computer system.

25 The invention further relates to a method for operating a sealing system according to the present invention comprising the steps of

- attaching at least one seal to each door of the transport vehicle,
- activating the seal via an indication means after attaching the seal to the transport vehicle, and
- 30 - sending out a warning signal by the seal in case of the seal being detached or

damaged after activation of the indication means.

The step of activating the seal can be executed manually by the operator, automatically by attaching the seal to the door and a corresponding response to the control unit of the indication means or by an external signal provided from a portable logging devices.

5

In an embodiment the method further comprising the steps of

- inserting a particular type of the transport vehicles into the portable logging device,
- inserting the execution of attaching the seal to a certain door into the portable logging device via a data insert unit, preferably by reading (R) a machine-readable code provided by a identification means (14) of the seal (1), and
- storing the inserted data in a data unit of the portable logging device.

10

In a preferred embodiment the method comprising the steps of

- 15 - receiving and storing the data inserted to the portable logging device from the portable device in a computer system, preferably via a wireless data connection,
- receiving a warning signal from the seal in case of detached or damaged seal, and
- providing an alarm signal at least inside a clearance area as a response of the received warning signal.

20

The alarm signal can be a visible, audible signal or a signal provided by the computer system to a certain security operator.

BRIEF DESCRIPTION OF THE DRAWINGS

- 25 These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

Fig.1: seal according to the present invention on a door of a transport vehicle.

- Fig.2: one embodiment of a seal according to the present invention shown (a) from the backside and (b) from the front side.

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Fig.3: embodiments of a seal and a portable logging device connected to a receiving station and a computer system.

Fig.4: a sealing system according to the present invention.

Fig.5: different transport vehicles with attached seals according to the present
5 invention.

DETAILED DESCRIPTION OF EMBODIMENTS

Fig.1 shows a seal 1 according to the present invention on a door 2 of a transport vehicle 3. One part of the seal 1 (a first area 11 not shown in detail in this figure) is
10 attached to the surface of the door 2, while another part of the seal 1 (a second area 12 not shown in detail in this figure) is attached to the area 21 around the door, here the wall of the transport vehicle 3. The transport vehicle 3 is only indicated schematically. The transport vehicle 3 could be e.g. a truck, a car, a train wagon, a ship, a container for container trucks, an aircraft such as an airplane or a helicopter.

15

Fig. 2 shows an embodiment of a seal 1 according to the present invention (a) from the backside and (b) from the front side. The backside denotes the side of the seal 1, which is attached to the surface of the door 2 and the area 21 around the door. The front side is the side of the seal 1 facing away from the door 2 and the area around the door 21. The
20 backside of the seal 1 comprises a first area 11 (grey) to be attached to the surface of the door and a second area 12 (grey) to be attached to the area around the door. In this embodiment the first and second areas 11, 12 have an adhesive surface to fix the seal 1 on top of door 2 and area around the door 21. A seal 1 with parts 11, 12 on its backside being adhesive can be applied to any doors 2 and areas 21 around the doors regardless
25 of the material of the doors 2 and the areas 21 around the doors. In alternative embodiment, also the area between the first and second areas 11, 12 might be adhesive as well to improve the adhesiveness of the seal 1. In other embodiments, the first and second areas 11, 12 as shown in figure 2 might be magnetic areas, which can be fixed to doors 2 and areas 21 around doors made of metal. For different embodiments, the size
30 of the first and second areas 11, 12 might vary. The seal 1 of figure 2 has a tape-like

shape with a rectangular area and with a thickness small against the other dimensions of the seal 1 (an essentially two-dimensional shape). In other embodiments, the seal 1 might be shaped differently within the scope of this invention, e.g. with circular or oval shape or with a three-dimensional shape, e.g. like a bulky device.

5

The seal 1 shown in figure 2 comprises an indication means 13, which comprises a control means 131 and a sending means 132. The control means continuously or periodically determines a parameter, which value is characteristic for the status of the door (closed or open). In case of a closed door, the seal is undamaged. The
10 characteristic parameter could be for example the resistance of a wire 1311 present at the surface of the backside of the seal 1. In case of a re-opened door 2 with formally applied seal 1, the seal and in particular the wire 1311 is damaged or broken. The control means 131 detects an increase of the resistance along the wire 1311, which correlates to a detached and/or damaged seal 1 as the result of the re-opening of the door
15 2. In other embodiments the parameter to be detected could be the capacity of a conductive area 1311, which changes, if the seal is damaged or broken. Alternatively, the first and second areas 11, 12 might comprise contact pins of a circuit, which is closed via the surface of the door 2 and/or the surface of the area 21 around the door in case of electrically conductive surfaces. Here again the value of the current through the
20 circuit or the value of the resistance can be utilized to check the status of the door 2. People skilled in the art might consider other control methods within the scope of the present invention. In all embodiments the control means 131 subsequently provides a detection signal 61 (indicated by the dashed arrow in part (b)), preferably an electronic signal 61, to the sending means 132. In response of the received detection signal 61, the
25 sending means transmits a warning signal 62, that a seal is damaged or broken. The warning signal 62 will be received by the sealing system and processed in order to trigger an inspection of the transport vehicle 3, where the seal 1 is attached. To be able to localize the broken seal 1, each seal 1 has to carry an identification means 14, which code being unique for each seal. Preferably the code is machine-readable in order to
30 simplify the assignment of the seal to a code.

The seal may further comprise a power source 16, e.g. a battery, to operate the control means 131 and the sending means 132, if these means require a power supply for being operational, e.g. an active RFID. Indication means 13 providing the same functionality
5 could also be passive RFID chips receiving the required energy from the electromagnetic fields present in the environment. The components of the indication means 13 are electrically connected to each other as well as to the battery 16 if present as indicated by the horizontal black line 17. The seal 1 might comprise optionally a lighting unit 15 in order to emit light either when being activated or in case of being
10 damaged or detached. If the seal 1 emits light when activated, a simple visual check looking for light emitting seals 1 from a larger distance proves the status of the doors 2. In another embodiment the identification means 14 might be also integrated into the indication means 13, e.g. RFID identification.

15 Fig. 3 shows a portable logging device 4, e.g. shape as a hand-held scanner, to record the sealing of doors 2. The portable logging device 4 comprises a data insert unit 41 to insert a particular type of the transport vehicles 3 (here displayed as "ABC..." in the display unit 44) and to insert the executed attachment of a seal 1 as well as a data unit 42 to store the inserted data. For example, the data unit 42 could be a storage chip or a
20 storage card permanently or reversible mounted to the portable device 4. The data insert unit 41 could be any suitable array of buttons or keys suitable to insert the required data. Here the data insert unit 41 is a small key board. The portable logging device 4 further comprises a display unit 44 to display the location of the doors 2 to be sealed with seals 1. As an example, an aircraft is displayed as the transport vehicle 3, where the two doors
25 (in this particular example) are indicated with bold arrows L1, L2 to support the operator executing the sealing procedure, where the seals 1 have to be attached. After attaching a seal 1 to a door 2 at a location L1, the portable logging device 4 reads R the machine-readable code of the identification means 14 of the particular seal 1 with a reading unit 43 and stores the machine-readable code in the data unit 42. The code of
30 the seal is now correlated to the particular door (location L1 as an example), where the

seal is attached. The correlated data of seal and location improves the inspection procedure in case of re-opened doors and also improves the logging of the sealing procedure and simplifies the archiving of the data of each sealing procedure. The portable logging device 4 further comprises a data connection unit 45 to transfer the data (identification code of the seal correlated to a certain location of the door, type of the transport vehicle and optional administrative data such as attaching time etc.) to a computer system 52. The data connection further allows to up-date the data stored in the data unit 42. The data connection 45 is preferably a wireless data connection, where the data are received by a receiving station 53 and transmitted to the computer system 52 by another data connection, e.g. a data cable. Alternatively, the data connection could be a data port unit able to be inserted in a corresponding plug-in unit to connect the portable logging device 4 to the computer system 52. In other embodiments, it could be possible to activate A the seal 1 with the portable logging device sending out an activation signal A as indicated by the dashed line. The same or other receiving stations 53 as used for establishing the data connection to the portable logging device 4 can be used to receive the warning signal 62 from the seal 1 in case of a re-opened door 2.

Fig.4 shows an embodiment of a sealing system according to the present invention. Here, the schematically indicated transport vehicle 3 comprises two doors 2, both equipped with attached seals 1. The portable logging device 4 is used to read R the machine readable code provided by the identification means of the seal 1 and to activate A the indication means of the seal 1 in order to start controlling the status of the door 2. The transport vehicle 3 is located in a clearance area 51 as part of the clearance system 5 further comprising four receiving stations 53 to receive the data transmitted from the portable device 4 in order to record the sealing procedure and to receive a warning signal 62 in case of a damaged or detached seal 1 from any location inside the clearance area 51. The data and/or the warning signal 62 are transmitted from the receiving station 53 to the connected computer system 52, where the sealing data are archived. The sealing data can be re-checked in case of doubts for any performed sealing procedure. The check proves the accurate execution of the sealing procedure without the necessity

to repeat the sealing procedure manually saving clearance time. In case of a received warning signal 62, the computer system 52 provides an alarm signal 63 via an alarm signal means 54 (loudspeakers etc.) at least inside the clearance area 51, preferably also to operators located outside the clearance area 51.

5

Fig.5 shows three examples of transport vehicles 3, where the sealing system, the seal and the portable logging device can be applied to, e.g. an airplane, a truck or a train wagon. The application of the seal, the portable device, the sealing system and the sealing method to other transport vehicles 3 is also covered by the present invention.

10

While the invention has been illustrated and described in details in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.

15

Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word “comprising” does not exclude other elements or steps, and the indefinite article “a” or “an” does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference sign in the claims should not be construed as limiting the scope.

20

LIST OF REFERENCE SIGNS

	1	seal according to the present invention
	11	first area of the seal
5	12	second area of the seal
	13	indication means
	131	control means
	1311	electrical circuit or wire
	132	sending means
10	14	identification means providing a machine-readable code
	15	lighting unit
	16	power supply, e.g. battery
	17	electrical connection
	2	door of a transport vehicle
15	21	area around the door of the transport vehicle
	3	transport vehicle
	4	portable logging device
	41	data insert unit
	42	data unit to store the inserted data
20	43	reading unit
	44	display unit
	45	data connection unit
	5	clearance system
	51	clearance area
25	52	computer system
	53	receiving station
	54	alarm signal means
	61	detection signal
	62	warning signal
30	63	alarm signal

L1, L2 displayed location of doors

R reading of the machine-readable code

A activating the indication means of the seal

CLAIMS

1. A seal (1), preferably having a tape-like shape, for sealing of doors (2) of transport vehicles (3), preferably aircrafts, attachable to the doors (2) to indicate the closure of the door (2) comprising a first area (11) to be positioned onto the door (2) and a second area (12) to be positioned onto an area (21) around the door (2), wherein the
5 seal (1) further comprises an indication means (13) suitable to be activated (A) after attaching the seal (1) to the transport vehicle (3) and suitable to send-out a warning signal (62) in case of the detached or damaged seal (1) after activation of the indication means (13).
- 10 2. The seal (1) according to claim 1, characterized in that the first and second areas (11, 12) are arranged to apply an adhesive and/or magnetic force to the door (2) and the area (21) around the door (2) in order to be attached.
3. The seal (1) according to claim 1 or 2, characterized in that the seal (1) further
15 comprises an identification means (14) providing a machine-readable code suitable to be read (R) by a portable logging device (5) after attaching the seal (1) at least to the door (2).
4. The seal (1) according to any of the preceding claims, characterized in that the
20 indication means (13) comprises a control means (131) to detect a detaching or damaging of the seal (1) and to subsequently provide a detection signal (61), preferably an electronic signal (61).

5. The seal (1) according to claim 4, characterized in that the indication means (13) comprises a sending means (132), preferably a RFID chip (132), suitable to send out the warning signal (62) as a response to the detection signal (61) provided by the control means (131).

5

6. The seal (1) according to any of the preceding claims, characterized in that the seal (1) further comprises a lighting unit (15) to emit light after activation (A).

7. A portable logging device (4) for sealing of doors of transport vehicles (3) comprising a data insert unit (41) to insert a particular type of the transport vehicles (3) and to insert the executed attachment of a seal (1) according to claim 1 to a certain door (2) to record the sealing of the door (2), and a data unit (42) suitable to store the inserted data.

8. The portable logging device (4) according to claim 7, characterized in that the seal (1) comprises an identification means (14) providing a machine-readable code and the portable logging device (4) further comprises a reading unit (43) to read (R) the machine-readable code of the identification means (14) and to store the machine-readable code in the data unit (42).

20

9. The portable logging device (4) according to claim 8, characterized in that the portable logging device (4) further comprises a display unit (44) for displaying the location (L1, L2) of each door (2) of the particular type of the transport vehicles (3), where the seal (1) has to be attached, and for correlating the location (L1, L2) of the door (2) with the machine-readable code of the identification means (14) of the seal (1) attached to this door (2).

25

10. The portable logging device (4) according to any of claims 7 to 9, characterized

in that the portable logging device (4) comprises a data connection unit (45) suitable to transfer the data to a computer system (52) and/or update the data stored in the data unit (42), preferably via a wireless data connection (45).

5 11. A sealing system for sealing of doors (2) of transport vehicles (3) comprising multiple seals (1) according to claim 1, at least one portable logging device (4) according to claim 7 and a clearance system (5) comprising a computer system (52) for receiving and storing data from the portable logging device (4), suitable to receive the warning signal (62) from the seal (1) and to provide an alarm signal (63) at least inside a
10 clearance area (51) as a response of the received warning signal.

12. The sealing system (5) according to claim 11, characterized in that the clearance system further (5) comprises multiple receiving stations (53) arranged at different suitable places within the clearance area (51) to receive the warning signal (62) from
15 any location in the clearance area (51) accessible for transport vehicles (3).

13. A method for operating a sealing system according to claim 11 comprising the steps of

- attaching at least one seal (1) to each door (2) of the transport vehicle (3),
- 20 - activating (A) the seal (1) via an indication means (13) after attaching the seal (1) to the transport vehicle (3), and
- sending out a warning signal (62) by the seal (1) in case of the seal (1) being detached or damaged after activation (A) of the indication means (13).

25 14. A method for operating the sealing system according to claim 13 further comprising the steps of

- inserting a particular type of the transport vehicles (3) into the portable logging device (5),

- inserting the execution of attaching the seal (1) to a certain door (2) into the portable logging device (5) via a data insert unit (41), preferably by reading (R) a machine-readable code provided by an identification means (14) of the seal (1), and
- 5 - storing the inserted data in a data unit (42) of the portable logging device.

15. A method for operating the sealing system according to claim 14 further comprising the steps of

- receiving and storing the data inserted to the portable logging device (5) from
10 the portable device (5) in a computer system (52), preferably via a wireless data connection,
- receiving a warning signal from the seal (1) in case of detached or damaged seal (1), and
- providing an alarm signal (63) at least inside a clearance area (51) as a response
15 of the received warning signal (62).

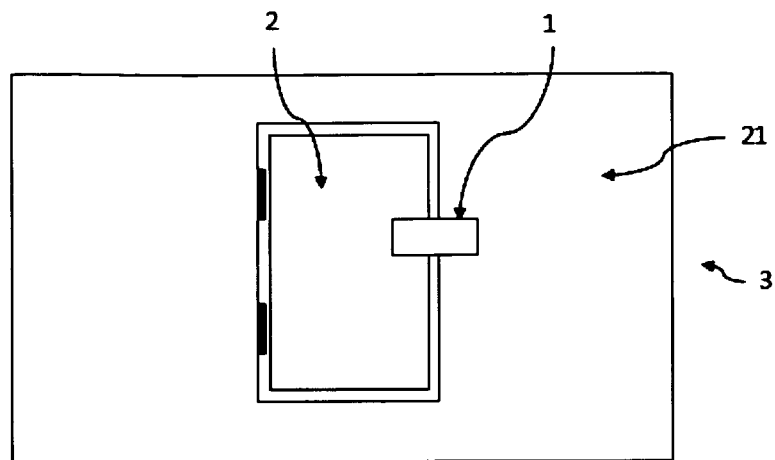


Fig.1

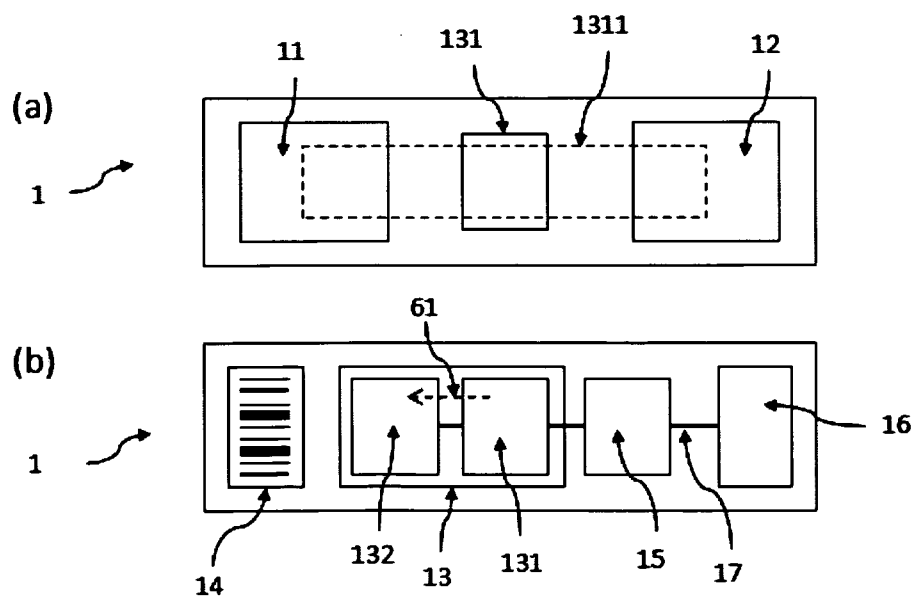


Fig.2

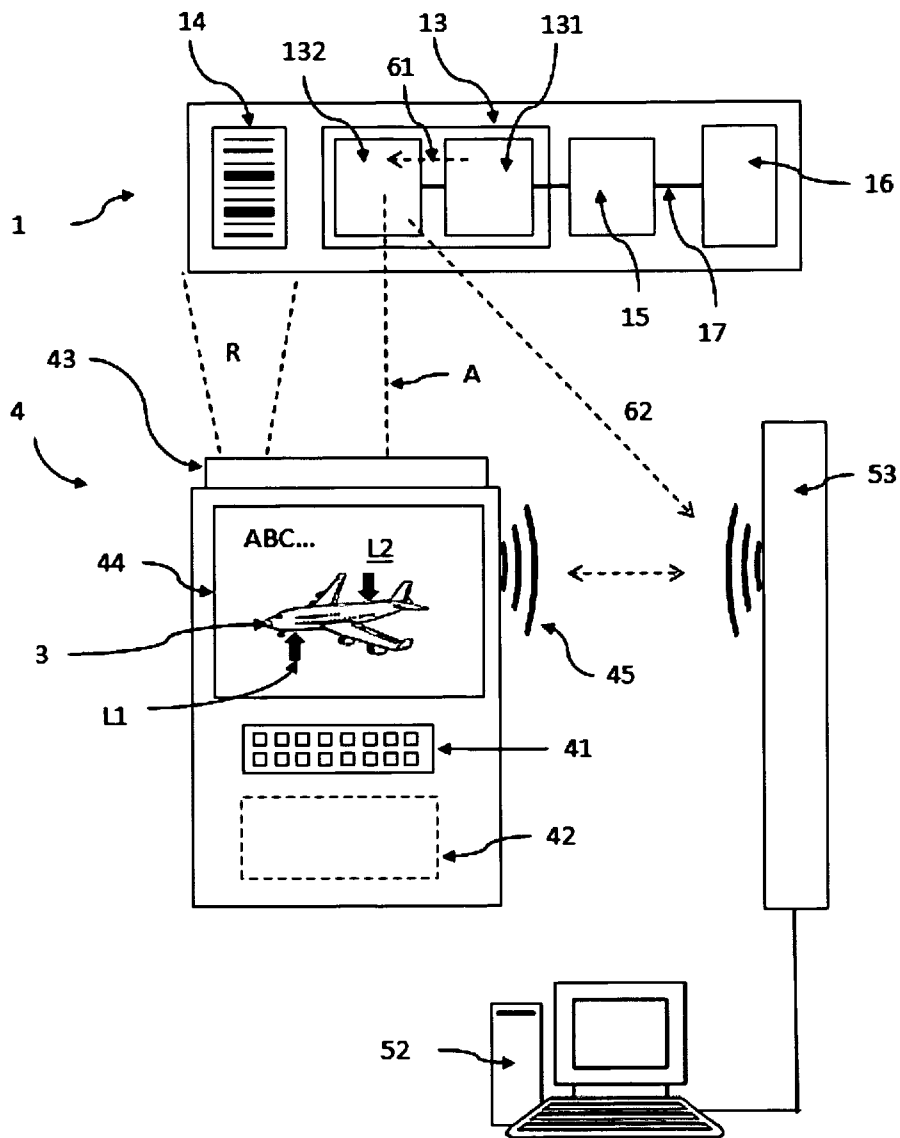


Fig.3

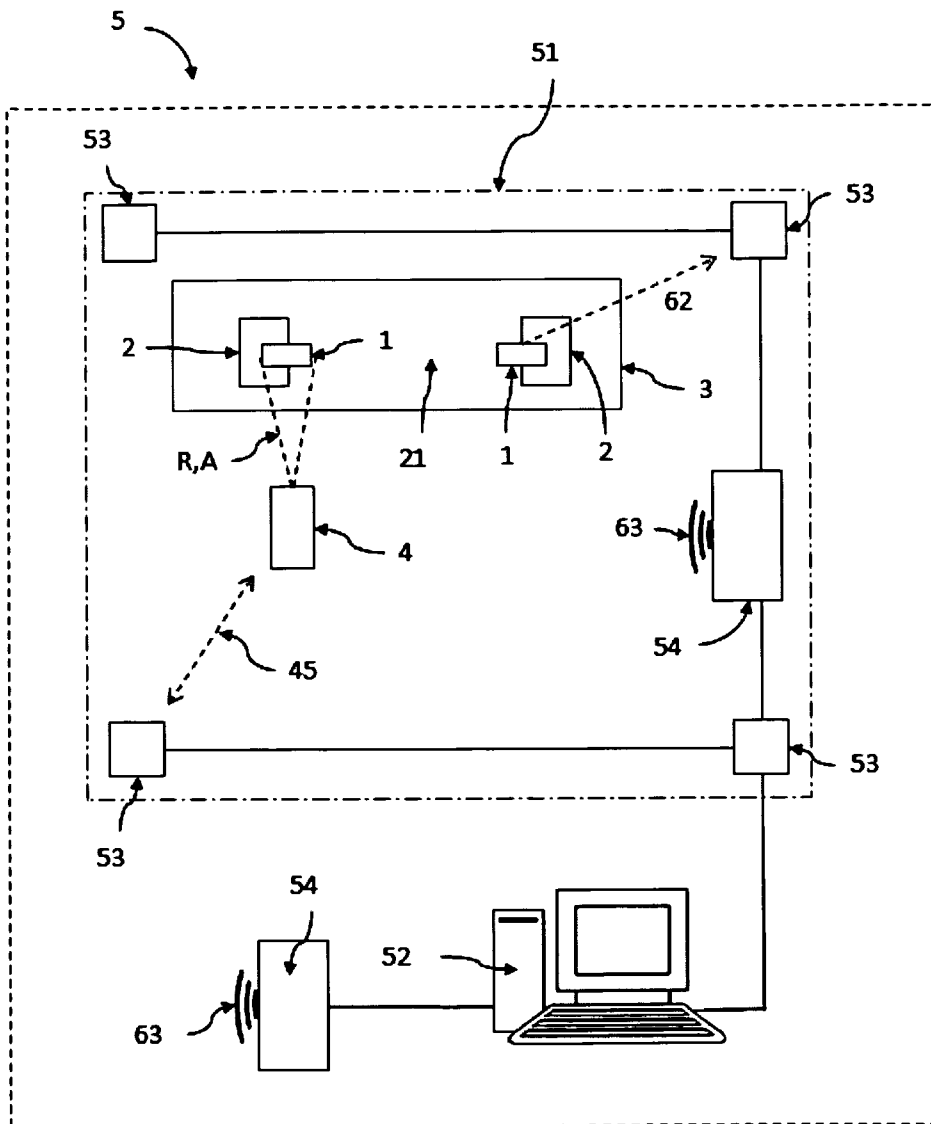


Fig.4

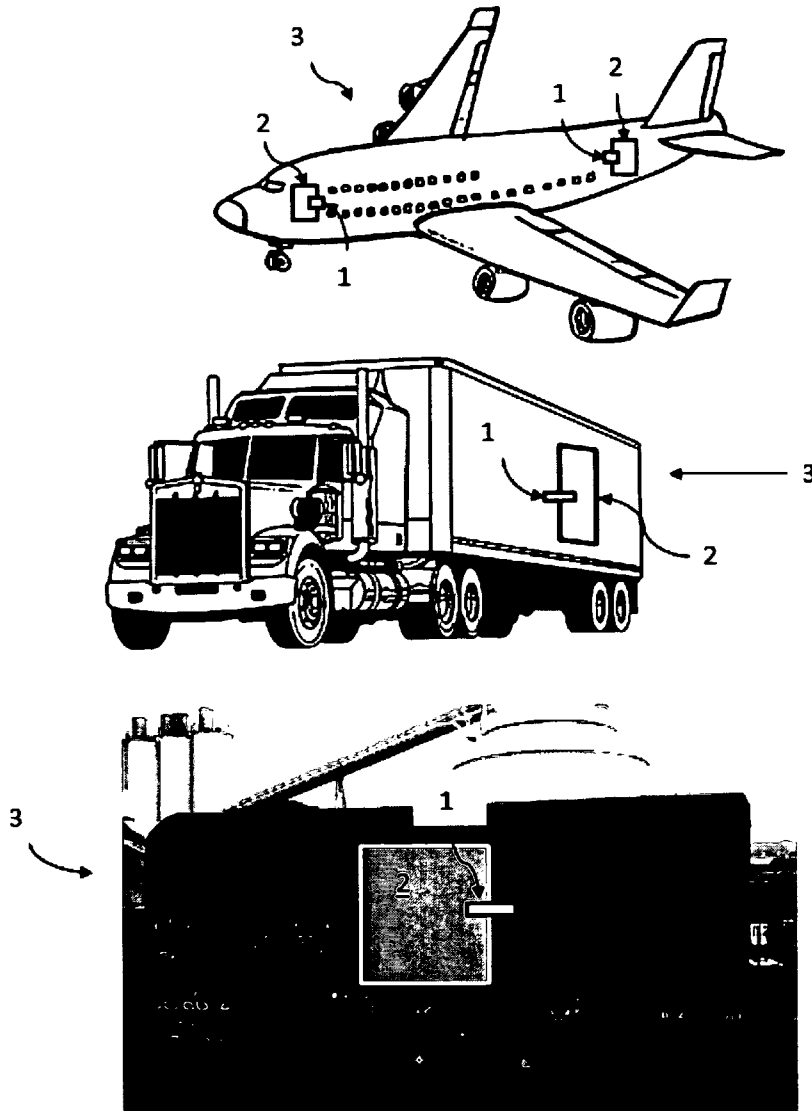


Fig.5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/001432

A. CLASSIFICATION OF SUBJECT MATTER INV. G09F3/02 G09F3/03 ADD.		
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) G09F E05B B64C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2004/227632 A1 (GRIJALVA RAMON LORENZO [US] ET AL) 18 November 2004 (2004-11-18) paragraphs [0014] - [0016] paragraphs [0030] - [0048] figures 1-8 -----	1-6,13, 14 7-12,15
X A	GB 2 446 178 A (HEWLETT PACKARD DEVELOPMENT CO [US]) 6 August 2008 (2008-08-06) figures 3-4 page 1, lines 9-14 page 1, paragraph 2 - page 7, paragraph 1 -----	1-6,14 7-12,15
X A	GB 2 447 518 A (SCHOFIELD BARRY JAMES [GB]) 17 September 2008 (2008-09-17) figures 1-5 pages 1-5 -----	1-6,14 7-12,15
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" 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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" 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 "X" 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 "Y" 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		
Date of the actual completion of the international search 16 June 2011	Date of mailing of the international search report 24/06/2011	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Pierron, Christophe	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/001432

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004227632	A1	18-11-2004	NONE

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		WO 2008110843 A1 18-09-2008	
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