(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 722 339 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.11.2006 Bulletin 2006/46

(51) Int Cl.:
G08C 17/00 *(2006.01)* ***G08C 19/28*** *(2006.01)*
E05F 15/00 *(2006.01)*

(21) Application number: **05104051.7**

(22) Date of filing: **13.05.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(71) Applicant: **CARDO DOOR AB**
201 21 Malmö (SE)

(72) Inventor: **Lu, Alex**
452 38 Strömstad (SE)

(74) Representative: **Kraenzmer, Martin et al**
Awapatent AB,
Box 11394
404 28 Göteborg (SE)

(54) Method and arrangement for wireless control of a building door

(57) A method and arrangement, for controlling movement of a door leaf (3) comprised in a building door, comprising the steps of wirelessly communicating information between a control unit (4, CU) and a signal unit (6, SU) and controlling movement of the door leaf (3) based on this information. The step of wirelessly communicating information comprises the steps of transmitting (40), to the signal unit (6, SU), a first message comprising a first identification code (ID_1), receiving (41), from the signal unit (6, SU), a second message comprising a second identification code (ID_2), and verifying (42) the second identification code (ID_2) by comparing at least a first identifying portion (ID_{21}) of the second identification code (ID_2) with at least a first identifying portion (ID_{12}) of the first identification code (ID_1).

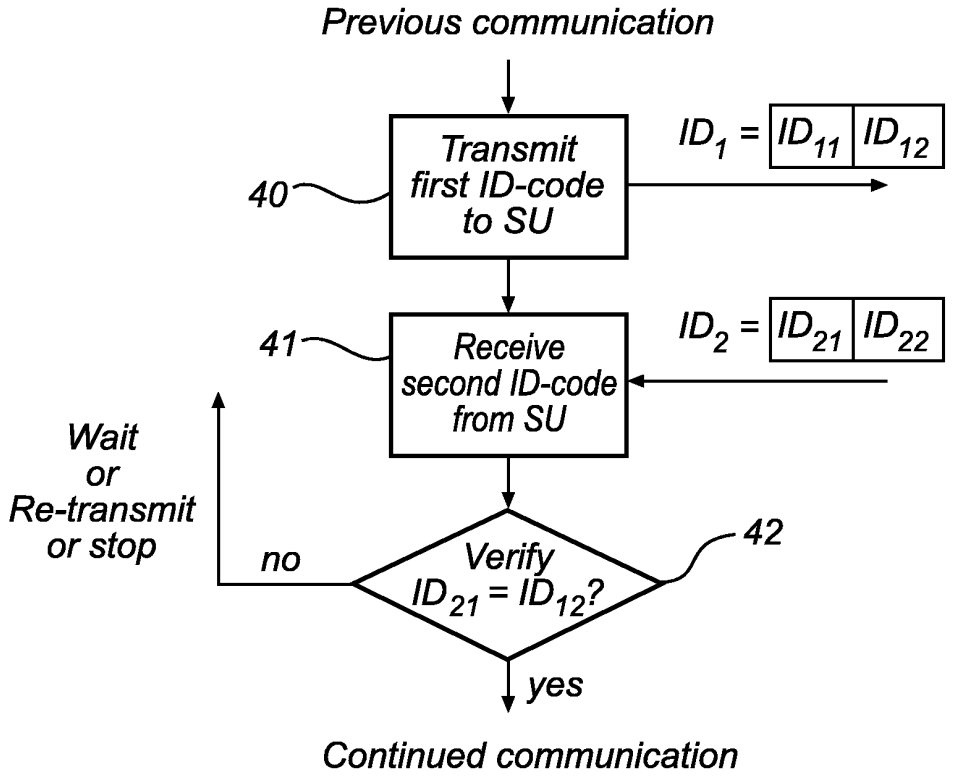

Fig. 2a

EP 1 722 339 A1

Description

Technical Field of the Invention

[0001] The present invention relates to a method, for controlling movement of a door leaf comprised in a building door, comprising the steps of wirelessly communicating information between a control unit and a signal unit capable of providing signals indicative of a door status, and controlling movement of said door leaf based on said information.

[0002] The invention further relates to a building door arrangement, for controlling movement of a door leaf comprised in a building door, comprising a control arrangement, an actuator arranged to move said door leaf in response to control signals from said control arrangement and a signal unit capable of transmitting signals indicative of a door status, wherein said control arrangement and said signal unit are arranged to wirelessly communicate information between each other.

Technical Background

[0003] Building doors exist in almost any size and shape, the common feature of all such doors being that they are used to, partly or completely, close an opening existing inside or on the perimeter of a building. Some building doors are manually operated, while the operation of others is assisted by a motor or similar. Motor assisted doors are found among medium to high end garage doors and larger "industrial type" doors used, for example, in factories, warehouses and to seal of a larger garage complex.

[0004] Substantial force can be involved when opening and closing motorised building doors, in particular when it comes to large industrial doors. Additionally, it is often important that the opening and closing of such doors occur rapidly. At the same time, there is typically a rather large number of people working and moving around in the vicinity of these doors. The issue of personal safety is thus obviously an important aspect when developing in particular motorised building doors.

[0005] Ordinarily, the safety aspect is addressed by providing a pinch protection device comprising a sensor for detection of potential obstacles. The pinch protection device is conventionally positioned at the lowermost part of the door leaf. As a consequence of detection of any object or person, the door is adapted to stop immediately. The information about the detected obstacle or possibly reaching of the floor of the lower part of the door leaf is normally relayed to a motor controller through a spiral cable having one end attached to the pinch protecting device of the door and the other end connected to the motor controller on the wall next to the door.

[0006] This spiral cable is often the weak link in the building door system. It is so frequently extended and contracted that there is a risk for wearing. If a spiral cable would e.g. break an operator has to be sent to repair the door, leading to increased costs and downtime of the door.

[0007] In EP 1 441 101, a wireless alternative to the above-mentioned spiral cable is disclosed. Information from the pinch protection device is here wirelessly transmitted from a unit mounted on the door leaf and connected to the pinch protection device to a wall-mounted control unit which controls a motor moving the door up or down. Furthermore, the present document discloses a secure data protocol for the communication between the door leaf mounted unit and the wall mounted unit. According to this protocol, a number of identical ASCII character codes are transmitted by one of the units during a certain time. The receiving unit compares a number of these consecutive ASCII codes with each other and checks if the received codes are equal.

[0008] A problem with the above-described arrangement is that personal safety is decreased compared to the solution with a spiral cable, since no method is provided for ensuring that the wall mounted control unit receives signals from the correct door mounted unit.

Objects of the Invention

[0009] In view of the above-mentioned and other drawbacks of the prior art, a general object of the present invention is to provide an improved method and arrangement for controlling movement of a door leaf comprised in a building door.

[0010] A further object of the present invention is to enable safer operation of a wirelessly controlled building door.

Summary of the Invention

[0011] According to a first aspect of the present invention, these and other objects are achieved by a method, for controlling movement of a door leaf comprised in a building door, comprising the steps of wirelessly communicating information between a control unit and a signal unit capable of providing signals indicative of a door status, and controlling movement of said door leaf based on said information, wherein said step of wirelessly communicating information comprises the steps of transmitting, to the signal unit, a first message comprising a first identification code, receiving, from the signal unit, a second message comprising a second identification code, and verifying said second identification code by comparing at least a first identifying portion of said second identification code with at least a first identifying portion of said first identification code, thereby validating a source of said second message.

[0012] According to a second aspect of the present invention, these and other objects are achieved by a building door arrangement, for controlling movement of a door leaf comprised in a building door, comprising a control arrangement, an actuator arranged to move said door leaf in response to control signals from said control

arrangement and a signal unit capable of transmitting signals indicative of a door status, wherein said control arrangement and said signal unit are arranged to wirelessly communicate information between each other, wherein said control arrangement includes a control unit comprising transmitting means for transmitting, to the signal unit, a first message comprising a first identification code, receiving means for receiving, from the signal unit, a second message comprising a second identification code, and processing means for verifying said second identification code by comparing at least a first identifying portion of said second identification code with at least a first identifying portion of said first identification code, thereby validating a source of said second message.

[0013] Information wirelessly communicated from the control unit to the signal unit may, for example, be operational commands to the signal unit or information regarding the state of the door or the state to be entered. Such information can for example be: "a closing movement is initiated".

[0014] By "door status" should be understood the status of the door at a given time. For example, the door status can include the current direction and/or speed of movement of the door leaf and the safety status, such as whether or not an object has been encountered by the moving door leaf.

[0015] The "first" and "second" messages referred to above may, of course, be sent and received, respectively, at any time during the wireless communication between the control unit and the signal unit.

[0016] By verifying that at least a first identifying portion included in a first identification code comprised in a first, transmitted, message is identical to at least a first identifying portion included in a second identification code comprised in a second, received, message it can be concluded that the second message originates from the signal unit that received the first message.

[0017] It can thus, through the method and arrangement of the invention, be secured that the correct signal unit is communicating with the correct control unit and vice versa so that the door leaf movement is not controlled based on door status signals from another door in the vicinity. Thereby, a safer operation of the building door is achieved.

[0018] According to one embodiment of the present invention, the step of wirelessly communicating door information may further comprise the steps of receiving, from the signal unit, a third message comprising a third identification code, and verifying the third identification code by comparing at least a first identifying portion of the third identification code with a second identifying portion of the second identification code, thereby validating a newness of the third message.

[0019] In addition to securing that the wireless communication takes place between the correct control unit and the correct signal unit, it can, through the addition of the above-mentioned steps, be ensured that a received message is new and original. Using this method, it would, for example, be detected if the signal unit would, due to a software or hardware glitch, continuously re-transmit the same safety-related door status information. Based on the detection of consecutive identical messages, the door leaf can be stopped and a potentially dangerous situation avoided.

[0020] Preferably, the step of wirelessly communicating information can further comprises the step of generating a new identification code by combining a received first identifying portion and a new second identifying portion.

[0021] In this way, the identification code is always new and "unique" and still possible for the respective units to recognise.

[0022] The new second identifying portion can be a locally generated random or quasi-random number or it could be a code which is randomly or quasi-randomly selected among a plurality of locally stored codes. An advantage of the selection approach is that the implementation of a simple and low-power solution is facilitated. If a battery is used for driving the control unit and/or signal unit, the life time of the battery can thereby be increased and a battery exchange possibly avoided during the life time of the door.

[0023] According to another embodiment, the method of the invention can further comprise the steps of determining and storing an initial individualised code in order to individualise the control unit prior to first use, and transmitting, to the signal unit, the initial individualised code thereby associating the signal unit with the control unit.

[0024] Preferably, the initial individualised code is stored in a non-volatile memory in the control unit as well as in the signal unit. Thereby, communication can be securely restarted after power outage and/or battery exchange without having to redo the above-described initial association.

[0025] If control units and signal units can leave the factory being more or less identical rather than individualised, production can be made more efficient and cost of production lowered. The control unit and the signal unit may also be manufactured in different factories or even by different companies. Through the above-described method, a control unit can be individualised and a signal unit associated thereto. Thereby, a control arrangement comprising a control unit and a signal unit can be tied to a certain door, potentially among a large number of doors at a warehouse or similar. Of course, the signal unit may be the unit in which an initial individualising code is first determined and stored and subsequently transmitted to a control unit which is thereby associated with the signal unit.

[0026] If several signal units are within range of a control unit, one or several of these can be selected to be associated with the control unit. This can be done by manually selecting the signal unit, for example by activating the pinch protection device on the door leaf(s) if the signal unit is connected to this pinch protection device.

[0027] According to a further embodiment of the present invention, the step of wirelessly communicating information can further comprise the step of determining whether any transmission takes place in a selected frequency band before transmitting the first message.

[0028] Through this method of "listening before talking", safety is increased further. This method is particularly useful when an operation requiring a high degree of safety, such as a closing operation, is to be performed. Before transmitting a message initiating a closing movement, the control unit then listens in the selected frequency band. If communication from other units of sufficient signal strength is detected, the communication is not initiated at this time. Through this method in combination with selecting a frequency band with a very low allowed duty cycle, the possibility of communicating without any interference is increased. Safety is thus improved.

[0029] The control unit may listen before talking prior to every message or only at the onset of the communication between control unit and door unit.

[0030] Furthermore, the step of wirelessly communicating information can additionally comprise the step of transmitting, to the signal unit, an activation signal prior to transmitting the first message in order to bring the signal unit into an active state.

[0031] In order to save power, the signal unit preferably has a number of states with different levels of activity and, consequently, power consumption. Typical states are "sleep", "standby" and "active". In order to take the signal unit from the "sleep" to either of the "standby" and "active" states, an activation signal can be transmitted. In order to be certain that the signal unit is actually activated, the activation signal should extend over a sufficiently long period of time.

[0032] In addition, the step of wirelessly communicating information may further comprise the step of switching, before transmitting the first message, from a first frequency band with a first permitted duty cycle to a second frequency band with a second permitted duty cycle, lower than the duty cycle of the first frequency band.

[0033] By switching to a frequency band with a lower permitted duty cycle, the risk of receiving interfering signals is reduced. Thereby, safety is further improved.

[0034] According to one embodiment of a building door arrangement according to the invention the signal unit may be connected to a sensor system.

[0035] By connecting the signal unit to a sensor system, door status information originating from this sensor system can be collected by the signal unit and be provided by the signal unit to the control unit so that this door status information can be used as parameters for the control of the door leaf movement.

[0036] The above-mentioned sensor system can be an object encounter sensor which is integrated in the door leaf.

[0037] Through the connection of the signal unit to an object encounter sensor integrated in the door leaf, preferably at the lower edge of the door leaf, information on an encounter with an object or a person can be provided to the control unit which can then instantaneously stop the movement of the door leaf. When the signal unit is connected to an object encounter sensor which is integrated in the door leaf, the signal unit is also preferably positioned on the door leaf.

[0038] The above-mentioned sensor system can also be an object encounter sensor which is positioned in the door frame.

[0039] Through this arrangement, information on a potential object encounter can be obtained. For example, the sensor system may give a signal indicative of a risk of an object or person encounter when a light beam across the door opening is interrupted.

Brief Description of the Drawings

[0040] These and other aspects of the present invention will now be described in more detail, with reference to the appended drawings showing currently preferred embodiments of the invention.

Fig 1a is a schematic view of a building door arrangement according to a first embodiment of the second aspect of the present invention.

Fig 1b is a schematic view of the interior of the control unit comprised in the arrangement in fig 1a.

Fig 1c is a schematic view of the interior of the signal unit comprised in the arrangement in fig 1a.

Fig 1d is a schematic view of the building door arrangement in fig 1a within wireless communication range of other building door arrangements of the same type.

Fig 2a is a flow chart illustrating a wireless communication method included in a control method according to a first embodiment of the first aspect of the present invention.

Fig 2b is a flow chart illustrating wireless communication method included in a control method according to a second embodiment of the first aspect of the present invention.

Fig 3a is a flow chart illustrating an association method included in a control method according to a third embodiment of the first aspect of the present invention.

Fig 3b is a flow chart illustrating a wireless communication method included in a control method according to a fourth embodiment of the first aspect of the present invention.

Fig 4 is a schematic signalling sequence diagram

illustrating a wireless communication method included in a control method according to a fifth embodiment of the first aspect of the present invention

Fig 5a is a schematic signalling sequence diagram illustrating a first example of handling of communication errors occurring in the wireless communication in fig 4.

Fig 5b is a schematic signalling sequence diagram illustrating a second example of handling of communication errors occurring in the wireless communication in fig 4.

Fig 5c is a schematic signalling sequence diagram illustrating a third example of handling of communication errors occurring in the wireless communication in fig 4.

Fig 5d is a schematic signalling sequence diagram illustrating a fourth example of handling of communication errors occurring in the wireless communication in fig 4.

Fig 5e is a schematic signalling sequence diagram illustrating a fifth example of handling of communication errors occurring in the wireless communication in fig 4.

Detailed Description of Preferred Embodiments of the Invention

[0041] Fig 1a schematically shows a first embodiment of a building door arrangement 1 according to the present invention where an actuator 2, in the form of a motor, is arranged to move a door leaf 3 up in order to open the building door or down to close it. The motor 2 is configured to move in response to signals from a control arrangement comprising a control unit 4. The control unit receives instructions regarding the desired movement of the door leaf 3 via a command input device 5 which is here shown as a simple three-button keyboard having an "up"-button, a "down"-button and a "stop"-button. In many situations it is desirable that the building door opens automatically when, for example, a fork lift is approaching. The keyboard 5 shown here is then preferably substituted by a suitably placed photocell or other detector which can give an opening signal when the fork lift is approaching the door. On the door leaf 3, a signal unit 6 is mounted. The signal unit 6 is powered by a battery 7, connected to a pinch protection device 8 and equipped with a transceiver (see fig 1b) and an antenna 9. Via the transceiver and the antenna 9, the signal unit 6 can transmit signals indicative of the status of the building door, such as if an object has been encountered by the moving door leaf 3, to the control unit 4 via the antenna 10 and transceiver (see fig 1c) included therein.

[0042] In fig 1b the interior of the signal unit 6 is schematically shown. The signal unit 6 has processing circuitry 20 connected to an interface 21 and to a transceiver 22. Through the transceiver 22, signals from the processing circuitry 20 are wirelessly transmitted by the antenna 9. The signal unit 6 is, furthermore, connected to a power supply 7 in the form of a battery and, via the interface 21, receives door status signals from various sources 23 a-c. These sources can be various types of sensor systems, such as object encounter sensors 8, door leaf speed sensors, door leaf acceleration sensor, door leaf path deviation sensors or motor torque sensors. Of these possible sources of door status information, only the object encounter sensor is included in the drawings (fig 1a).

[0043] As schematically shown in fig 1c, the control unit 4 has a very similar configuration as the signal unit 6. The control unit 4 has processing means, in the form of processing circuitry 30, which are connected to transmitting and receiving means in the form of a transceiver 31 and, via an interface 32, to the motor 2. The connection to the motor 2 can either be direct or via a motor controller (not shown) which can be an integral part of the motor assembly 2. This connection can be wire-based or wireless. The control unit 4 can also, as shown in fig 1c, be connected to a command input device 5 through which commands regarding the desired movement of the door leaf 3 are received by the processor circuitry 30 through the interface 32.

[0044] In fig 1d a situation is illustrated where several similar door arrangements 1, 36, 38 are placed in a row. Such a situation can, for example, occur at a storage facility where lorries dock to be loaded or unloaded. The typical range of transceivers such as those used in the control unit 4 and the signal unit 6 is about 20 metres. Even though the range is so small, a particular control unit 4 may be in within the range of several signal units 35, 37 belonging to other door arrangements 36, 38. With several doors opening and closing at more or less the same time, it is essential that the control unit 4 only considers signals emanating from the correct signal unit 6.

[0045] Fig 2a shows a flow chart illustrating a wireless communication method included in a first embodiment of a control method according the present invention. In the first step 40 of transmitting, possibly following some previous communication, a first message comprising a first identification code ID_1 is transmitted from the control unit 4 to the signal unit 6. The first identification code ID_1 is constituted by a first identifying portion, in the following called "sub-code" ID_{11} and a second sub-code ID_{12}. In the subsequent step 41, a second message, comprising a second identification code ID_2, is received from the signal unit 6. The second identification code ID_2 comprises the sub-codes ID_{21} and ID_{22}. In order to ensure that the correct signal unit 6 is the source of the received message, the first sub-code ID_{21} comprised in the second identification code ID_2 is compared to the second sub-code ID_{12} comprised in the first identification code ID_1 in the step 42 of verifying the received second identification code. If the compared sub-codes ID_{21}, ID_{12} are not iden-

tical, the control unit 4 typically disregards the received message and waits for a message from the correct signal unit 6. Other options are to immediately stop the movement of the door leaf 3 or to re-transmit the first message including the first identification code ID_1. If, on the other hand, the compared sub-codes ID_{21}, ID_{12} are identical, the message is received and the information contained in the message evaluated. Of course, the entire second identification code may be identical to the entire first identification code.

[0046] Fig 2b shows a flow chart illustrating a wireless communication method included in a second embodiment of a control method according to the present invention where specific attention is paid not only to the source of a received message but also to its newness or originality. In fig 2b a continuation of the communication illustrated in fig 2a is shown where a third message comprising a third identification code ID_3 is received 50 from the signal unit 6. In this example, the third message is received 50 without previously transmitting a new message from the control unit 4 to the signal unit 6. However, the principle is the same for the cases when such a message has been transmitted and the received message is the fourth message. The received third identification code ID_3 is first verified 51 with respect to its source by comparing the first sub-code ID_{31} of the third identification code ID_3 with the second sub-code ID_{12} of the, most recently transmitted, first identification code ID_1 in a manner described above. Given that the correct source of the third message can be validated, the step 52 of verifying the newness of the third message follows. In this step 52, the second sub-code ID_{32} of the third identification code ID_3 is compared with the second sub-code ID_{22} of the second identification code ID_2. If the compared sub-codes ID_{32}, ID_{22} are identical, the received third message is not new or original, but rather a copy of the second message or corrupt in another way. Depending on the situation, the control unit 4 can then decide to stop the movement of the door leaf 3, wait for a period of time for a new message or re-transmit the first message. If, on the other hand, the compared sub-codes ID_{32}, ID_{22} are not equal, then the originality of the third message is validated in addition to the previous validation of the source of the third message.

[0047] Fig 3a shows a flow chart illustrating an association method included in a third embodiment of the control method according to the present invention, where an initial individualised code IC is determined and stored 60 following the actuation of an initiation button (not shown) on the control unit 4, CU at installation of the door arrangement 1. Subsequently, the initial individualised code IC is transmitted 61 by the control unit CU and received 62 by each of the signal units SU_1, SU_2, SU_3 happening to be in range of the control unit CU. In order to associate the correct signal unit, in this case SU_2, with the control unit CU, this signal unit SU_2 is selected 63, for example by activating the pinch protection device 8. Following this selection 63, the initial individualised code IC is stored 64 in the selected signal unit SU_2, preferably in a non-volatile memory, such as a flash or an EEPROM. Following the above-described procedure, the control unit CU and the selected signal unit SU_2 now have the same initial individualised code IC stored in their respective non-volatile memories.

[0048] In fig 3b, a flow chart is shown, illustrating a wireless communication method included in a fourth embodiment of the control method according to the present invention. Upon the first communication of information between the control unit CU and the associated signal unit SU, a first message including an initial identification code ID_0 comprising a first sub-code ID_{01} and a second sub-code ID_{02} is transmitted 70 from the control unit CU to the signal unit SU. The first sub-code ID_{01} is identical to the initial individualised code IC and the second sub-code ID_{02} is a new code. The identification code ID_0 is, together with the first message, received 71 by the signal unit SU. In a subsequent step 72, the first sub-code ID_{01} of the initial identification code ID_0 is compared with the stored initial individualised code IC. If this first sub-code ID_{01} is non-identical to the initial individualised code IC, the first sub-code ID_{01} is compared to the contents of an area in a working memory in the signal unit SU. In the present example, since this is the first communication from the correct control unit CU, however, the first sub-code ID_{01} is identical to the initial individualised code IC stored in the signal unit SU. In the next step 73 a new, first identification code ID_1 is generated in the signal unit SU. This first identification code ID_1 is generated by combining the received second sub-code ID_{02} of the initial identification code ID_0 and a new sub-code ID_{12}. Following the generation 73 of the new first identification code ID_1, this identification code ID_1 is transmitted 74 to the control unit included in a second message. This second message, comprising the first identification code ID_1 is received 65 by the control unit CU.

[0049] Fig 4 schematically shows a signalling sequence diagram illustrating a wireless communication method included in a fifth embodiment of the control method according to the present invention, where the communication between the control unit 4, CU and the signal unit 6, SU during closing of the door, i.e. a downward movement of the door leaf 3.

[0050] In order to maximise the safety during closing of the door, the control unit CU listens for possible communication in the currently selected radio frequency band f_1. If another radio transmitter, which could belong to another door arrangement or a completely different product, transmits, the control unit CU waits for a period of time before listening again. When the frequency band f_1 is quiet, the control unit CU transmits an activation signal 80 to activate the signal unit SU. This activation signal 80 contains no information and is simply a pulsed signal sufficiently long to be sensed by the signal unit while the signal unit SU is in its "idle" state. Following the activation of the signal unit SU, a wake-up message 81 is transmitted from the control unit CU. The wake-up message 81

includes an identification code constituted by the sub-codes C_0 and C_1. Upon receipt of the wake-up message 81, the signal unit SU compares the first sub-code C_0 with the initial individualised code stored in the flash memory of the signal unit SU. Since, in this example, the wake-up message 81 originates from a control unit with the same initial individualised code IC, the first sub-code C_0 is identical to IC and the signal unit SU therefore processes the wake-up message 81 as an authentic message and replies with an ACK-message 82. In the following, it is assumed that all messages originate from the proper source and are new. Various modes of communication failures will be described in later examples. The Ack-message 82 includes an identification code comprising the sub-codes C_1 and C_2. Following receipt of the Ack-message 82, the control unit CU transmits a Change-frequency message 83 comprising sub-codes C_2 and C_3. After transmitting this message 83, the control unit CU switches to another frequency band (from f_1 to f_2). The signal unit SU reacts on the Change-frequency message 83 by switching to the stipulated frequency band (from f_1 to f_2) and transmitting an Ack-message 84 comprising the sub-codes C_3 and C_4. After receipt of the Ack-message 84, the control unit CU transmits a Down-message 85, comprising the sub-codes C_4 and C_5, telling the signal unit SU that the door leaf 3 is about to move downwards. The signal unit SU responds with an Ack-message 86, comprising the sub-codes C_5 and C_6 and information regarding the status of the door. In this case, the door status information constitutes information on whether the pinch protection device 8 has been activated or not. If the pinch protection device 8 has not been activated, the Ack-message 86 comprises on OK and the control unit CU allows the door leaf 3 to commence its downward movement. During the downward movement of the door leaf 3, the control unit CU periodically receives status-messages 87-90 from the signal unit SU. All these status-messages 87-90 comprise two sub-codes, one of which is a sub-code C_5 previously transmitted by the control unit CU. The other sub-codes C_7, C_8, C_n, C_{n+1} are all different. Thereby, the control unit can validate the origin as well as the newness of the received status-messages 87-90. When the door leaf 3 has reached its closed position, the control unit CU transmits a stop-message 91 comprising the sub-codes C_{n+1} and C_{n+2} to the signal unit SU indicating that the signal unit SU may return to its idle state.

[0051] Figs 5a-e schematically show signalling sequence diagrams illustrating five examples of handling of communication errors that may occur in the wireless communication in fig 4.

[0052] In the first example, schematically illustrated in fig 5a, a part of the communication in fig 4 is shown where the Ack-message 86 following on the Down-message 85 is not received by the control unit CU within a certain time limit or "time-out". After the time-out limit, the control unit resends the down-message 85 comprising the same sub-codes. In this first example, the control unit CU receives the Ack-message 86 properly and communication and the downward movement of the door-leaf can continue.

[0053] In the second example, schematically illustrated in fig 5b, a part of the communication in fig 4 is shown, where two consecutive status messages 88 and 89 are not received by the control unit CU. After two consecutive time-out limits without having received a status message, the movement of the door leaf 3 is instantly stopped.

[0054] In the third example, schematically illustrated in fig 5c, a part of the communication in fig 4 is shown, where a status message 88 returns the door status "not ok" indicating that the object encounter device has been activated to the control unit CU. When this status message 88 is received by the control unit CU, the movement of the door leaf 3 is instantly stopped.

[0055] In the fourth example, schematically illustrated in fig 5d, a part of the communication in fig 4 is shown, where status messages 100 and 101 are received by the control unit CU from another signal unit SU_2 associated with a different control unit. The status message 100 comprises the sub-codes A_1 and A_2 and the status message 101 comprises the sub-codes A_1 and A_3. None of these sub-codes A_1, A_2, A_3 are recognised by the control unit CU and the status messages 100, 101 are consequently disregarded. After two consecutive time-outs, the movement of the door leaf 3 is instantly stopped.

[0056] In the fifth example, schematically illustrated in fig 5e, a part of the communication in fig 4 is shown, where status messages 87, comprising the sub-codes C_5 and C_7, returns a door status indicating an "OK" door status. The control unit continues to move the door leaf 3 down. The next status message 88 from the signal unit SU comprises the same sub-codes C_5 and C_7. This indicates to the control unit CU that the status message 88 originates from the correct signal unit SU but that the message is not new and original. There is thus a risk that the signal unit SU has suffered a processor hang-up and is returning the same message over and over. Since the object encounter device 8 may then be activated without the control unit CU receiving any such information, the movement of the door leaf 3 is instantly stopped.

[0057] The person skilled in the art realises that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims. For example, the door could be any type of building door, such as a garage door, a roll-gate or a sideways closing door. In the case of a sideways closing door, such as a hinged door or a sideways sliding door, the closing movement, of course, takes place sideways rather than downwards. Furthermore, the signal unit 6 may optionally be connected to the motor 2 and the motor 2 controlled by the control unit 4 through the signal unit 6 using the method of the present invention.

Claims

1. A method, for controlling movement of a door leaf (3) comprised in a building door, comprising the steps of:

   - wirelessly communicating information between a control unit (4, CU) and a signal unit (6, SU) capable of providing signals indicative of a door status, and;
   - controlling movement of said door leaf (3) based on said information,

   characterised in that said step of wirelessly communicating information comprises the steps of:
   - transmitting (40), to the signal unit (6, SU), a first message comprising a first identification code (ID_1);
   - receiving (41), from the signal unit (6, SU), a second message comprising a second identification code (ID_2), and;
   - verifying (42) said second identification code (ID_2) by comparing at least a first identifying portion (ID_{21}) of said second identification code (ID_2) with at least a first identifying portion (ID_{12}) of said first identification code (ID_1), thereby validating a source of said second message.

2. A method according to claim 1, wherein said step of wirelessly communicating door information further comprises the steps of:

   - receiving (50), from the signal unit (6, SU), a third message comprising a third identification code (ID_3), and;
   - verifying (51) said third identification code (ID_3) by comparing at least a first identifying portion (ID_{32}) of said third identification code (ID_3) with a second identifying portion (ID_{22}) of said second identification code (ID_2), thereby validating a newness of said third message.

3. A method according to claim 1 or 2, wherein said step of wirelessly communicating information further comprises the step of:

   - generating (73) a new identification code (ID_1) by combining a received first identifying portion (ID_{01}) and a new second identifying portion (ID_{12}).

4. A method according to any one of the preceding claims further comprising the steps of:

   - determining and storing (60) an initial individualised code (IC) in order to individualise the control unit (4, CU) prior to first use, and;
   - transmitting (61), to the signal unit (6, SU), said initial individualised code (IC) thereby associating said signal unit (6, SU) with said control unit (4, CU).

5. A method according to any one of the preceding claims, wherein said step of wirelessly communicating information further comprises the step of:

   - determining whether any transmission takes place in a selected frequency band before transmitting said first message.

6. A method according to any one of the preceding claims, wherein said step of wirelessly communicating information further comprises the step of:

   - transmitting, to said signal unit (6, SU), an activation signal (80) prior to transmitting said first message (40; 85) in order to bring said signal unit (6, SU) into an active state.

7. A method according to any one of the preceding claims, wherein said step of wirelessly communicating information further comprises the step of:

   - switching, before transmitting said first message (85), from a first frequency band (f_1) with a first permitted duty cycle to a second frequency band (f_2) with a second permitted duty cycle being lower than said first permitted duty cycle.

8. A building door arrangement (1, 36, 38), for controlling movement of a door leaf (3) comprised in a building door, comprising a control arrangement (4, 5), an actuator (2) arranged to move said door leaf (3) in response to control signals from said control arrangement (4, 5) and a signal unit (6) capable of transmitting signals indicative of a door status, wherein said control arrangement (4, 5) and said signal unit (6) are arranged to wirelessly communicate information between each other, **characterised in that** said control arrangement (4, 5) includes a control unit (4) comprising:

   - transmitting means (31) for transmitting (40), to the signal unit (6), a first message comprising a first identification code (ID_1);
   - receiving means (31) for receiving (41), from the signal unit (6), a second message comprising a second identification code (ID_2), and;
   - processing means (30) for verifying (42) said second identification code (ID_2) by comparing at least a first identifying portion (ID_{21}) of said second identification code (ID_2) with at least a first identifying portion (ID_{12}) of said first identification code (ID_1), thereby validating a source of said second message.

9. A building door arrangement (1, 26, 38) according to claim 8, wherein:

- said receiving means (31) are further adapted to receive (50), from the signal unit (6), a third message comprising a third identification code (ID_3), and;
- said processing means (30) are further adapted to verify (52) said third identification code (ID_3) by comparing at least a first identifying portion (ID_{32}) of said third identification code (ID_3) with a second identifying portion (ID_{22}) of said second identification code (ID_2), thereby validating a newness of said third message.

10. A building door arrangement (1, 36, 38) according to claim 8 or 9, wherein:

- said processing means (30) are further adapted to generate (73) a new identification code (ID_1) by combining a received first identifying portion (ID_{01}) and a new second identifying portion (ID_{12}).

11. A building door arrangement (1, 36, 38) according to any one of claims 8 to 10, wherein:

- said processing means (30) are further configured to determine and store (60) an initial individualised code (IC) in order to individualise the control unit (4) prior to first use, and;
- said transmitting means (31) are further configured to transmit (60), to the signal unit (6), said initial individualised code (IC), thereby associating said signal unit (6) with said control unit (4).

12. A building door arrangement (1, 36, 38) according to any one of claim 8 to 11, wherein:

- said processing means (31) are further arranged to determine whether any transmission takes place in a selected frequency band (f_1) before transmitting (40) said first message (85).

13. A building door arrangement (1, 36, 38) according to any one of claim 8 to 12, wherein:

- said transmitting means (31) are further arranged to transmit, to said signal unit (6), an activation signal (80) prior to transmitting said first message (40; 85) in order to bring said signal unit (6) into an active state.

14. A building door arrangement (1, 36, 38) according to claim 12 or 13, wherein:

- said transmitting means (31) are further adapted to switch from a first frequency band (f_1) with a first permitted duty cycle to a second frequency band (f_2) with a second permitted duty cycle after transmitting said activation signal (80), said second permitted duty cycle being lower than said first permitted duty cycle.

15. A building door arrangement (1, 36, 38) according to any one of claim 8 to 14, wherein said signal unit (6) is connected to a sensor system (8).

16. A building door arrangement (1, 36, 38) according to claim 15, wherein said sensor system (8) is an object encounter sensor which is integrated in the door leaf.

17. A building door arrangement according to claim 15, wherein said sensor system is an object encounter sensor which is positioned in the door frame.

18. A building door arrangement (1, 36, 38) according to any one of claim 7 to 17, further comprising a command input device (5) associated with said control unit (4).

19. A building door arrangement according to claim 18, wherein said command input device (5) is adapted to automatically generate a command indicative of a desired movement of said door leaf (3).

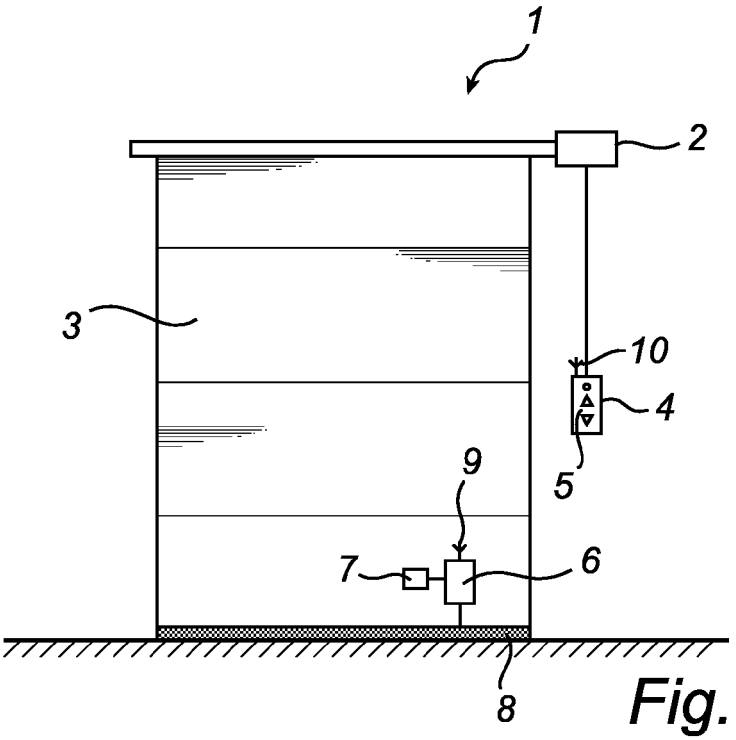

Fig. 1a

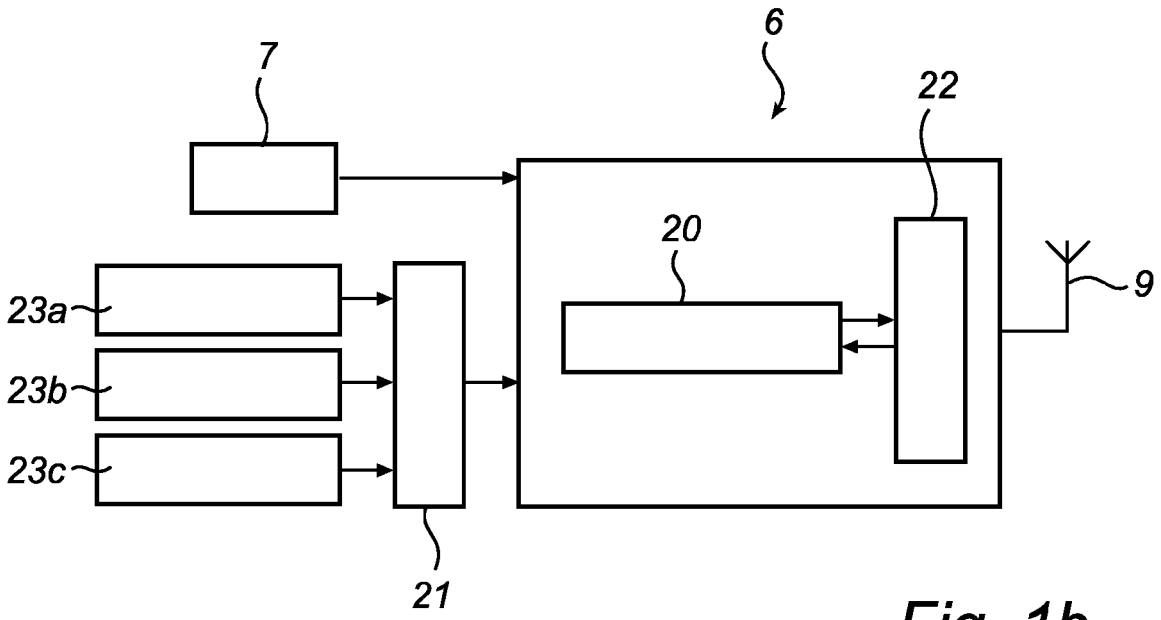

Fig. 1b

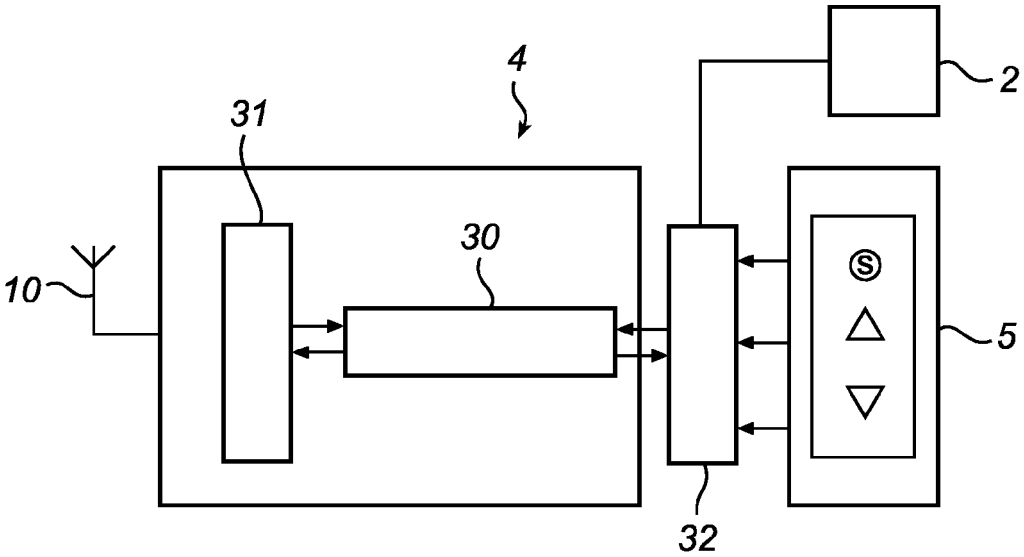

Fig. 1c

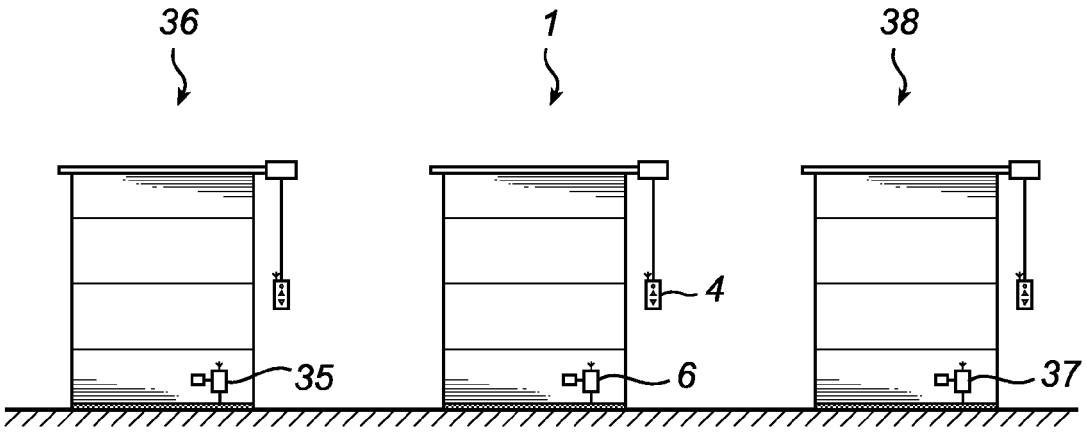

Fig. 1d

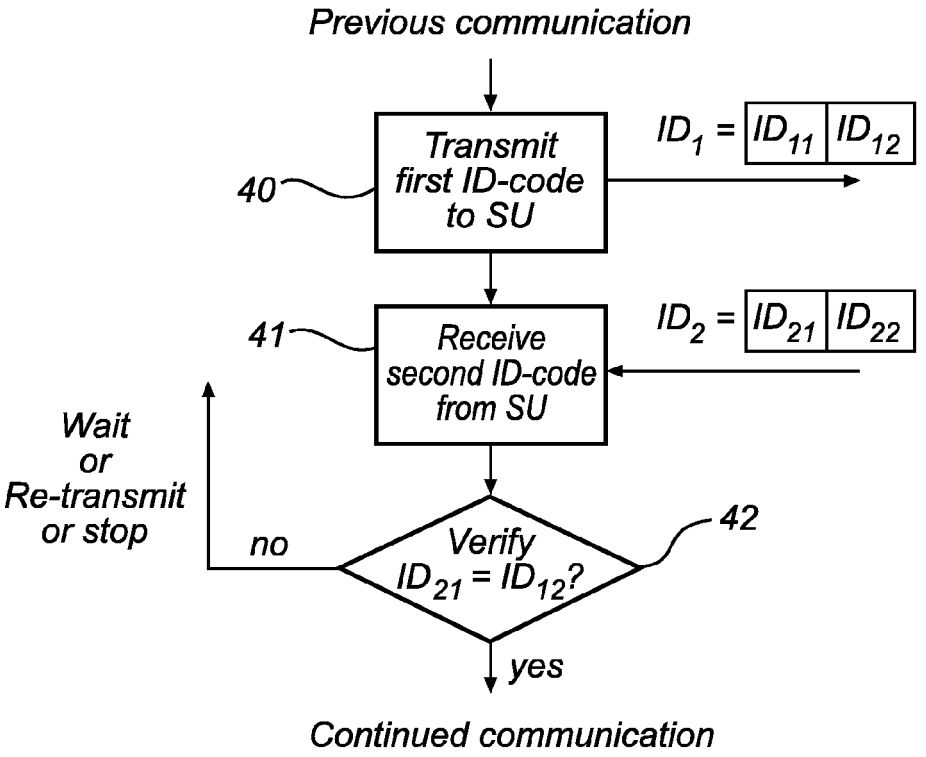
Previous communication
Transmit first ID-code to SU
40
$ID_1 = ID_{11} | ID_{12}$
Receive second ID-code from SU
41
$ID_2 = ID_{21} | ID_{22}$
Wait or Re-transmit or stop
no
Verify $ID_{21} = ID_{12}$?
42
yes
Continued communication

Fig. 2a

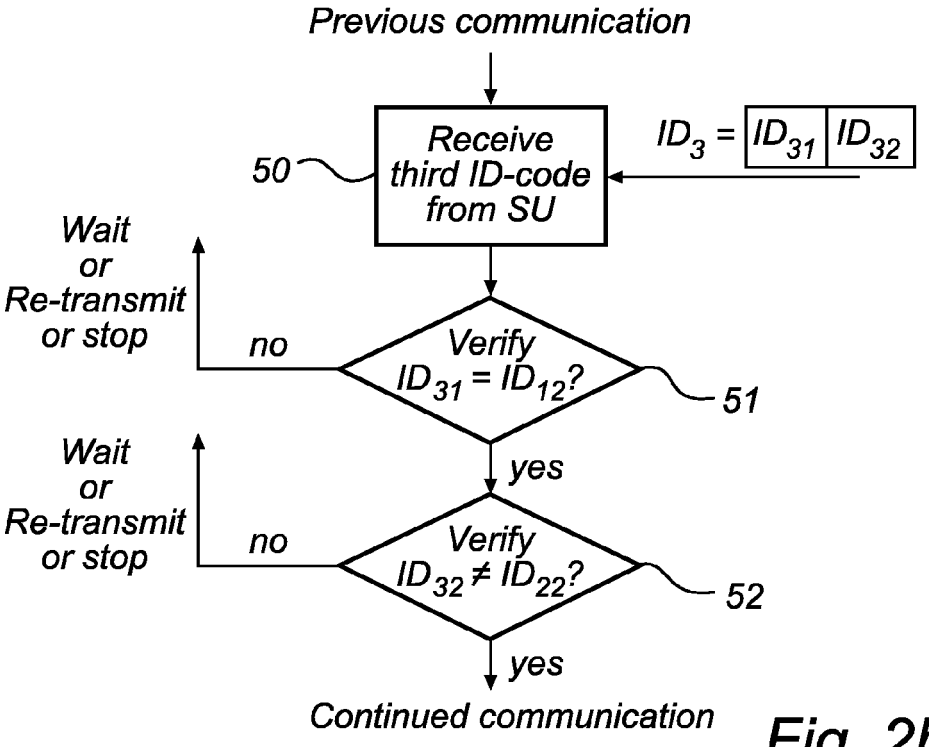
Previous communication
Receive third ID-code from SU
50
$ID_3 = ID_{31} | ID_{32}$
Wait or Re-transmit or stop
no
Verify $ID_{31} = ID_{12}$?
51
yes
Wait or Re-transmit or stop
no
Verify $ID_{32} \neq ID_{22}$?
52
yes
Continued communication

Fig. 2b

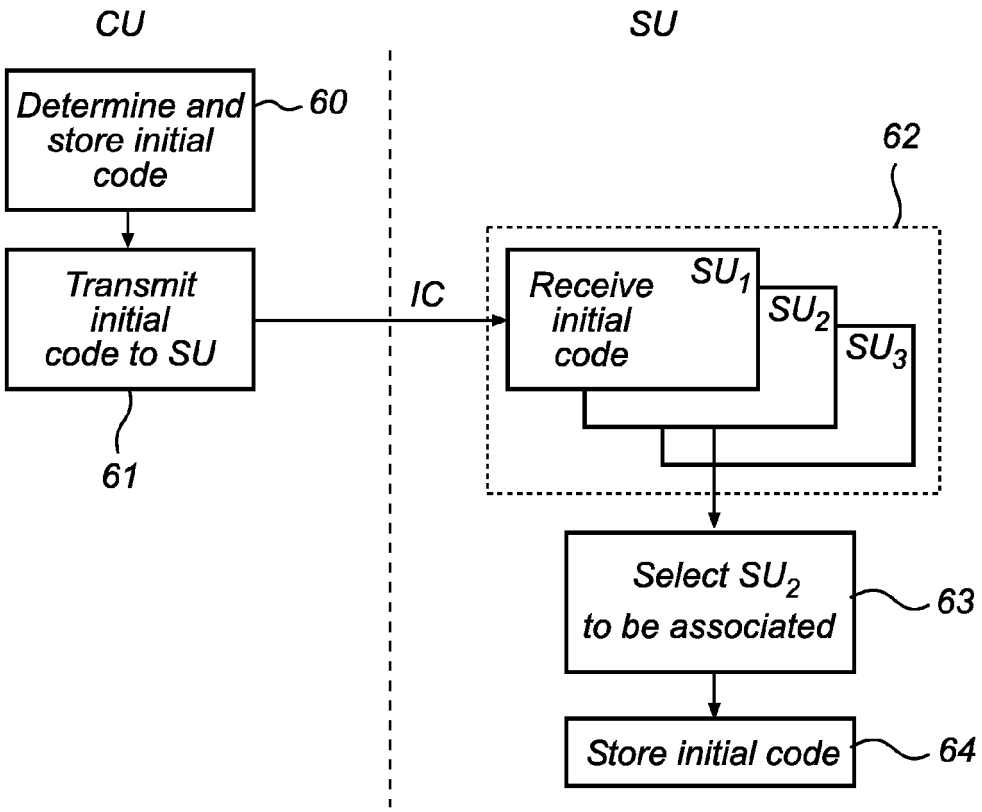
CU
SU
Determine and store initial code
60
62
Transmit initial code to SU
IC
Receive initial code
SU1
SU2
SU3
61
Select SU2 to be associated
63
Store initial code
64

Fig. 3a

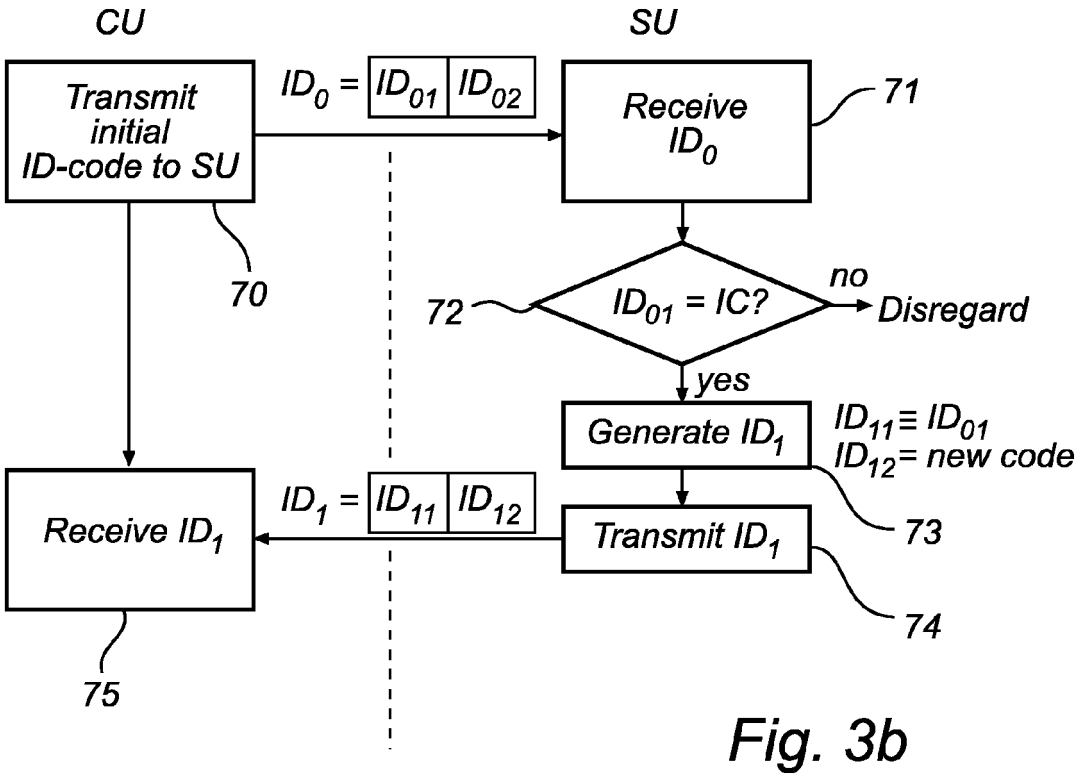
CU
SU
Transmit initial ID-code to SU
ID0 = ID01 ID02
Receive ID0
71
70
72
ID01 = IC?
no
Disregard
yes
Generate ID1
ID11 ≡ ID01
ID12 = new code
73
Receive ID1
ID1 = ID11 ID12
Transmit ID1
74
75

Fig. 3b

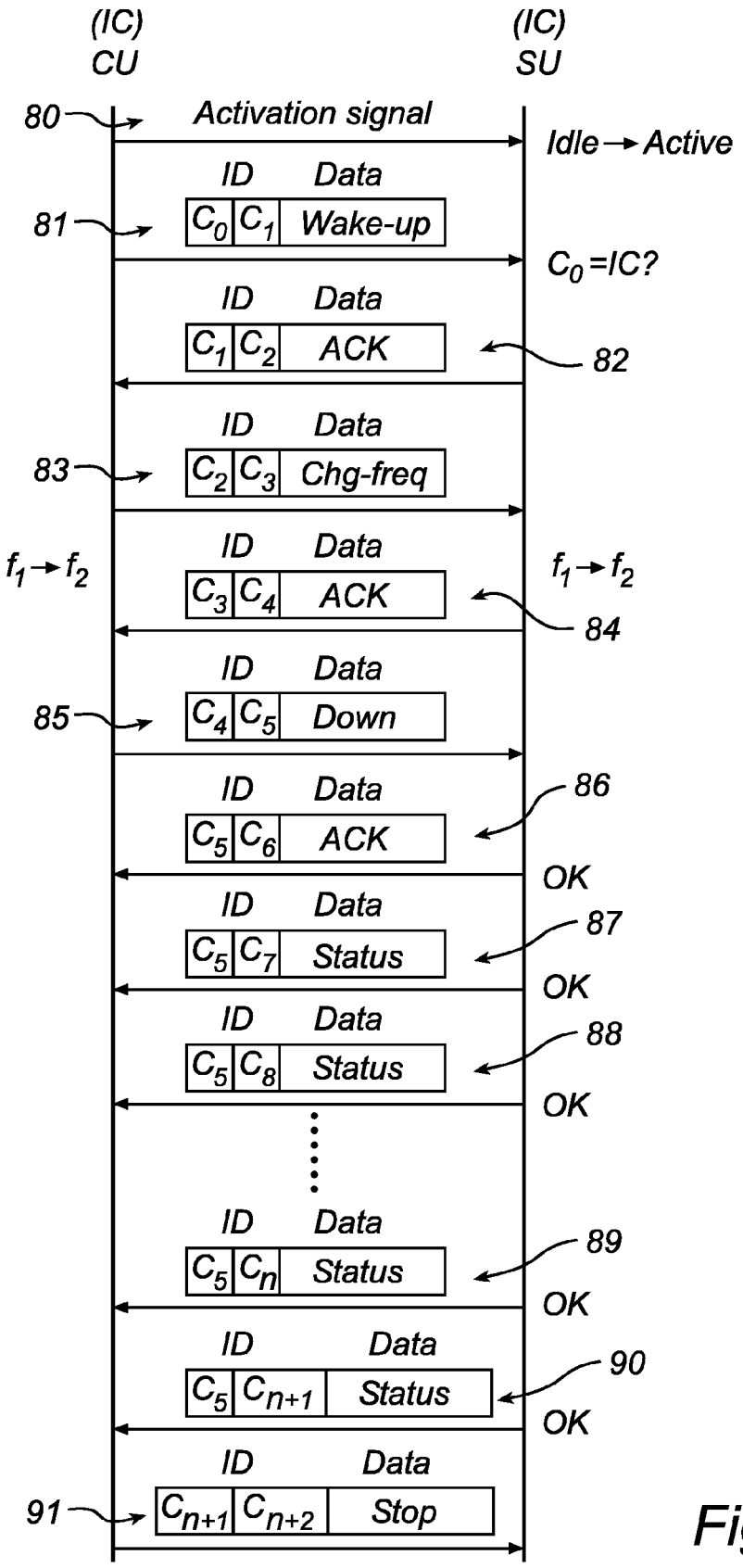
(IC) CU
(IC) SU
80
Activation signal
Idle → Active
ID Data
81
C0 C1 Wake-up
C0 =IC?
ID Data
C1 C2 ACK
82
ID Data
83
C2 C3 Chg-freq
f1 → f2
ID Data
C3 C4 ACK
f1 → f2
84
ID Data
85
C4 C5 Down
ID Data
86
C5 C6 ACK
OK
ID Data
87
C5 C7 Status
OK
ID Data
88
C5 C8 Status
OK
ID Data
89
C5 Cn Status
OK
ID Data
90
C5 Cn+1 Status
OK
ID Data
91
Cn+1 Cn+2 Stop

Fig. 4

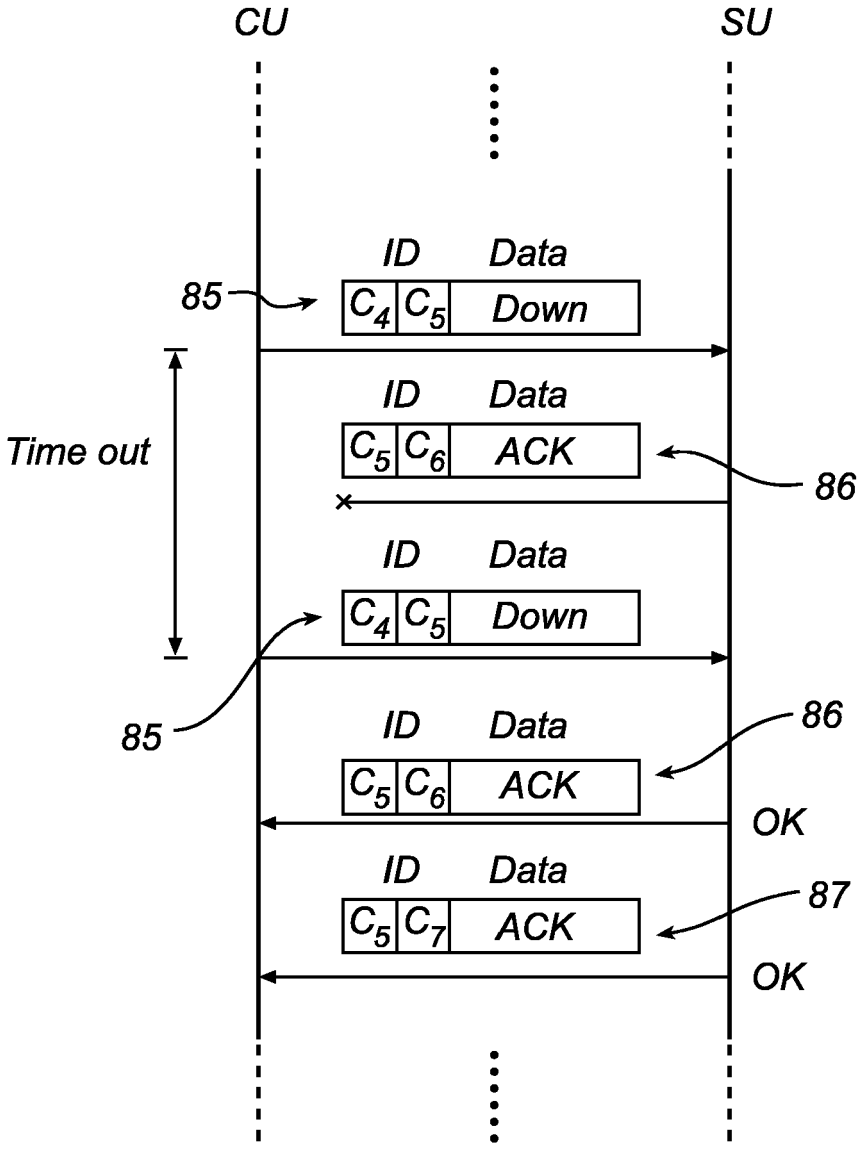
CU
SU
ID
Data
85
C4 C5
Down
Time out
ID
Data
C5 C6
ACK
86
ID
Data
C4 C5
Down
85
ID
Data
86
C5 C6
ACK
OK
ID
Data
87
C5 C7
ACK
OK

Fig. 5a

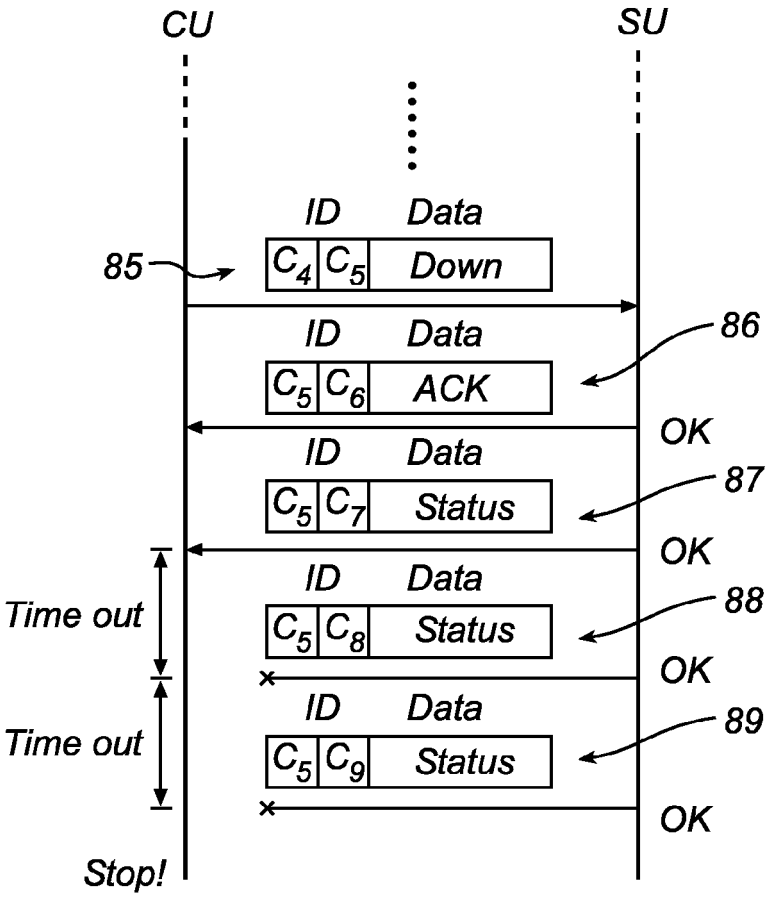
CU
SU
ID
Data
85
C4 C5
Down
ID
Data
86
C5 C6
ACK
OK
ID
Data
87
C5 C7
Status
OK
Time out
ID
Data
88
C5 C8
Status
OK
Time out
ID
Data
89
C5 C9
Status
OK
Stop!

Fig. 5b

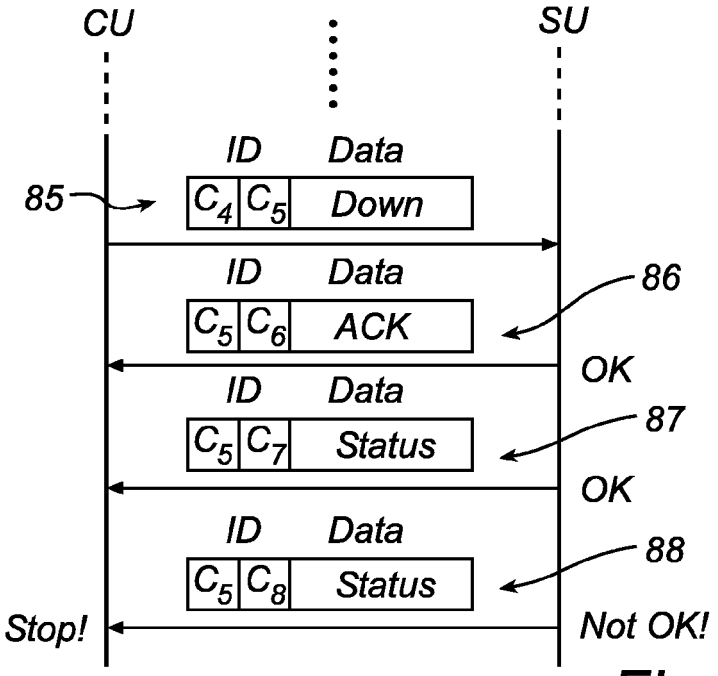
CU
SU
ID
Data
85
C4 C5
Down
ID
Data
86
C5 C6
ACK
OK
ID
Data
87
C5 C7
Status
OK
ID
Data
88
C5 C8
Status
Stop!
Not OK!

Fig. 5c

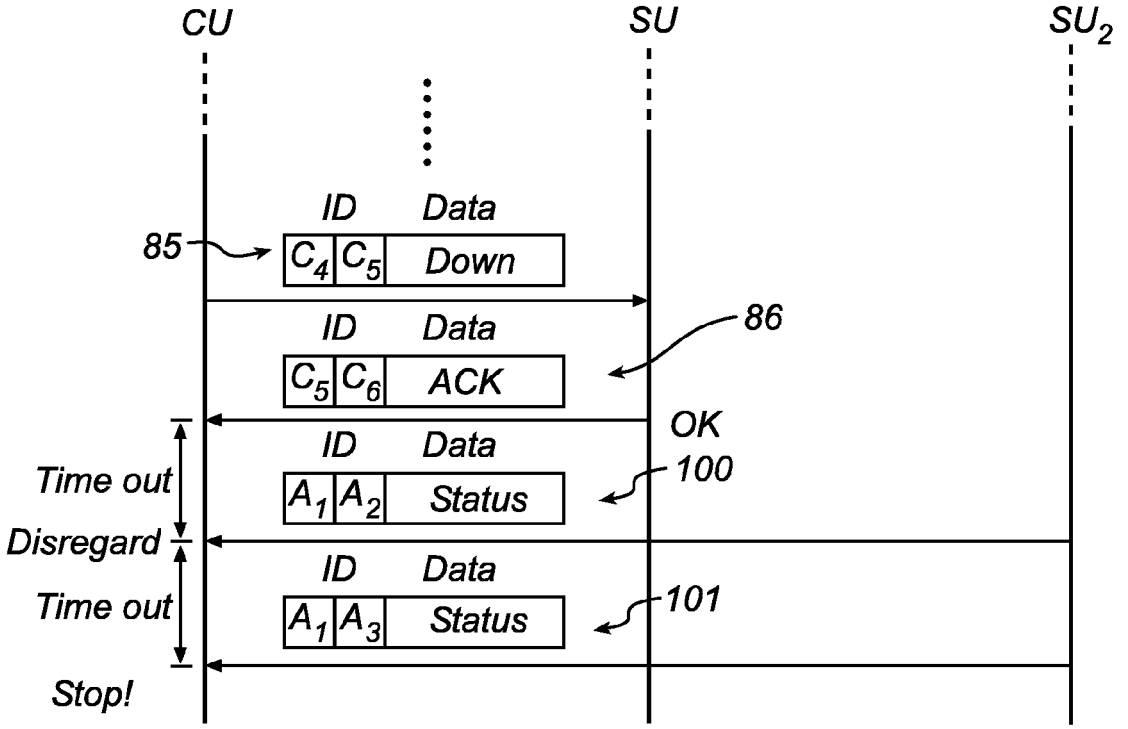
CU
SU
SU2
ID
Data
85
C4 C5
Down
86
C5 C6
ACK
OK
Time out
100
A1 A2
Status
Disregard
Time out
101
A1 A3
Status
Stop!

Fig. 5d

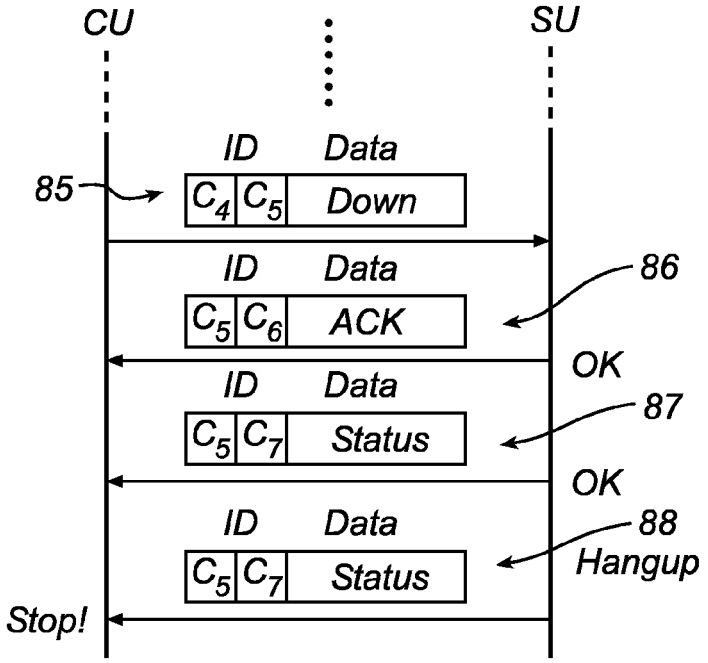
CU
SU
ID
Data
85
C4 C5
Down
86
C5 C6
ACK
OK
87
C5 C7
Status
OK
88
Hangup
C5 C7
Status
Stop!

Fig. 5e

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 10 4051

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 03/054827 A (SOMFY SAS; VIGNON, BRUNO; PELLARIN, FLORENT) 3 July 2003 (2003-07-03) * page 1, column 1 - column 15 * * page 4, line 2 - line 23 * * page 8, line 1 - page 9, column 4 * -----	1,2,4-9, 11-19	G08C17/00 G08C19/28 E05F15/00
X	WO 99/23335 A (UT AUTOMOTIVE DEARBORN, INC) 14 May 1999 (1999-05-14) * abstract; figures 1a-2 * -----	1,2,4-9, 11-19	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

G08C
E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 November 2005	Janyszek, J-M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 10 4051

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-11-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03054827 A	03-07-2003	AU 2002364999 A1	09-07-2003
		EP 1459276 A1	22-09-2004
		ES 2226600 T1	01-04-2005
		FR 2834147 A1	27-06-2003
		US 2005024228 A1	03-02-2005
WO 9923335 A	14-05-1999	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1441101 A **[0007]**