

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
24 March 2005 (24.03.2005)

PCT

(10) International Publication Number
WO 2005/027488 A1

(51) International Patent Classification⁷: H04M 11/04, A61B 5/00, G08B 25/01

(21) International Application Number: PCT/IB2004/003060

(22) International Filing Date: 16 September 2004 (16.09.2004)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
AN2003A000048 18 September 2003 (18.09.2003) IT
AN2003A000049 23 September 2003 (23.09.2003) IT
AN2004A000001 8 January 2004 (08.01.2004) IT

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

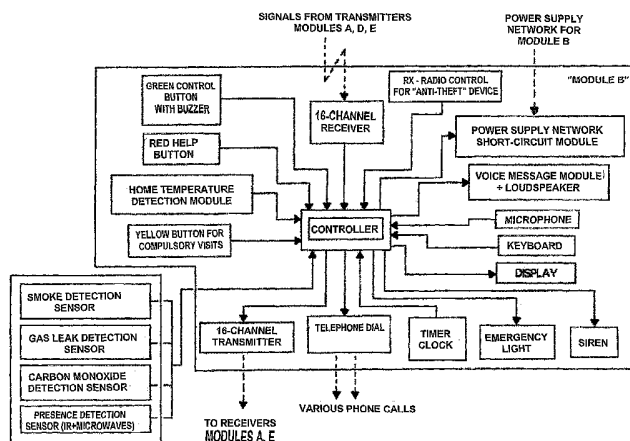
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(71) Applicant and
(72) Inventor: BIANCHELLI, Sauro [IT/IT]; Via Dell'ospizio, 16, I-60121 Ancona (IT).
(74) Agents: FAGGIONI, Giovanmaria et al.; Fumero Studio Consulenza Brevetti, Via S. Agnese, 12, I-20123 Milano (IT).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MULTI-FUNCTION DEVICE FOR ELDERLY OR ILL SUBJECTS LIVING ALONE, ACTING AS A LIFE-SAVING, THEFT-ALARM AND CARER-MONITORING DEVICE



(57) Abstract: The invention concerns a method and a device to control any emergency conditions connected with the mental/physical conditions in which said subject lives, for the purpose of preventing individual and/or community risks tied to such conditions. Said method comprises the steps of: a) collecting information from sensors and/or apparatuses detecting and controlling the conditions of the "mental/physical state" of health of the subject, any "critical environmental conditions" present in the place where the subject lives, and the "correct behaviour of any persons assisting the subject"; b) confirming or annulling, through a manual actuator, any possible critical conditions detected by said sensors and/or control apparatuses, concerning the mental/physical state of the subject and/or the environment; c) automatically introducing, in case the critical conditions detected should be confirmed, said information into an electronic central data processing unit in order to process a coded warning signal; d) releasing a consent to the forwarding of said coded signal to the telephone network towards destinations selected on the basis of the coding of said signal.

WO 2005/027488 A1

MULTI-FUNCTION DEVICE FOR ELDERLY OR ILL SUBJECTS LIVING ALONE, ACTING AS A LIFE-SAVING, THEFT-ALARM AND CARER-MONITORING DEVICE

*_*_*_*_*

5 REASONS, OBJECTS AND PRIOR ART

The device of the present invention aims at:

- periodically and automatically controlling the health and the mental and physical conditions of elderly and/or ill subjects living alone at their home (either permanently or
10 for a few hours a day) or on other premises (such as, for example, offices, centres for the elderly, warehouses, night guards, etc.), automatically requiring the sending of any help in the case of actual need;

- automatically controlling the safety and liveability of
15 the place of living of such subjects, also comprising anti-theft/anti-intrusion checks;

- controlling the correct behaviour of any assistant and/or carer living, either permanently or for a few hours a day, with the monitored subject.

20 The various devices currently available on the market are completely unable to achieve the multiple results obtained by the device of the present invention; for example, they are completely unable to periodically control, in an automatic mode and with different modes, the mental and physical
25 tions of the subject to be kept under surveillance and the level of safety and liveability of the place of living of such subjects (home or else).

STRUCTURE OF THE DEVICE ACCORDING TO THE INVENTION

The main and innovative philosophy of operation of the
30 present device is the following: when the (elderly or ill)

subject to be surveilled is alone (for a few hours a day or permanently) at home (or in another surveilled location) and is not in bed, the device will operate as a «multi-function life-saving device», whereas when he or she is out of their home or in bed and with no one else at home (during night-time hours and, if provided, in the afternoon, too) the device will operate as an «anti-intrusion/anti-theft device», automatically switching from operation as a «life-saving device» to that as an «anti-theft device» and viceversa with no manual intervention by said subject (when he or she is at home). Moreover, in the case that the subject to be surveilled lives with assistants and/or carers, the device will be capable of verifying also the correct behaviour of said individuals (during working hours thereof or during the time they are required to provide assistance to said elderly or ill subject).

When the device operates as a «life-saving device» it adopts the following operation mode:

- in the case that a subject feels unwell, he or she will have to do nothing (also because they would probably be unable to do anything), whereas when they are in good health, they will have to prove it (during daytime hours) by following the indications provided by the device on each occasion; if they are unable to perform some extremely simple operations, it means that they are unable to live on their own at home, for their safety and for that of the whole neighbourhood.

These results are achieved through a control method and through a multi-function surveillance device according to the present invention, having the features mentioned in claims 1

and 21.

Further features and advantages of the invention will anyhow be more evident from the following detailed description of a preferred embodiment, given by way of a mere non-limiting example and illustrated in the accompanying drawings, wherein:

fig. 1 shows a general diagram of the apparatus according to the invention, consisting of all of the modules A, B, C, D, E which process and transmit information;

10 fig. 2 shows the diagram of module A of the apparatus according to the invention

fig. 3 shows the diagram of the central module B of the apparatus according to the invention

15 fig. 4 shows the diagram of the module C of the apparatus according to the invention

fig. 5 shows the diagram of the module D of the apparatus according to the invention

fig. 6 shows the diagram of the module E of the apparatus according to the invention

20 fig. 7 diagrammatically shows a container with compartments according to the invention, intended to contain the medication being used.

As shown in figure 1, the device of the present invention consists of a central data processing module (module B - figure 3 -) and of four other peripheric modules, generally connected thereto by means of radio controls (radio-frequency signals) or, at least partly, by means of cable connections:

- module A: worn on the wrist of the subject to be surveilled or placed on a piece of home furniture (figure 2);
- 30 - module B: preferably installed near the home telephone

in order to use both the telephone socket and power from the power supply network (figure 3);

- module C: partly installed on the home front door (figure 4) and partly in other areas of the home (for example in the corridor);

- module D: installed in the bedroom of the subject to be surveilled (figure 5), in particular in the mattress or underneath the bedside rug;

- module E: preferably installed in the kitchen (and hence radio-connected with module B) or directly connected by cable to module B and hence installed next thereto (figures 6 and 7).

Such modules communicate with each other by means of multi-channel radio controls, for example in the European frequency of 433,92 MHz (or any other allowed one) and will be powered by internal batteries (preferably rechargeable, long-life lithium, or else mini-batteries); module B will in any case be always connected to the power supply network, which will allow permanent operation thereof (i.e. it will always be on and provided with buffer batteries, which will provide for the device to be powered also in case of power cuts of the supply network, with suitable battery life). It will be possible to connect also modules C, D and E, by means of suitable extension cables and a transformer, to the nearest socket of the power supply network. Module A instead, requiring to be worn on the subject, can be equipped with standard long-life or rechargeable batteries (in that case they will be plugged in the power supply network, for recharge, during the time when module A is not worn on the wrist). Module E will make use of the power of module B in the case that

it is connected thereto by cable.

The invention hence relates to a universal device, easily installable and normally devoid of special connections between the various modules, therefore usable in any type of home (or other location). Subjects will also be able to use the device who, although not elderly, need to be surveilled and assisted in case of difficulty (both at home and in other predetermined locations).

In the «life-saving» mode, the device will perform periodic, automatic daily checks on the mental and physical health conditions of the subject and/or the place to be surveilled: only in this way will the extremely severe problems be managed and reduced which, every year, increase ever more the number of people «died in solitude».

When the device, due to obvious and natural reasons, is no longer used to surveille elderly and/or ill subjects, instead of being discarded, it can be converted for the following uses:

- as a normal anti-theft/anti-intrusion alarm (for the home, the office, etc.) ;

- to verify the presence in the home of teen-age children and/or domestic help, without the need of phoning repeatedly to be sure thereof (and with the hope of finding the home telephone line not deliberately engaged);

- to verify the presence of employees on the work premises, without the need of phoning repeatedly to be sure thereof.

Description module A (figure 2)

The part of the device indicated as "module A" will normally be incorporated in a wristband worn on the wrist of the

elderly and/or ill subject to be surveilled (only when the subject leaves the home or is in the shower, or sleeps, or similar, will module A be provisionally placed on a piece of furniture or on a table) and will be used to detect the following information (to be sent later, via radiofrequency signals, to central processing module B):

- abnormal values of blood pressure and/or pulse frequency, abnormal values of body temperature, very low physical activity, responsiveness and mental/physical skills, possible falls, excessive or abnormal conditions of inactivity/inertia (i.e. absence or near absence of any body movement), incorrect position of the module (i.e. not worn on the wrist), discharging power batteries.

Module A consists of the elements indicated in the points from a) to i) here below:

a) Controller of module A: with the task of controlling and managing any transmission of radio signals (to be sent to module B, for example on 7 channels), corresponding to the data from the various control sensors and apparatuses whereto it is connected, as better described in the following.

Should an apparatus, corresponding to a precise transmission channel, become alarmed, the controller will send to the transmitter module the "send signal" command, which will be received by module B as better detailed in the following).

b) Multi-channel transmitter (seven channels in the following example): there will be radio transmission of one or more coded signals (for example in the frequency of 433,92 MHz), in the corresponding transmission channel, only when one or more sensors (of module A) have alarmed the controller.

The meaning of the signals transmitted in the various channels is the following:

- 5 - signal transmission over channel no. 1: it corresponds to the circumstance of «buzzer still on after a preset waiting time» (see point c) here below);
- transmission of signals over channel no. 2: it corresponds to the circumstance of «abnormal blood pressure values and/or heartbeat of the monitored subject» (too low or too high values - see point d) here below);
- 10 - transmission of signals over channel no. 3: it corresponds to the circumstance of «module A not worn on the wrist of the monitored subject» (see point d) here below);
- transmission of signals over channel no. 4: it corresponds to the circumstance of «impact sensor or fall sensor
15 switched on» (see point g) here below);
- transmission of signals over channel no. 5: it corresponds to the circumstance of «module A with battery discharging» (see point f) here below);
- transmission of signals over channel no. 6: it corre-
20 sponds to the circumstance of «abnormal condition of inertia or inactivity of the monitored subject» (see point h) here below);
- transmission of signals over channel no. 7: it corre-
25 sponds to the circumstance of «abnormal values of the monitored subject's body temperature» (too high or too low values - see point i) here below);

The transmitted signals will then be received by the receiver module, for example a 16-channel one, associated with central module B (for example near the home telephone), which
30 will then manage them in ways specified here below. The range

of the transmitted signals will be deliberately limited to the home range only, in order to better distinguish the case where the subject left the home with the wristband of module A still on the wrist (due to forgetfulness - hence, completely in order, the subject is well); as a matter of fact, in the case where module A is at a distance from the home, module B will be unable to receive the signals transmitted by module A, which module B will hence consider the situation in order, thereby avoiding possible false alarms.

5
10 c) Buzzer and/or blinking device and relative «stopping button». This buzzer operates according to the following operation mechanism: upon activation of a (blinking and/or beeping) buzzer, the monitored subject is required to "respond" by pushing a stopping "button" within a certain
15 time frame; if that does not occur, the elderly subject may be feeling unwell and an alarm must therefore be triggered. The buzzer (with an intermittent or bitonal sound) is activated by the controller of module A following a command received from the controller of module B (refer to signalling
20 of abnormal conditions at points from e) to i), or at preset intervals (for example every hour, every 2 hours or as else programmed by the user) and will remain switched on (uninterruptedly or with alternating on/off phases, also preset by the user), up until manual switch-off thereof. Switch-off is
25 effected through a simple button, which must be pushed by the monitored subject (or possibly by their carer); conversely, it will turn off automatically. Should the buzzer not be switched off within that certain preset maximum period of time (for example 5 minutes or even less), it may mean that
30 the monitored subject has either simply left the home (refer

to the cases detailed here below) or that they are unable to do so and in such case the alarm will be triggered, transmitting the corresponding radiofrequency signal to the receiver of module B, which will provide to launch various automatic
5 phone calls with pre-recorded messages, as detailed in the following. One of the fundamental features of the device according to the invention, which makes it completely different from all other devices on the market and above all really effective in helping ill subjects or subjects in difficulty
10 living alone at their home, is its innovative philosophy of operation:

«when an elderly subject is unwell, he or she is unable to push any button (or they do not want to do so, precisely to ask for help), whereas when they are well (both physically
15 and mentally) they are required, at preset intervals or in response to the activation of one or more sensors verifying any critical conditions, to push a button (precisely because such action indicates their condition of good health, thanks to the responsiveness to a possible pre-alarm condition)».

20 If an elderly subject is unable to push, a few times a day or when required to do so, a simple buzzer-stopping button (the sound of which will surely be a nuisance to them), to cancel any pre-alarm conditions, it means that they cannot stay alone at home because they are unable to look after
25 themselves and/or control their health. Moreover, the fact of obliging the elderly subject, only for a few seconds a day, to periodically push a button, will indirectly serve as a tool to evaluate, in a continuous manner, their physical/mental conditions; in this way it will thereby be possible
30 to monitor and appraise the safety and wellbeing both of

the elderly subject, and of the whole building where he or she lives (for example dangers of the home of the elderly subject due to gas leaks, explosions, smoke, fires, malfunctioning of chimneys or heaters, flooding, or else).

5 d) Module for «blood pressure detection»: a module known per se incorporated in an anatomic wristband worn on the wrist will be used for the detection of the pulse frequency and of the blood pressure (systole and diastole). In case of detection of abnormal (too high or too low) values of the
10 blood pressure (maximum and minimum blood pressure, and heart beats) of the subject to monitor, the controller of module A will be alarmed, which will send a corresponding signal over channel no. 2 to the receiver of module B. In this case the controller of module B, after any other controls verifying
15 blood pressure, will launch at once "control" phone calls, reducing the time of a possible rescue of the elderly and/or ill subject, i.e. without waiting for the next automatic activation of the buzzer.

The case of «total lack of pressure», however, means that
20 module A is no longer on the wrist of the elderly subject (which is important for some automatic decisions, as shown further on) and hence signals will be sent over channel no. 3 (without this circumstance representing a reason for «alarm»).

25 e) Receiver (for example a single-channel one): it is capable of receiving, from the transmitter of module B, a coded signal only when the controller of module B wants to activate the sound buzzer in module A, to carry out the "periodic" check of the health conditions of the subject to monitor (as
30 described in relation to the operation of module B).

f) Module for the «detection of the tension values of the power battery»: the controller of module A will also manage the conditions of its power battery so as to send to module B signals over channel no. 5, if the battery begins to discharge (for example when the tension at the ends thereof is for example 20-30% of its highest charge value). By doing so, the device will be able not only to monitor the battery conditions (which is an essential factor for the correct functioning of the entire device) but, by launching an "information" phone call to relatives, neighbours or carers, it will be able also to solicit their intervention in replacing the battery, will provide the opportunity for a "visit" to the elderly subject and to verify in subject their health conditions.

g) «Impact/fall» sensor: it has the function of detecting any falls of the monitored subject, both in case of accidental fall and in case of fainting. It is based on the use of an impact sensor inserted in the wristband worn on the wrist: such a sensor may consist of a small piezo-electric disc (or capsule), which is capable of emitting sounds when an acoustic frequency is applied to the ends thereof, or, conversely, if it is made to vibrate (due to a fall), it will be possible to detect a low-frequency signal at the ends thereof. The electric signal, generated by impact vibrations, detected at the ends of the disc, will then be suitably amplified, processed and later sent to the controller of module A, for the relative processing as a "fall alarm".

Such detection of an «impact/fall» can occur only if module A is correctly worn on the wrist (hence with the indication of a pressure value other than zero and no sending of

signals over channel no. 3). Once the impact sensor is alarmed, the transmitter inserted in module A will send a signal to module B over channel no. 4; at this point the controller of module B, to avoid launching useless phone calls (since the problem may have already been solved or it may have been a false alarm), will invite the monitored subject (through a buzzer, or even through a voice message, if the device is equipped with a loudspeaker) to push a «control button (for example a green one)» found in module B: if the button is pushed, it means that the subject does not need help, conversely the subject shall not move, since within a short time (for example 1-2 minutes) various "control" or "immediate help" phone calls will be launched.

h) "Inertia/inactivity" sensors»: they have the function of occasionally or cyclically detecting a possible condition of inertia, of excessive inactivity of the subject (i.e. lack or near lack of body movements), verifying their arm movements, both horizontally and vertically. A suitable sensor may be for example a mercury switch or rocker switch incorporated in the band of module A worn on the wrist. Such switch must be capable of opening or closing an electric contact at any noticeable arm movement; the "continuous" opening and closing of such electric contact will indicate to the device that the monitored subject has at least a minimal physical activity (at least in the arm). Of course, such checks will be activated outside night-time hours and/or of any afternoon resting time, because in such case the arm of the monitored subject remains necessarily stationary.

Similarly to what has been described heretofore, if the controller of module A has not detected any change of condi-

tion of the electric contact of the sensor (from "on" to "off" or viceversa) for a certain limited period of time (for example for 5 minutes or for another time which is defined by the user), and hence an excessive condition of inertia/inactivity (i.e. fainting) of the subject may be possible, a radiofrequency signal will be sent to module B over channel 6, to indicate that the arm (and/or the body) of the subject is excessively stationary or still. As soon as it receives this signal, the controller of module B will send to module A the signal to activate the sound buzzer (or voice call): if the monitored subject does not push the stopping button within very few minutes (for example 1 or 2 minutes, or even less), thereby showing a certain responsiveness, the controller of module B will at once impart the order to launch various phone calls asking to check and for help.

i) Detection sensor of body temperature: it has the function of detecting, occasionally and/or cyclically, the body temperature of the monitored subject. A sensor of the infra-red type will be used which will detect the temperature upon mere contact or brushing of the skin of the wrist onto which the wristband of module A is worn. The temperature will be calculated on the basis of the detection thereof on the wrist; once the "skin" temperature has been detected, it will be then necessary to introduce a suitable correction to obtain the "body" temperature (based on the features of the sensor and/of the subject's wrist).

Description of module B (figure 3)

The part of the device that is preferably installed near the home telephone (to use the connection thereof to the telephone network, as well as to the power supply network)

will be used as a central data processing unit, as well as for the following objects:

- communicating with the various modules of the device (through reception and transmission of radiofrequency and/or cable signals), detecting abnormal values of room temperature, the presence/movement of subjects in the home, the dangerous presence of gas, smoke and/or carbon monoxide, the use of various buttons, the automatic launching of phone calls asking for help, the activation of a siren, and more.

10 Module B will consist of the following elements:

- a) Receiver module, for example a 16-channel one: it will receive, from the transmitters of the other modules A, C, D, and E (refer to their description in the following), the signal sequences over the channels 1 to 16. This receiver module will preferably receive radiofrequency signals which are «coded» (to avoid possible interference with any other radio controls present in the same building); the working frequency will be for example 433,92 MHz and the transmission power not very great. The signals received over the channels 1 to 16, and then intended for processing for later decisions, will have the following meanings:

- receipt by module A of signals over channel no. 1: in case of buzzer still on after a preset waiting time. If the corresponding buzzer-stopping button has not been pushed, the monitored subject may be unwell. Therefrom must derive the triggering of an alarm with the forwarding of phone calls asking for help. The activation (in module A) of the buzzer (and hence the corresponding signal to be received by module B) can occur both at preset times and at any time, if the controller of module B receives information, over the other

channels, such to give rise to «concern/alarm». The preset time to switch on the buzzer will be programmed (on the timer/clock of module B) during the initial installation, on the basis of the habits and requirements of the monitored subject: for example, the buzzer may be switched on at 8 am, at 12 am, at 2 PM, at 5 PM, and at 8.30 PM, also considering a possible interval during which the buzzer is switched off in order not to disturb the afternoon nap.

5
10 - receipt by module A of signals over channel no. 2 in the case of detection of «abnormal» values of blood pressure and/or pulse frequency of the monitored subject. There must follow the triggering of an alarm with the forwarding of phone calls asking to "check" and/or for help;

15 - receipt by module A of signals over channel no. 3 in the case of module A not correctly worn on the wrist of the monitored subject. The blood pressure value is zero and is interpreted as "module A not worn on the wrist"; it does not represent per se an alarm for the device;

20 - receipt by module A of signals over channel no. 4 in case of switched-on impact/fall sensor. There must follow a check of the urgency condition and, in case of a positive outcome (i.e. button unpushed), the triggering of an alarm with the forwarding of phone calls asking to «check» and/or for help;

25 - receipt by module A (as well as by other modules C, D, E) of signals over channel no. 5, in the case of "discharging" batteries. There must follow the triggering of an alarm with the forwarding of phone calls asking for technical assistance. The condition of empty battery (of module A and of
30 all the other modules that are not directly powered by the

power supply network) will be maintained by the controller of module B (and hence new phone calls will be periodically launched) as long as it continues to receive the signals over channel no. 5: when it no longer receives such signals, it
5 will mean that somebody replaced the empty batteries.

- receipt by module A of signals over channel no. 6 in the case of «abnormal condition of inertia/inactivity, lack or near lack of body movement» of the monitored subject. There must follow a check of the urgency condition and, in case of
10 a positive outcome (i.e. button unpushed), the triggering of an alarm with the forwarding of "check" phone calls and/or phone calls asking for help;

- receipt by module A of signals over channel no. 7 in the case of «abnormal» values of the subject's body temperature.
15 There must follow a check of the condition of urgency and, in case of a positive outcome (i.e. unpushed button), the triggering of an alarm with the forwarding of "check" phone calls and/or of calls asking for help;

- receipt by module C of signals over channel no. 8, in
20 the case of alarmed magnetic contacts due to «open front door» (see the required intervention further down);

- receipt by module C of signals over channel no. 9, in the case of activated sensor for the detection of «presences» (of the infra-red only type, or with microwaves also). This
25 signal detecting the movement of subjects in certain conditions will be put in correlation with the "open front door" signal, as better detailed in the following;

- receipt by module C of signals over channel no. 10, in the case of other activated sensor for the detection of
30 «presences». This sensor is intended for the detection of

movement of subjects in the home, but not near the front door;

- receipt by module D of signals over channel no. 11, in the case of detection of at least one activated weight sensor (of the on/off type) of those located under the mattress and pillow of the bed of the monitored subject, and under the bedside rug, with such a "sequence" as to indicate that the subject has got up from bed;

10 - receipt by module D of signals over channel no. 12, in the case of detection of at least one activated weight sensor (of the on/off type) of those located under the mattress and pillow of the bed of the subject and under the bedside rug, with such a "sequence" as to indicate that the subject has just gone to bed;

15 - receipt by module D of signals over channel no. 13, in the case of activation of another presence sensor (with infra-red or with dual technology: infra-red and microwaves) located beyond the bedroom door; it indicates, combined with the signals transmitted over channel no. 11 or 12, that the subject is entering or leaving the bedroom;

20 - receipt by module E of signals over channel no. 14, in the case of activation of sensors associated with a special container for medication: it indicates that, after taking the medication, said medication has not been put back in the correct compartment;

25 - receipt by module E of signals over channel no. 15, in the case of activation of sensors associated with a special container for medication: it indicates that an incorrect medication has been taken;

30 - receipt by module E of signals over channel no. 16, in

the case of activation of sensors associated with a special container for medication: it indicates that the medication has not been taken at the established time;

5 b) 16-channel Transmitter Module, with working frequency preferably different from the 16-channel receiver (for example 868,3 MHz); it will be used to send to module A the command to switch on the sound buzzer, to send to module E the various "medication taking" commands at a certain preset time (also selecting the corresponding medication to be taken, for
10 example up to a maximum of 15 tablets or similar), and others.

c) Controller module, complete with Real Time Clock (capable of managing all the days of the year, minutes and seconds and of generating periodical interruptions; it will be very
15 useful to determine the various activation times of the sound buzzers, the beginning of checks and the waiting times before making decisions). The controller will manage the various signal sequences over channels 1 to 16 coming (through the receiver module) from the transmitters of modules A (usually
20 on the subject's wrist), C (on the front door), D (in the bedroom) and E (in the kitchen or directly connected to module B).

According to the number of the received channel and in combination with the data received by the various components
25 of the system, the controller of module B will decide whether to launch «warning», or «check», or «help», or «emergency» phone calls, to a certain preset number of phone users, through the dial connected thereto.

Should the anatomic wristband of module A not be worn on
30 the wrist for a long period of time (for example 2-3 days,

but also a shorter period, if thus desired by the user), every day the controller of module B, having received for a certain time a series of signals over channel no. 3, will launch a «warning» phone call (to relatives, neighbours
5 and/or carers) until said module A is worn again on the wrist. The controller of module B will be able to verify such condition when it no longer receives signals over channel no. 3.

Should the controller of module B verify that between a
10 periodic activation of the sound buzzer and the other the four (or more) presence and in-home movement detection sensors have been "often alarmed" - hence demonstrating a certain physical activity of the monitored subject -, it can also decide not to send to module A the command to activate
15 the sound buzzer which must be subsequently silenced in order to ascertain the subject's responsiveness (because certainly superfluous).

d) Room temperature detection module: having the function of detecting the room temperature of the home and, in case of
20 abnormalities (for example a temperature below 16°C or above 30°C), the controller of module B will impart the order to immediately launch «check» phone calls with «abnormal room temperature alarm» only after having verified, on the one
25 hand, that such abnormality lasts for at least a certain period of time (for example 30 minutes) and only after having warned, on the other hand, the monitored subject to push the corresponding response button (for example green button located in module B) if he or she wants to cancel the pre-alarm condition.

30 Detecting a high room temperature in the home may be use-

ful also to detect, together with a suitable smoke detection sensor, any fires.

e) Telephone dial, directly managed by the controller of module B and connected to the home telephone socket to launch
5 a certain number of phone calls (to relatives and/or neighbours and/or carers, to rescue services, emergency services, the police, or other) through different messages according to the circumstances to be reported.

f) Buzzer with blinking «green control button» to be
10 pushed occasionally (for example once or twice a day - with sound and tone different from the buzzer of module A), to verify a certain «mobility» (walking) of the monitored subject: such subject will in fact have to move from where he or she is to go and stop the sound buzzer through the suitable
15 blinking button; conversely (i.e. if the buzzer is not silenced within a certain period of time, for example 5 minutes), a suitable type of phone call will be launched to report this circumstance:

- it will be a «warning» phone call if the elderly subject
20 did not go and stop the buzzer (i.e. they did not move) in module B (for example near the telephone) but has nevertheless stopped the buzzer in module A (usually worn on the wrist);

- or an «alarm» phone call if the elderly subject, within
25 a certain (preset) period of time has not stopped the buzzer in module B nor the buzzer in module A ;

- or no phone call, if the elderly subject did not go and
stop the buzzer in module B (near the telephone) but stopped
the buzzer in module A which is not worn on the wrist (situa-
30 tion reported over channel no. 3) since that means that they

have in some way moved (they went to silence the buzzer in module A not worn on the wrist).

When the timer/clock of module B activates (up to once/twice a day) also this buzzer (of module B, in addition to that of module A), a «voice message» will be produced for a better comprehension and identification by the monitored subject.

g) Red button for «manual help»: to be (arbitrarily) pushed if the elderly subject is unwell, without waiting for the activation at preset intervals of the various automatic buzzers (this way the elderly subject will anticipate the help request time, if he or she is capable of doing so).

h) Yellow button for «mandatory visits»: it is a slightly hidden button (not within easy reach of the monitored subject) and will be useful to «force» children and/or relatives to pay periodic visits (with a programmed frequency) to the subject living alone. In fact, until such button (for example a yellow one) is pushed/deactivated, module B will keep sending daily warning phone calls to children and/or relatives wherein they are (compulsorily) invited (if they want such phone calls to cease) to pay a visit to the subject (and on such occasion they can deactivate the yellow button).

i) Module for pre-recorded voice messages + loudspeaker: to warn the elderly subject about what the device is about to do and to achieve improved interaction and communication between the two (elderly subject and device; for example, it will warn to push the button within a certain number of minutes, or to take the medication, etc.). Moreover, the subject, knowing that they are being monitored, will feel safer and at peace. Such «voice» module will further be used to

also warn the elderly or ill subject (as well as relatives, neighbours and/or carers, through a phone call) that the battery of the device may be running low. The various interactions or communications (voice messages) between the device and the subject (for example «...push the button, otherwise alarm ... take medication », etc.) will be very useful also to verify, continuously, the subject's mental/physical conditions!

1) Siren (inside module B and self-powered): it will activate itself, upon controller command, in case of impossibility to launch phone calls (for example due to malfunctioning of the telephone line, or an incorrectly positioned telephone handset, or engaged line), or in the (rare) case that nobody has answered the telephone, or in the case of a gas leak or fire (in this way it will be possible to alert neighbours also), or in the case of strangers' intrusion in the home (operation in the anti-theft mode). It will be possible to deactivate the siren either after a certain time from its activation (for example 10-15 minutes or less), or (which, however, is valid only in the case of operation of the device as a «life-saving device», and not as an «anti-theft device») only after somebody has pushed the green control button in module B (in response to a voice message of the device about «what to do to switch off the siren»).

m) Sensors for the detection of the presence in the air of methane gas or lpg and/or carbon monoxide: some sensors will be connected to module B through cables (or radio control), but installed at a certain height (towards the ceiling), also to detect the presence in the room of methane gas (or lpg) and/or carbon monoxide (also to avoid possible explosions);

in case of alarmed sensors, the controller of module B will immediately cut the power supply to the whole home (to ward off any explosions in gas-filled rooms), through a forced short-circuit (achieved, for example, by closing a relay or a normally open circuit, by forced closure of electric contacts, etc.), and will activate an emergency light (to give some light) inserted in the outer cover thereof and the siren to alert neighbours, too. Moreover, thanks to its spare batteries (in case of power cut), it will instruct by voice the subject to open the windows and/or leave the home and will launch various automatic «help» and «emergency» phone calls.

Once normality has been re-established, module B can be reactivated, for example by a relative (i.e. removing the short-circuit) through a small lever to be depressed (or a button to be pushed, for example the green control one, or another).

n) Sensor for the detection of smoke or fire: it will be connected to module B through a cable (or radio control), but installed at a certain height (towards the ceiling); in case of detection of smoke and also of an excessively high room temperature (possible fire), the controller of module B will instruct by voice the elderly subject to leave the home and/or to open the windows, it will activate the siren (to alert the building, too) and will immediately launch the «emergency» and «help» phone calls. In case only «smoke» was detected, without an excessive rise of the room temperature, the controller - in addition to instructing by voice the subject (to open the windows, etc.) and activating the siren - will first launch the «check» phone calls and then, in case of no reply or rise of the room temperature or unpushed green

control button, the «emergency» and «help» phone calls.

Once normality has been re-established, module B can be reactivated (and hence the alarm of the smoke detection sensor can be deactivated) by pushing the usual green control
5 button (usual voice message to aid the operation).

o) Sensor for the detection of «presence» in the vicinity of module B: it will be, for example, of the dual technology type, i.e. infrared and microwaves, in order to better detect the presence and/or movement of subjects in the home. This
10 type of sensor (there are at least four thereof in the home) is very important for three reasons:

the first one because in this way a certain "physical activity" by the monitored subject or of any guests will be detected; in any case the presence of other people in the home
15 will fully reassure from the point of view of the «check» of the subject's health conditions; therefore, if there is movement in the home, it means that everything is in order and in this case the controller of module B (according to the time and to how many movement alarms have occurred between one
20 buzzer activation and the other) may also decide not to activate, because superfluous, the sound buzzer in module A, increasing even further the automatic mechanism of the whole device and reducing to a minimum the number of «manual activities» requested to the monitored subject.

25 The second reason, to prove the "presence in the home" of the monitored subject (who is hence not outside the home) or in any case of other people (and hence everything is in order).

The third reason, because it will be useful also as a de-
30 tection of unauthorised "strangers" (in the operation mode as

anti-theft/anti-intrusion device).

p) Emergency light: it will be activated only in case of natural or forced (by module B, to remove the power supply from the whole home) power cut.

5 q) Numeric keypad and multi-line display: they will be used to enter initial installation data, such as the subject's habitual resting times (at night-time and/or in the afternoon), the various waiting times, the number, the quantity, the taking times and the end date of any medication
10 course, the secret code for the deactivation of the anti-theft function, and more.

r) Anti-theft radio control: of the «dynamic» type (i.e. it changes the secret code at each radio control activation); when it receives the "deactivation" signal of the «anti-
15 theft» function, the device will necessarily return to operate in the «life-saving» mode.

Description of module C (figure 4)

Such module of the device will be used for the following objects:

20 - to detect the open and/or closed condition of the home front door, the presence of people near such door and/or in other areas of the home, any power supply batteries of the module running low.

Module C consists of the following components:

25 a) Pair of contacts (magnetic or otherwise): to be connected in the home front door to detect opening of the same; they will become alarmed, being no longer in contact with each other, whenever the door is opened (closure of the door will cancel such alarm, since the two magnetic contacts will
30 again be near or in contact with each other and therefore the

signal sequences over channel no. 8 will no longer be transmitted).

Upon the next door opening there will be a renewed sensor alarm, which will then be sent, through the transmitter module of module C, to the receiver of module B.

b) Sensors for the detection of presence in the proximity of the front door and in other areas of the home; there will be at least two thereof, one installed near the front door and the other in another area (for example in the corridor) and, possibly, of the «dual technology» (i.e. infrared + microwaves or volumetric) type to better detect subject presence and/or movement in the home.

This type of «presence/movement» sensor will be very important for two reasons:

- the first one because in this way a certain physical activity by the monitored subject or by any guests will be detected (this situation will be better controlled by checking the front door opening); in any case the presence of other people in the home will fully reassure from the point of view of the «check» of the subject's health conditions; therefore, if in the home there is movement, it means that «everything is in order» and in this case module B (according to the time and to the number of alarms or movements occurred between one activation of the «buzzer» and the other) may also decide not to activate, because superfluous, the sound buzzer in module A, increasing even further the automatic mechanism of the entire device and reducing to a minimum the number of «manual activities» requested to the monitored subject.

- The second reason, to prove the presence in the home of the monitored subject (who will hence not be outside the

home) or in any case of other people (and hence everything is in order, as said above). In case of activated presence detection sensors there will be transmission of a coded signal to the receiver of module B over channels no. 9 and/or 10 according to which sensor has detected the movement.

The detection sensor installed on the front door will be adjusted, configured and positioned so as to detect the presence at a distance of no less than 1.5-2 metres from the door (and not at a shorter distance): this is to avoid false alarms and/or confusion during opening of the door. The other sensor, installed in an area other than the front door (for example along the corridor), will instead be adjusted and positioned to «cover» and control the widest possible area of the home (the other presence detection sensor belonging to module B will be installed in a similar way).

c) Transmitter module having 4 or more channels: it will send coded signals over the channels:

- no. 5 = alarm due to discharging batteries;
- no. 8 = alarm due to front door opening;
- 20 - no. 9 = alarm due to presence detection in the proximity of the front door;
- no. 10 = alarm due to presence detection in an area other than the front door.

The corresponding coded signal will be sent to module B over channel no. 8 only when the two magnetic contacts have become alarmed, i.e. when they have detected an opening of the front door. This condition (door opening) will then be controlled and managed by the controller of module B together with other data received and processed (example: buzzer-stopping button not pushed in time, abnormal room and/or body

temperature and/or blood pressure, module A not on wrist, etc.). Let us see more in detail how the controller of module B reasons whenever it receives, over channel no. 8, various «door opening» signals (the «door closure» is not of interest, since it immediately follows the opening). There will be two operation modes, according to the presence detection sensors (inside the home) becoming alarmed or not after the opening of the front door:

10 1.a) after opening of the front door: alarm from at least one of the presence detection sensors inside the home

- in the case that at least one of the presence detection sensors, after a few seconds from the opening and then of the closure of the front door, should become alarmed (i.e. detect movement inside the home), the controller of module B will «deactivate» the open-door alarm, considering this condition within the norm, i.e. as if the door had never been open and the subject had always stayed at home (for example only guests may have left).

20 2.a) after opening of the front door: no alarm by any of the presence detection sensors inside the home; however, since there is no absolute certainty of the actual absence of the subject/s in the home (because, for example, the subject may be staying in areas not covered by said sensors), in this case, for increased safety, the device will operate as follows:

25 - module B will update, for example in a suitable archive (in an EPROM and/or ram memory), a specific field called, for example, «alarmed door» with a "1" (corresponding to a «yes») or with a "0" (corresponding to a «no») according to the number of times of the opened front door being «odd» or «even»;

30

i.e. when the home door is opened (and reopened) the first, third, fifth time, etc., (and "without" any alarm from the presence detection sensors - because otherwise it would fall within the previously described case) before the buzzer-stopping button in module A is pushed or the green control button in module B, the controller of module B, will update the field in the memory with a "1" to consider the door alarm «activated» (i.e. "likely/possible absence of subjects in the home"); upon the second, fourth, sixth, etc. opening (and re-opening) of the front door (and always "without" any alarm from the presence detection sensors - because otherwise it would fall within the previously described case), always before the buzzer is silenced, the controller of module B will update the archive with a "0" to indicate that the door alarm has been «deactivated». Summing up, when module B receives from module C the first open door signal (over channel no. 8), and "without" receiving alarm signals from any of the various presence detection sensors (installed in various areas of the home), it will update the archive with a "1" to represent the activation of the door alarm; when it receives the next - and hence even - signal of open door, it will update said archive with a "0" to represent the deactivation of the alarm and so on, of course until the buzzer is switched off or one of the at least four presence detection sensors is alarmed, in which case everything will be cleared, i.e. a "0" will be stored to indicate the deactivation of the door alarm. In the (rare and abnormal) case in which the front door should remain open for a long time (without ever being closed again), the magnetic contacts will remain open, alarmed, and there will hence be a continuous transmission,

at regular and preset intervals, of signals over channel no. 8; in this case, given the high number of sequential signals received over channel no. 8 (instead of a few signals, as it usually occurs when the door is then closed), the controller
5 of module B will consider «activated» the alarm of the front door, regardless of the fact that it is an even or an odd signal.

In the case of "deactivated" open-door alarm, the controller of module B will consider the subject as «certainly at
10 home» and hence the control of their health conditions will fall within the normal daily routine (controls through module A, buzzer, etc.).

In case of "activated" open-door alarm (in this case the subject may not be at home), there will be instead two main
15 cases to manage:

- module A at the wrist of the monitored subject and normal blood pressure values: the subject should hence be at home. When the usual buzzer (in module A) is activated (at the established time), should said buzzer not be silenced
20 within the expected period of time, the controller of module B will immediately launch, through the telephone dial, various «check» and/or «help» phone calls: in this case it will be inferred in fact that the monitored subject is certainly at home, despite the recent opening of the door, but has
25 problems - due to a health condition or else (for example theft or burglary) - to push the buzzer-stopping button;

- module A not on the wrist of the monitored subject (blood pressure zero): module B will check this condition together with that of activated open-door alarm (receipt of
30 signals over channels no. 3 and no. 8); moreover, not having

received presence detection signals in the home (both in radiofrequency through channels no. 9 and/or 10 and/or 13, and directly from the detection sensor connected by cable to the same module B), the controller of module B will begin to
5 "think" that the monitored subject is not at home, but has left, hence the situation should be in order. However, it will equally activate the buzzer (at the established time or immediately after having received the signals over channels no. 3 and no. 8 only), which of course will sound uninter-
10 ruptedly until evening (for example until 9 or 10 PM - to avoid sending a false alarm by phone), unless it is "manually switched off " (through the usual stopping button) and such operation will indicate the subject's presence in the home (who may have come back a few seconds before) and their con-
15 dition of ability. In the case that, for example after 9 (or 10) PM, the buzzer should not have been silenced yet (it should be remembered that, once the buzzer has been switched off or once presence has been detected in the home, the condition of «open-door alarm» will be automatically deactivated
20 to avoid confusion or false alarms), module B will launch various «check» phone calls to relatives, neighbours and/or any carers («help» ones, in this case, will be launched only if nobody has answered the previous phone calls). It can be provided, during the initial installation, also a case of in-
25 termediate telephone control (only to relatives and/or neighbours), i.e. in the early afternoon, also taking into account the elderly subject's age and how long before the front door had been opened (and then closed).

c) Module for the detection of the battery tension values:
30 the controller of module C will manage and check also the

tension values of the supply battery thereof so as to send signals to module B over channel no. 5, should the battery be running low. By doing so the device will be able to monitor also the condition of the battery of the modules thereof
5 (highly important feature).

Thanks to the presence of module C (and of all the components thereof), module B will be able to easily calculate "how long" (hours or even days) the monitored subject "has not left home"; this check can take place thanks to the presence of the magnetic contacts on the front door and of the
10 various presence sensors located in the home. In case of excessive and prolonged presence of the subject at home, "warning" phone calls to relatives can be provided to be launched (by module B) and also an increase of the "periodic
15 checks" through the usual buzzer to be silenced.

Description of module D (figure 5)

Such module of the device will be used for the following objects:

- to detect whether the subject is in bed or has got up, and has left his or her room (useful information both for the
20 «life-saving» and for the «anti-theft» mode).

Module D will consist of the following components:

a) presence/movement detection sensor installed outside the bedroom: like the other already described sensors, it
25 will be a sensor of the dual technology type (infrared + microwaves) with a wide control and detection range; it will be used to detect whether the monitored subject is entering or leaving the bedroom.

b) bedside rug with weight/pressure sensor (of the on/off
30 type): it will be used, in combination with the weight sen-

sors underneath the mattress and underneath the pillow (see the following point c)) to detect whether the subject is going to bed or has just got up therefrom.

c) weight/pressure sensors (of the on/off type) located
5 underneath the bed mattress and pillow; these are at least two sensors, for a better check, and will be used to detect whether the subject is «certainly in bed» or not. It is important to detect the weight also under the pillow to detect the (frequent) case of the subject «partly» getting up from
10 bed, or of the subject sitting there for a while (pillow sensor off + mattress sensor on); in this case the subject will not be considered as «up from bed» until the sensor underneath the mattress goes into the off position also and the sensor underneath the bedside rug (this too is very important
15 to avoid false alarms) has gone through the conditions off+on+off, but the device will «supervise» by monitoring how long the subject remains in such seated position; should too many minutes elapse (for example 5-10), the usual buzzer will be activated (and possibly the usual phone calls launched).
20 The sensor under the pillow will be useful also in those not rare cases in which a subject sleeps in a slightly offset, lateral position, which might not continuously activate the weight sensor underneath the mattress; in this case the sensor under the pillow («on») and the sensor underneath the
25 bedside rug («off» for some time) will show that the subject is still in bed (despite the sensor under the mattress possibly being off).

To be «sure» (and hence avoid annoying false alarms) that the monitored subject is «in bed», the following conditions
30 must be verified sequentially:

1.a) the presence sensor installed outside the bedroom has become alarmed (on) and has then been deactivated (off);

2.a) the weight/pressure sensor placed under the bedside rug has become alarmed (on) and has then been deactivated
5 (off);

3.a) the weight/pressure sensors located under mattress and pillow have become alarmed (on) and have then remained in such condition (on), at least the pillow;

4.a) no other presence sensor installed in the home from
10 this moment onwards and for at least 10 minutes will have become alarmed (they will hence all have to be off), since that means at least that there are other people (not strangers) in the home; after said 10 minutes, before automatically activating the «anti-theft» mode (see further on) the device will
15 ask, through a voice message, any non-strangers possibly present in the home, to push (within a few seconds) the green control button placed in module B to avoid activating the anti-theft system; if such button should not be pushed it will mean that in the home there is nobody else (other than
20 the monitored subject, who is, however, already in bed) and the anti-theft device will hence automatically be activated across the entire home (excluding the bedroom) thanks to the four (or more) dual-technology sensors (infrared + microwaves) and to the magnetic contacts monitoring the front
25 door.

Instead, to be sure that, after having gone to bed, the monitored subject has not then «got up from bed», the following conditions will have to be verified sequentially:

1.a) weight/pressure sensors under mattress and pillow:
30 after having been «on» for a while, they will now deactivate

themselves (off);

2.a) weight/pressure sensor under bedside rug: after having been «off» for a while, it will activate itself (on) for a few seconds, to then deactivate itself (off) again;

5 3.a) presence sensor outside the bedroom: if it activates itself (on) it means that the subject has left the room also;

4.a) presence sensors in the home: if they activate themselves (one or more) it means that the subject is «walking about the home».

10 It is to be underlined that when the subject «is in bed», (in order not to disturb their rest) the device will never activate the (sound and light) buzzer to be silenced within a few minutes, unless the subject has gone to bed at an «abnormal» time (different from the expected one for night-time
15 and/or afternoon rest), in which case, as soon as the sensors underneath mattress and pillow bed have been activated, the device, in order to verify the subject's health conditions, will immediately activate the sound buzzer to be silenced (either in module A and/or in module B); in the case that
20 such buzzer should not be silenced within a few minutes, there will follow the immediate launch of check phone calls to children/relatives, etc. A similar check will occur also when the subject, getting up from bed at night-time, has not returned there within a certain time (for example 15-20 min-
25 utes). In this period of time, the device will first verify whether the various «presence/movement» detection sensors scattered around the home have repeatedly become alarmed (thereby at least showing a certain «mobility» of the subject); then, in any case, it will activate the usual sound
30 buzzer to be silenced within a few minutes (the buzzer will

be activated in advance if the various presence sensors have not become alarmed very often); should the buzzer not be switched off and should the sensors under bed and pillow still be off, various check phone calls will instead be
5 launched to children, relatives, etc.

The presence of all these «control» sensors (detecting presence outside the bedroom, detecting weight/pressure underneath the bedside rug, underneath pillow and mattress) will be essential to avoid errors and false alarms; in fact,
10 thanks to the combined and «sequential» action of all these sensors it will be possible, for example, to learn whether the subject:

- has really gone to bed and whether they have done so by themselves or with somebody's help;

15 - has really got up from bed (or has sat up there) and whether they have done so by themselves or with somebody's help;

- once got up from bed, they have also left the room;

- whether one or more subjects have entered the bedroom
20 without going to bed;

- whether more subjects live in the home;

d) transmitter module having 3 or more channels: to send module B radiofrequency signals over channels:

- no. 11 = alarm from all the weight sensors (of the
25 on/off type) located under pillow and mattress of the subject's bed and under the bedside rug: the subject has got up from bed (condition established through weight sensors on mattress + pillow, first «on» and then «off» and through weight sensors on a bedside rug, first «off», then «on» and
30 immediately afterwards «off»);

- no. 12 = alarm from at least one of the weight sensors (of the on/off type) located under pillow and mattress of the subject's bed and under the bedside rug: the subject has just gone to bed (condition established through weight sensors on
5 mattress + pillow: first «off», then «on»; weight sensors on bedside rug: first «off», then «on» and then «off»);

no. 13 = alarm from presence sensor (infrared or dual-technology one) located outside the bedroom door; in combination with the signals transmitted through channel number 11
10 or 12, it will mean that the subject is entering the bedroom or is leaving it.

e) Microcontroller which will have to coordinate and manage little information: acquiring the signals (on/off) coming from the presence sensor located outside the bedroom and from
15 multiple weight/pressure sensors (from bed and rug) and ordering the launch, through the transmitter module, of some radiofrequency signals (to the receiver of module B) to signal the occurrence of some events (such as: presence near the bedroom, subject gone to bed or got up from bed and/or having
20 left the room).

f) Module for the detection of the battery tension values with the warning function of battery running low, and with actions similar to the preceding cases.

Description of module E (figures 6 and 7)

25 Such module of the device will be used for the following objects:

- to daily aid, remind, check, the correct taking of any medication.

Module E (figure 6) will consist of the following components:
30

a) a special medication container (for example made of clear material, such as Plexiglas), divided into various differently-sized and differently-coloured compartments (such as diagrammatically shown in figure 7), to contain any medication to be taken: such container will have installed, for example at the bottom thereof and for each different compartment, both a weight/pressure sensor (a very sensitive one which will activate itself in the presence of weights even of a few grams and which will detect the presence in the compartment of the corresponding medication, previously placed there) and a luminous indicator (see in fig. 6 the frames "intermittent light, compartment no. 1" and so on up to "intermittent light, compartment no. 15").

When the time has arrived to take a specific medication, module B will send to module E (by cable or radio) the order to light up intermittently the corresponding compartment (a small sound buzzer will also be activated) in order to better point out to the monitored subject, which medication is to be taken within a few minutes.

Each compartment will be associated with a progressive number (1, 2, 3, ...) ; therefore the first medication to be taken will be associated with compartment no. 1 (for example a green-coloured one), the second medication (different from the first one) with compartment no. 2 (for example a red-coloured one), the third medication (different from the first and from the second one) will be associated with compartment no. 3 (for example a yellow-coloured one) and so on. Of course a same medication can be taken repeatedly over the course of the day and in such case (at the established and programmed times) always the same compartment will light up.

Once the correct medication has been removed, the compartment will remain lit up until the medication just taken is put back (check performed through the weight/pressure sensor underneath the compartment), so that it may be ready for a
5 subsequent intake.

The possible mistake of putting the medication just taken into a different compartment (perhaps an empty one) (signal sent over channel no. 14) or the intake of an incorrect medication (signal over channel no. 15) or even the missed medication
10 intake (within a certain period of time and despite various voice messages) (signal over channel no. 16) will also be checked and signalled (to module B).

b) Receiver-transmitter module (of radiofrequency signals): module E will be connected to module B possibly by cable or through a radiofrequency receiver-transmitter module,
15 in order to "send" to module B signals over channels no. 14, 15, and 16, in case of mistake made in the above-described sequence (missed or incorrect intake or incorrect putting back of the medications taken) and to "receive" (from module
20 B) the controls of (previously programmed) "medication intake time" with the indication of which medication to take (through lighting up of the corresponding compartment: for example no. 3 corresponds to the third medication), while the loudspeaker installed in module B continuously repeats the
25 "quantity" of medication to be taken (value previously programmed in module B through keypad and display). When the intake period of a certain medication has ended, the signal corresponding to the compartment thereof will no longer be sent (to module E, which will therefore no longer light up,
30 and will turn itself off).

For example, to start the intake of medication no. 4, a signal (by cable or in radiofrequency) will be sent (from module B to module E) for example over channel no. 4, which will instruct to light up intermittently compartment no. 4 of
5 the medication container.

The compartment will remain lit up until the medication is taken and then put correctly back into the correct compartment; when the weight/pressure sensor of the lit up compartment changes from an initial «on» condition (medication in
10 the compartment), to an «off» condition (medication taken from the compartment) and then to «on» again (medication put back in its place), the various LEDs corresponding to such compartment will turn off and the device will set the next medication intake at the programmed time.

15 d) Microcontroller which will have to coordinate and manage the following information: acquiring the signals coming from module B concerning the "number" of compartment to light up and check, acquiring the signals coming from the weight/pressure sensors present in each compartment, lighting
20 up or turning off various LEDs present in the various compartments, checking the weight variations (on/off) of all the compartments to verify any mistakes and send (to module B) the corresponding alarm signals, in case of incorrect medication intake.

25 Let us see more in detail how the device can detect the following mistakes:

- incorrect medication intake: the mistake will be detected thanks to the sudden absence of weight of an incorrect (not lit up) compartment where up until a short time before a
30 certain weight was present (detected by its own

weight/pressure sensor now in an «off» condition). At this point module E will send to module B the signal over channel no. 15: module B will immediately warn, through a loudspeaker, not to take the incorrect medication and to take instead the medication in the lit up compartment; should this not occur (check whether the weight sensor of the lit up compartment is still «on»), the automatic launch of the usual warning phone calls to relatives and/or carers, etc. will follow.

10 - missed medication intake at an established time: the mistake will be detected thanks to the lack of weight absence (persisting even after several minutes) in the correct lit up compartment (condition detected by the always «on» weight/pressure sensor). At this point module E will send to
15 module B the signal over channel no. 16: module B will immediately instruct by voice message to take at once the medication corresponding to the lit up compartment; should this not occur (check whether the weight sensor of the lit up compartment is still «on»), the automatic launch of the usual warning
20 phone calls to relatives and/or carers, etc. will follow.

- mistake in putting back a medication taken: the mistake will be detected thanks to the continued absence of weight (still after several minutes from taking the medication from its compartment - check based on the still «off»
25 weight/pressure sensor) in the lit up compartment and, perhaps, even on the presence of weight in a compartment (without associated medication) «empty» up until then. At this point module E will send to module B the signal over channel
no. 14: module B will immediately instruct by vocal message
30 to put back the medication in the lit up compartment and not

somewhere else; should this not occur after a few minutes (check whether the weight sensor underneath the lit up compartment is still «off»), the automatic launch of the usual warning phone calls to relatives and/or carers will follow.

5 For greater safety and visibility, each medication to be taken may be equipped (initially by a relative, carer or similar) with an "adhesive label" (issued with the device) of the "same colour as the compartment" where the medication will be placed.

10 It must be stressed that the correct intake of any medication, i.e. without mistakes or omissions, already represents per se a good demonstration of «mental/physical ableness» and the device will be able to take this into account at the next programmed activation of the usual sound buzzer; should such
15 activation be programmed a few minutes after a correct medication intake (for example after 15-20 minutes), the same can be avoided (increasingly reducing manual activities and hence increasing the automatic mechanisms of the device).

OPERATION OF THE DEVICE/OPERATION STEPS

20 1) Starting, switching off and self-diagnosis of the device

Module B of the device will remain always on and powered, through connection to the power supply network; in case of power cut, for a certain period (several hours) the module
25 will be automatically powered, as already said, by rechargeable spare buffer batteries.

Module C, which is always on, will be powered, if possible, by the power supply network or by long-life mini-batteries; the same will occur for the various components of
30 modules D and E.

Module A, which is always on, will be powered only by long-life or rechargeable mini-batteries, with a «maximum power consumption» only during the (user-programmed) time intervals in which it will have to be active (i.e. when it has to be activated, and then manually turned off, the sound buzzer will have to be activated and checks will have to be carried out on whether module A is worn on the wrist of the monitored subject, and on the measurements of blood pressure and body temperature). During the time intervals in which it does not have to operate (for example at night), module A will be in a condition of «minimum power consumption» (standby).

The device in its entirety, once installed, will never be switched off but for force majeure (for example prolonged absence from the home of the monitored subject); the "off" switch of the «main» device B will be positioned in a hidden location which is difficult to use (for example underneath the container).

As already specified, there will also be an important check on the condition of the batteries of module A, as well as on all those other modules C, D, and E which cannot be directly powered by the home power supply network with the possible launch of warning phone calls (over channel no. 5) in case of «empty batteries».

Moreover, there will also be a self-diagnosis module (inserted in module B) which will warn by phone (or through a siren in case of a broken-down telephone line) customer care (as well as relatives and/or carers) of any technical troubles.

2) Daily operation - LIFE-SAVING mode

The device, in its essential functions, will be fully automatic, i.e. the monitored subject will not have to do anything of their own device to ask for help.

The device will activate one or more sound buzzers to be
5 silenced «manually» or when the device has become alarmed or
pre-alarmed, and/or at preset time intervals, initially pro-
grammed by the user according to the habits and requirements
of the monitored subject; for example, they can be activated,
according to requirements, within the intervals ranging for
10 example from 7 AM to 2 PM and, if an afternoon nap is taken,
from 4 PM to 9 PM; the buzzers will hence not be activated at
night-time (i.e. from 9 PM until 7 AM), unless the subject
has got up from bed and has returned thereto after a certain
period of time, and during the possible afternoon rest (i.e.
15 from 2 PM to 4 PM). Within these check intervals, the other
various functions of modules A, C, D, and E will also be ac-
tivated. Module D will also and mainly operate at night-time.
Module E, used for monitoring the correct intake of any medi-
cation, will operate in the time intervals which will be pro-
20 grammed on each occasion. Module A, usually worn on the wrist
of the monitored subject, in order to aid the use of said
module contains three important components for verifying the
subject's mental/physical conditions: the sound (and light)
buzzer with corresponding stopping button (to be pushed
25 within a set period of time in order not to alarm the de-
vice), the blood pressure detection module (with maximum and
minimum values, and pulse rate) and the module to detect body
temperature, to check in advance the health conditions of the
monitored subject. The buzzer (in module A) will activate it-
30 self, through a radiofrequency activation signal coming from

module B, at well-established times, for example at 8 AM, 11 AM, 2 PM, 4.30 PM, 7 PM and 9 PM, and will have a preset duration (for example 10-15 minutes or longer, according to which other alarms will be active), or will be immediately
5 activated, at any time, as soon as the device should become pre-alarmed about the subject's health conditions. Of course, such times will be decided during the initial installation step on the basis of the habits of the monitored subject, on their age and their mental/physical conditions: the buzzer
10 will be activated frequently (for example every hour or less) in case of advanced age and/or health conditions which are less than reassuring, or occasionally (for example after 3-4 hours) in case of an able and self-sufficient subject. The buzzer (according to what has been decided during the initial
15 installation step) will sound at impulses until the corresponding stopping button is pushed (which will also light up for improved visibility) or it will sound for a certain period of time (for example 10-15 minutes or more), after which it will cease to ring. In both cases, after a certain period
20 of time has elapsed since its activation, should it not have been silenced yet and should the home front door not be open and/or should the subject be in bed at an «abnormal» time, the controller of module B, upon receiving such signals and information from modules A, C, and D, will order the launch
25 of «warning» phone calls (to relatives, neighbours and/or carers), and in case of a negative response (i.e. nobody has answered the telephone) will launch further phone calls to rescue services through pre-recorded messages, containing all the subject's data (name, surname, address, telephone number,
30 name of relatives and/or neighbours and their telephone num-

bers) and the reason of the phone call (for example: buzzer not pushed after a certain period of time and/or abnormal blood pressure and/or abnormal home temperature, etc).

Should various movements or subject presence in the home
5 have been detected (at least three detection occurrences: the controller of module B will count the number of alarms coming from the presence sensors installed in modules C and D and/or from that installed directly in module B) between two successive buzzer activation occurrences (in module A and/or in
10 module B), the controller of module B will not activate (because superfluous) the buzzer of module A (i.e. it will not send any buzzer activation signal, even though expected at such time, to the receiver of module A). In this way the automatic checks of the device will increase even further,
15 without disturbing (not even minimally) the monitored subject. In any case the device, for increased safety and control, even though it detected various and continuous movements in the home, at least once/twice a day (for example: once in the morning and once in the afternoon), will in any
20 case require the subject to turn off (through the suitable button) the buzzer (in module A or in module B).

In the following the main cases of «alarm» will now be listed which may occur on a daily basis.

a) No subject movement detected within the last hour, or
25 no movement detected since the last stopping of the buzzer up until now, in addition to no opening of the front door (i.e. open-door alarm deactivated), as well as sound buzzer (in module A and/or B) not silenced within a limited period of time (for example 3-4 minutes) from its activation: there
30 follows an immediate and anticipated launch (max. after 3-4

minutes from buzzer activation) of "check" and help phone calls (to relatives and/or carers).

b) The sound buzzer (in module A and/or B) is not stopped within a certain preset period of time, as well as anatomic
5 wristband worn on the wrist signalling normal blood pressure, normal body temperature, normal room temperature, deactivated open-door alarm: there follows an immediate launch (i.e. after the period of time set for the sound buzzer) of "check"
10 phone calls to relatives, neighbours and/or carers with the elderly subject's identification data and reason of the call (explained on the basis of which sensors and components are alarmed); then, if nobody has answered the phone calls, launch of phone calls to «rescue» services.

c) The sound buzzer (in module A and/or B) is not silenced
15 within a certain preset period of time, in addition to anatomic wristband «not» worn on the wrist, as well as normal room temperature, as well as deactivated open-door alarm: there follows an immediate launch of «check» phone calls (to relatives, neighbours, carers) with identification data and
20 reason; then, if nobody has answered the calls, launch of phone calls to «rescue» services.

d) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anatomic wristband worn on the wrist, as well as «abnormal» blood
25 pressure and/or body temperature, as well as normal room temperature, as well as indifferent position (activated or deactivated) of the open-door alarm: there follows an immediate and anticipated launch (over cases a) and b)) of «help» phone calls with identification data, reason and seriousness of the
30 conditions originating the phone call.

e) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anatomic wristband «not» worn on the wrist, as well as «abnormal» room temperature, as well as deactivated open-door alarm:
5 there follows the immediate launch of «check» phone calls (to relatives, neighbours, carers) with identification data, reason and seriousness of the conditions originating the phone call; then, if nobody has answered the phone calls, launch of phone calls to «rescue» services.

10 f) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anatomic wristband worn on the wrist, as well as abnormal room temperature, as well as indifferent position of the open-door alarm: there follows the immediate and anticipated launch
15 (over cases a), b), d)) of «check» phone calls (to relatives, neighbours, carers) with identification data, reason and seriousness of the conditions originating the phone call; then, if nobody has answered the phone calls, launch of phone calls to «rescue» services.

20 g) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anatomic wristband worn on the wrist, as well as abnormal blood pressure and/or body temperature, as well as abnormal room temperature, as well as indifferent position of the open-door
25 alarm: there follows that it is a very serious case and hence immediate and anticipated launch (over the other cases) of «help» phone calls with identification data, reason and seriousness of the conditions originating the phone call.

30 h) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anat-

omic wristband worn on the wrist, as well as alarmed «im-
pact/fall» sensor, as well as indifferent position of the
open-door alarm: there follows an immediate and anticipated
launch of «rescue» phone calls with identification data, rea-
5 son and seriousness of the conditions originating the phone
call.

i) The sound buzzer (in module A and/or B) is not silenced
within a certain preset period of time, in addition to anat-
omic wristband worn on the wrist, as well as alarmed «iner-
10 tia/inactivity» sensor, as well as indifferent position of
the open-door alarm: there follows the immediate and antici-
pated launch of «help» phone calls with identification data,
reason and seriousness of the conditions originating the
phone call.

15 1) The sound buzzer (in module B) is not silenced within a
certain preset period of time, in addition to anatomic wrist-
band worn or not on the wrist, as well as alarm due to gas
leak, as well as indifferent position of the open-door alarm,
as well as indifferent position of the room temperature
20 alarm: there follows a forced short-circuit action to cut the
power from the home power supply network with activation of
the emergency light (in module B) and successive immediate
and anticipated launch of «help» and «emergency» phone calls
to the relevant services with identification data, reason and
25 seriousness of the conditions originating the phone call.

m) The sound buzzer (in module B) is not silenced within a
certain preset period of time, in addition to anatomic wrist-
band worn or not on the wrist, as well as alarm due to pres-
ence of carbon monoxide, as well as indifferent position of
30 the open-door alarm, as well as indifferent position of the

room temperature alarm: there follows the immediate and anticipated launch of «help» and «emergency» phone calls to the relevant services, with identification data, reason and seriousness of the conditions originating the phone call and
5 "siren" activation.

n) The sound buzzer (in module B) is not silenced within a certain preset period of time, in addition to anatomic wristband worn or not on the wrist, as well as alarm due to presence of smoke (fire), as well as indifferent position of the
10 open-door alarm, as well as normal room temperature: there follows the immediate launch of «help» and «emergency» phone calls to the relevant services with identification data, reason and seriousness of the conditions originating the phone call and "siren" activation.

15 o) The sound buzzer (in module B) is not silenced within a certain preset period of time, in addition to anatomic wristband worn or not on the wrist, as well as alarm due to presence of smoke (fire), as well as indifferent position of the open-door alarm, as well as abnormal room temperature: there
20 follows a forced short-circuit action to cut the power from the home power supply network with activation of an emergency light (in module B), siren activation and immediate and anticipated launch of «emergency» and «help» phone calls with identification data, reason and seriousness of the conditions
25 originating the phone call.

p) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anatomic wristband worn on the wrist, as well as normal blood pressure and body temperature, as well as normal room temperature,
30 as well as activated open-door alarm: there follows

the immediate launch of «check» phone calls (to relatives, neighbours and/or carers) with identification data, reason and seriousness of the conditions originating the phone call (explained on the basis of which sensors and components are
5 alarmed); then, if nobody has answered the calls, launch of «help» phone calls to the relevant services.

q) The sound buzzer (in module A and/or B) is not silenced for example by 9 PM, in addition to anatomic wristband not worn on the wrist, as well as normal room temperature, as
10 well as activated open-door alarm: there follows the launch, only after 9 PM, of «check» phone calls (to relatives, neighbours and/or carers with identification data, reason and seriousness of the conditions originating the phone call (explained on the basis of which sensors and components are
15 alarmed); then, if nobody has answered the calls, launch of «help» phone calls to the relevant services.

r) The sound buzzer (in module A and/or B) is not silenced within a certain preset period of time, in addition to anatomic wristband not worn on the wrist, as well as deactivated
20 open-door alarm, as well as subject «not returned to bed» after a certain period of time at night-time: there follows the immediate launch of «check» phone calls (to relatives, neighbours and/or carers) with identification data, reason and seriousness of the conditions originating the phone call (explained on the basis of which sensors and components are
25 alarmed); then, if nobody has answered the calls, launch of «help» phone calls to the relevant services.

s) Missed intake of medication at established time: there follows the launch of a «warning» phone call (to relatives
30 and/or carers).

t) Incorrect intake of medication: there follows the launch of a «warning» phone call (to relatives and/or carers).

u) Mistake in putting back a medication just taken: there
5 follows the launch of a «warning» phone call (to relatives and/or carers).

In addition to the cases listed so far there will be others which may occur on a daily basis, but, in practice, they will all be mere «combinations» of those already described.

10 There are besides various cases in which, reassuring health and responsiveness conditions of the subject having already been verified, the buzzer will not be activated (even if at programmed times), thereby arriving to a nearly fully automatic mechanism of the device. In brief, if the subject
15 shows to be, continuously, in satisfactory conditions, the manual activities required will be nearly inexistant.

Another reason to reduce buzzer activation occurrences is provided by the "number of subjects present" in the home (or other location); the device could, in fact, avoid activating
20 the buzzer if, more or less in that period of time, two or more «presence» sensors had detected (in the life-saving mode) several subjects in the home (to avoid mistakes, such multiple detection by multiple sensors will, of course, have to occur at, or nearly at, the "same time" - otherwise there
25 would be the risk of always detecting the same subject).

ANTI-THEFT/ANTI-INTRUSION mode

The device will automatically (i.e. without any manual intervention by the subject when he or she is at home) activate the «anti-theft/anti-intrusion mode», when the subject «is at
30 home and in bed» or when they «have left the home». When they

return home, in order to deactivate the anti-theft mode, before opening the front door, they will have to push the button of a small radio control (integrated in the key holder for ease of use); in case of omission, they will have further
5 opportunities to deactivate the anti-theft function when they have already entered the home. Instead, should the subject get up from bed (at night-time), the device will "automatically" deactivate the anti-theft function, in order to allow them to walk about the home undisturbed (and it will
10 simultaneously activate the «life-saving» function), in order to then reactivate the anti-theft mode (again automatically) once they have returned to bed.

Let us examine in detail device operation in the «anti-theft/anti-intrusion» mode.

15 The central processing unit of the device (module B) will automatically activate the "anti-theft" function when it receives the following information:

a) the subject has left the home and there is nobody else in the home.

20 a.1) Module C will send (to module B) the «opened front door» signals (i.e. open magnetic contacts, distant from each other).

a.2) At this point module B will check if for a few minutes (for example 5), there is somebody else in the home,
25 through the data coming from the presence/movement sensors (dual technology, infrared + microwaves) belonging to modules B, C, and D; such sensors, of course, will never have to become alarmed during this check period.

a.3) The device will further check (for improved safety)
30 whether module A is worn on the subject's wrist (detected

values of pulse frequency and/or skin temperature); in the affirmative (the range of the signals transmitted from A to B and viceversa being extremely limited), it will not activate the anti-theft function (because the subject is certainly at
5 home and wearing module A on the wrist).

a.4) It will also check that the subject is not in bed, through the detection by weight/pressure sensors located under mattress and pillow (which will of course all have to be off).

10 a.5) Finally, before activating the anti-theft function, it will activate (in module B) the sound and luminous buzzer to be silenced (green control button) within a few minutes «in case there is somebody in the home» (voice message to aid use of the device).

15 b) The subject is in bed (at a not abnormal time) and there is nobody else in the home.

b.1) The device will check whether the subject has gone to bed (at a not abnormal time because, conversely, instead of activating the anti-theft mode, the device will immediately
20 activate the "life-saving" function by triggering the sound buzzer to be silenced within a short time and, in case of alarm, also by launching various help phone calls), through the detection of data coming from the presence sensor located outside the bedroom (which must certainly have become alarmed
25 previously), from the weight/pressure sensor located underneath the bedside rug (off, then on and then off again), and finally from the weight/pressure sensors located underneath mattress and pillow (which will remain on for a long time, at least as long as the pillow sensor).

30 b.2) It will further be checked (especially if it is not

night-time/evening, but for example afternoon) whether there is somebody else in the home: see the previous points a.2) and a.5).

5 c) When all the information collected confirms that the subject has "gone out" (hence is not unwell) and there is nobody else in the home, or that the subject is "in bed " and there is nobody else in the home, module B will activate the "anti-theft/anti-intrusion" function; in the following manner:

10 c.1) it will detect any alarm signals coming from the magnetic contacts opening the front door and from the various presence sensors scattered around the home; should even only one of these components become alarmed, it will mean that an intrusion by strangers is occurring.

15 c.2) At this point (in case of alarm) the device will activate the siren issued therewith and will immediately launch various check phone calls to relatives and, in the case that nobody has answered, also to the police.

In case of activated anti-theft function, the
20 "deactivation" thereof will occur in one of the following two manners:

a) when the subject "re-enters the home": he or she can deactivate the anti-theft device by pushing the button of a small radio control, usually integrated (for increased conspicuousness and ease of use) in the bunch of house keys;
25 this small manual activity will be compulsory since it represents the only way to distinguish the entrance in the home of an «authorised» subject from that of a stranger (proowler, thief, burglar, etc.). In case of omission to push the radio
30 control button to deactivate the anti-theft device or, for

various reasons, if it was impossible to do so, the device will indicate to deactivate the anti-theft device also by digiting, on the numeric keypad of module B, a secret deactivation code (for example a 4-digit one) (various voice messages will be provided to make the operation easier).

b) When the subject has "got up from bed": as soon as the weight sensors underneath pillow and mattress all go from on to off, and the one underneath the bedside rug goes from off to on and then to off again, it will mean that the subject has got up from bed moving away by at least 1-2 metres (such data are detected by the sensor located under the bedside rug). The device will then immediately and automatically deactivate the anti-theft function and from then on the various presence sensors, upon becoming alarmed, will no longer detect the presence of strangers (thieves) but only the «walking about the home» of the monitored subject (and/or of other non-strangers). From that moment the «life-saving» function will be active until the time when (especially at night-time) the subject returns to bed (check of the data coming from the presence sensor outside the bedroom, from the weight/pressure sensor underneath the bedside rug, and from the weight/pressure sensors underneath bed and pillow): at this point, after having checked that there is nobody else in the home, the device will activate again the «anti-theft/anti-intrusion» function.

It must be stressed that, during the life-saving function, should the subject (at night-time) not return to bed within a certain time (for example 15-20 minutes), the usual check routine will be activated to check their health conditions (buzzer to be silenced within a short time, otherwise launch

of various phone calls, etc.).

CARER MONITORING mode

In the case in which, carers should live permanently or for a few hours a day together with the monitored subject, the device will be able to «automatically» check their behaviour towards the subject needing care. During the installation step, the «carer monitoring» function will be entered through the keyboard (in module B), by a subject's relative, also defining the time interval to check. In order to check the carer's «work dedication» all the following conditions will have to be always verified:

- 1) module A (during the day and when the subject is at home) will always have to be worn on the wrist of the monitored subject (biometric parameters hence always detected);
- 2) it must never occur that there is a missed or incorrect intake of any prescribed medication (hence no alarm signals ever coming from module E);
- 3) when the subject has gone to bed, the anti-theft alarm must never activate itself automatically, because that would mean that also the carer has gone to bed at once (or even before anybody else), hence without switching off the usual sound buzzer to "deactivate" the anti-theft device (since there are at least two subjects in the home, sleeping in different rooms), which will activate itself about 5-10 minutes after the detection of «subject in bed»;
- 4) during the day, the various «presence» detection sensors must activate themselves often (even two or more thereof simultaneously), thereby indicating a certain movement about the home on the part of the carer (who should hence not - as is often the case - perhaps be sitting in an armchair for

hours on end reading a book ...).

In case of a superficial, not very correct behaviour by the carer, the device will activate the launch of "warning" phone calls to the subject's relatives.

5 ABSTRACT

The device of the present invention has been designed to operate automatically in 3 different modes:

- life-saving (main function, with some 16 automatic check functions: on the subject, on the location to be monitored and on the correct operation and use of the device itself);
- 10 - anti-theft/anti-intrusion (automatically activated and deactivated mode);
- carer monitoring (if presence thereof is provided).

In the "life-saving mode" the device will perform checks and "periodic" evaluations and/or "verifications" both on the (elderly and/or ill) subject's mental/physical conditions, and on the degree of safety, protection and liveability of the home (or other location), and on the correct operation and on the correct use of the device itself. If the subject shows, at least for a few days, to be in "good health" (i.e. mental/physical ableness, responsiveness, mobility, normal pressure and temperature values), the device will operate in a fully automatic mode (i.e. it will require no manual activity, no matter how simple and short, such as that of silencing a sound buzzer through a button).

As soon as the subject's condition should deteriorate, the device will immediately (and if necessary also increasingly frequently) activate various manual activities which will serve to better evaluate the subject's mental/physical conditions.

In the following are listed the various checks performed in the "life-saving" mode:

1) Checks on the SUBJECT:

1.1) possible condition of abnormal inertia/inactivity,
5 absence of body movement (automatic check);

1.2) abnormal values of blood pressure and/or pulse frequency (automatic check);

1.3) physical activity (automatic check);

1.4) responsiveness, mental/physical ableness (automatic
10 or deliberately manual check);

1.5) possible falls (automatic check);

1.6) abnormal body temperature values (automatic check);

1.7) (automatic) check whether the subject is in bed or
not, also during abnormal times;

15 1.8) correct intake of any medication (automatic check);

2) Checks on the HOME:

2.1) absence/presence of the subject in the home (automatic
check);

2.2) check on how long the subject has not left the home;

20 2.3) abnormal room temperature values (automatic check);

2.4) dangerous gas presence (automatic check);

2.5) dangerous presence of carbon monoxide (automatic
check);

2.6) dangerous smoke presence (automatic check).

25 3) Checks on the correct USE and OPERATION:

3.1) prolonged absence of anatomic wristband on the wrist
(automatic check);

3.2) pull-out batteries of various modules running low
(automatic check).

30 In case of one or more checks providing a "negative" out-

come (alarm), the device will automatically activate the launch of various types (warning, check, help, emergency) of "phone calls" on the basis of the quantity and seriousness of the negative checks carried out.

5 The device will further automatically understand when to activate the "anti-theft/anti-intrusion" operation mode and when to return to the (main) "life-saving" function. Finally, both during the operation as life-saving device and during that as anti-theft device, it will monitor the correct behav-
10 iour of any carers (if provided and present).

 It is understood, however, that the invention must not be considered limited to the specific embodiment illustrated so far, which represents only an exemplary embodiment thereof, but that a number of changes may be made, all within the
15 reach of a skilled subject in the field, without departing from the scope of protection of the invention, as defined by the following claims.

 By the term "subject" used in the following claims, any subject is to be understood who may at any time and/or sud-
20 denly display a critical health condition, due to their age and/or illness and/or disability, or who may, even only temporarily, become unable to check their health and/or look after themselves, and/or to solve any local emergencies, and/or to monitor the behaviour of any carers.

25 By the term "environment" used in the following claims, the place is to be understood where the subject lives, even temporarily, i.e. their home and/or place of work and/or hospital and/or resort.

CLAIMS

- 1) Method to control any emergency conditions connected with the mental/physical state of health of a subject and/or with the environmental conditions in which said subject lives, for the purpose of preventing individual and/or community risks tied to such conditions, of the type comprising the steps of:
- activating one or more signals indicating such emergency conditions;
 - 10 - forwarding one or more of said indication signals to the telephone network, to be sent towards preselected destinations;
- characterised in that it also comprises at least the steps of:
- 15 a) collecting information from sensors and/or apparatuses controlling the conditions of the "mental/physical state" of health of the subject, and/or from sensors detecting any "critical environmental and/or safety conditions" in the place where the subject lives, and/or from sensors and/or apparatuses checking the "correct behaviour of any persons assisting the subject";
 - 20 b) confirming or annulling, by means of one or more sensors to be manually actuated, any possible critical conditions detected by sensors and/or control apparatuses, concerning the mental/physical state of the subject and/or the environment;
 - 25 c) automatically entering, in case the critical conditions detected should be confirmed, said information into an electronic central data processing unit in order to process a coded warning signal;
 - 30 d) releasing a consent to the forwarding of said coded signal

to the telephone network towards destinations selected on the basis of the coding of said signal.

2) Control method as in claim 1), characterised in that said automatic collecting of information is carried out periodically, at preset intervals, possibly varying according to the hour of the day.

3) Control method as in claim 1), characterised in that said automatic collecting of information is carried out occasionally, in reply to the activation of at least one of said sensors prearranged to check any critical conditions of the subject and/or of the environment.

4) Control method as in claim 1), 2) or 3), characterised in that said automatic collecting of information is obtained only after forwarding of a control signal and the lack of reply to such signal within a preset period of time.

5) Control method as in claim 4), characterised in that said control signal consists of a sound buzzer and/or of a blinking LED, and the reply thereto is given by simple pressure of one or more push-buttons, the actuation of which will indicate the annulment of the critical condition detected.

6) Control method as in any one of the previous claims, characterised in that said automatic collecting of information includes detecting any physical movement of the subject.

7) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting an increase of the ambient temperature beyond a preset limit, so as to be able to reckon any excessive and dangerous climatic changes.

8) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of informa-

tion includes detecting a fall of the subject to the floor.

9) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting any physical movement or activity of
5 the subject in the environment.

10) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting the opening of the front door of the living place.

10) 11) Control method as in claim 10), characterised in that said automatic collecting of information obtained by detecting the opening of the front door is used to supply also indications as to the "amount of time" elapsed without the subject having "left" the place in which he lives.

15) 12) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting the lying of the subject in bed.

20) 13) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting the presence of other people, in addition to the subject.

25) 14) Control method as in any one of claims 1) to 5) and 11) to 13), characterised in that the collecting of information detecting the subject lying in bed or his absence from the living place, in combination with detecting the presence of other people in the environment, automatically activates an anti-intrusion/anti-theft intervention routine.

30) 15) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting the correct intake of prescribed

medication on the part of the subject.

16) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes also detecting the visit of expected people and/or people in charge of the subject.

17) Control method as in any one of claims 1) to 5), characterised in that said automatic collecting of information includes detecting the heartbeat and/or the blood pressure and/or the body temperature of the subject.

18) Control method as in any one of the previous claims, characterised in that said automatic collecting of information is carried out by means of sensors applied on the subject and/or positioned in his living place and is sent to said electronic data processing unit by transmission of radiofrequency signals.

19) Control method as in claim 1) or 18), characterised in that said electronic processing unit is apt to distinguish, among the signals issued by said sensors, those requesting to merely send warning phone messages from those requesting to send phone messages for interventions of control, aid and/or health or ambient emergencies.

20) Control method as in claim 19), characterised in that said electronic processing unit releases the consent to forward said phone messages only in response to the outcome of "additional controls" and/or checks as to the proper working and use of the system.

21) Device to control any emergency conditions connected with the mental/physical state of health of a subject and/or with the environmental conditions in which said subject lives, for the purpose of preventing individual and/or commu-

nity risks tied to such conditions, of the type comprising:

- means to activate a signal indicating such emergency conditions, and

- means to forward said indication signal to the telephone
5 network, fixed and/or mobile, to be sent towards preselected destinations,

characterised in that it also comprises:

- at least one sensor and/or automatic apparatus to control and verify the mental/physical fitness of the subject;

10 - at least one automatic sensor to verify the environmental conditions;

- at least one manual actuator to confirm or annul any critical and/or emergency conditions detected in the subject and/or in the environment;

15 - at least one sensor to detect the correct behaviour of any persons assisting the subject;

- at least one sensor and/or automatic detector to control the presence in the environment of people other than the subject, each sensor and/or detector being provided with means
20 to transmit the detected data;

- an electronic central data processing unit, which collects the data transmitted by said sensors and/or detectors and issues a coded warning signal; and

- means to forward said coded signal to the telephone net-
25 work, fixed and/or mobile, to destinations selected on the basis of the coding of said signal.

22) Electronic control device as in claim 21), characterised in that said sensor and/or automatic apparatus to control the mental/physical fitness of the subject comprises
30 at least one "physical movement" sensor to detect the state

of inertia or inactivity of the subject, said sensor being apt to transmit an almost continuous sequence of electric signals, alternatively on/off, to actually indicate the physical movement and/or responsiveness of the subject.

5 23) Electronic control device as in claim 22), characterised in that said "physical movement" sensor preferably consists of an electric mercury switch, applied on the arm of the subject.

10 24) Electronic control device as in claim 21), characterised in that said sensor and/or automatic apparatus to control the mental/physical fitness of the subject comprises at least one "impact/fall" sensor, preferably of the piezoelectric type, apt to detect the vibrations determined by the fall of the subject to the floor.

15 25) Electronic control device as in claim 21), characterised in that said automatic sensor to detect the environmental conditions comprises at least one sensor detecting any movement of people in the environment.

20 26) Electronic control device as in claim 25), characterised in that said sensor detecting people movements is preferably of the type, known per se, of combined infrared and microwave technology.

25 27) Electronic control device as in claim 21), characterised in that said automatic sensor to detect the environmental conditions comprises at least one sensor detecting the opening and closing of the front door of the living place.

 28) Electronic control device as in claim 27), characterised in that said detection sensor is preferably of the type, known per se, with magnetic contacts.

30 29) Electronic control device as in claim 21), charac-

terised in that said automatic sensor to detect the environmental conditions comprises at least a temperature probe or sensor positioned in the environment.

30) Electronic control device as in claim 21), characterised in that said automatic sensor to detect the environmental conditions comprises at least one sensor to detect the lying of the subject in bed, positioned in the place where the subject normally sleeps.

31) Electronic control device as in claim 30), characterised in that said sensor detecting the subject lying in bed comprises at least one pressure sensor, positioned under the mattress, under the pillow and/or under the bedside rug.

32) Electronic control device as in claim 21), characterised in that said sensor or automatic apparatus to control the mental/physical fitness of the subject comprises means to check that the subject has correctly taken the prescribed medication.

33) Electronic control device as in claim 32), characterised in that said means to check the intake of medication comprise a container of medication divided into several compartments, each equipped with a weight/pressure sensor which detects the presence, or not, of the medication in the respective compartment.

34) Electronic control device as in claim 21), characterised in that said automatic sensor to control the mental/physical fitness of the subject consists of a sensor or apparatus, applied on the body of the subject, to check any anomalous physical conditions.

35) Electronic control device as in claim 34), characterised in that said control sensor can be worn on the wrist

of the subject.

36) Electronic control device as in claim 34) or 35), characterised in that said sensor controls the pulse frequency.

5 37) Electronic control device as in claim 34) or 35), characterised in that said sensor controls the blood pressure.

38) Electronic control device as in claim 34) or 35), characterised in that said sensor controls the body temperature.
10

39) Electronic control device as in claim 21), characterised in that it also comprises means to urge the subject to reply, within a short time, to a requested control of the conditions, caused by detection of a possible critical condition and/or state of emergency concerning the subject and/or the environment.
15

40) Electronic control device as in claim 39), characterised in that said means to urge the subject to reply consist of a luminous and/or sound indicator.

20 41) Electronic control device as in claim 39) or 40), characterised in that it also comprises one or more push-buttons at the disposal of the subject, to allow him to supply, or not, a simple reply to the requested control of the conditions, the lack of reply representing moreover a confirmation of any possible critical conditions and state of emergency concerning the subject and/or the environment.
25

42) Electronic control device as in claim 21), characterised in that said means to automatically activate an anti-intrusion/anti-theft intervention routine comprise pressure sensors positioned under the mattress, under the pillow
30

and/or under the bedside rug to detect the lying of the subject in bed, sensors of combined infrared and microwave technology to detect the presence of other people in the environment, and sensors with magnetic contacts to detect the opening of the front door of the living place.

5

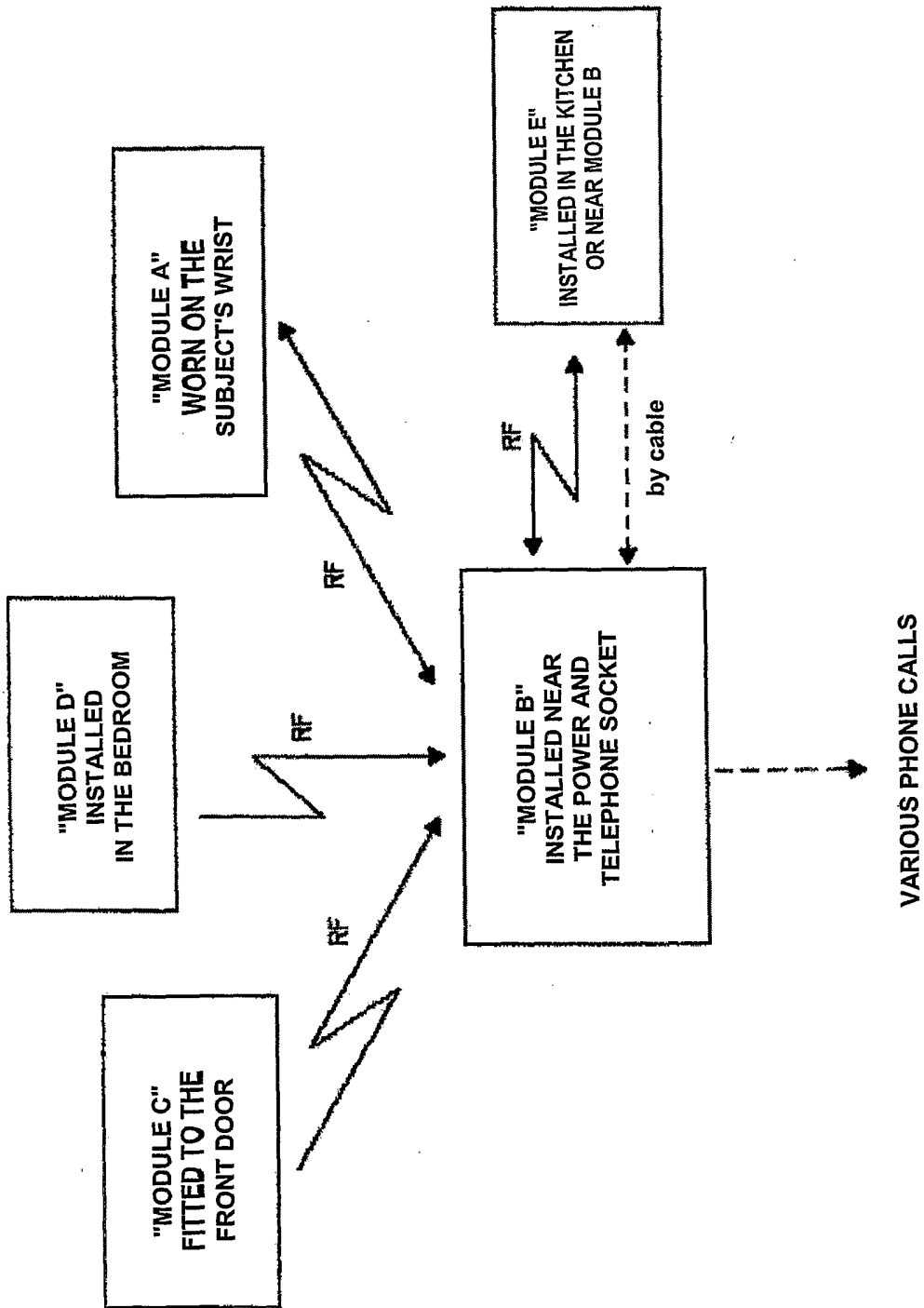


FIG. 1

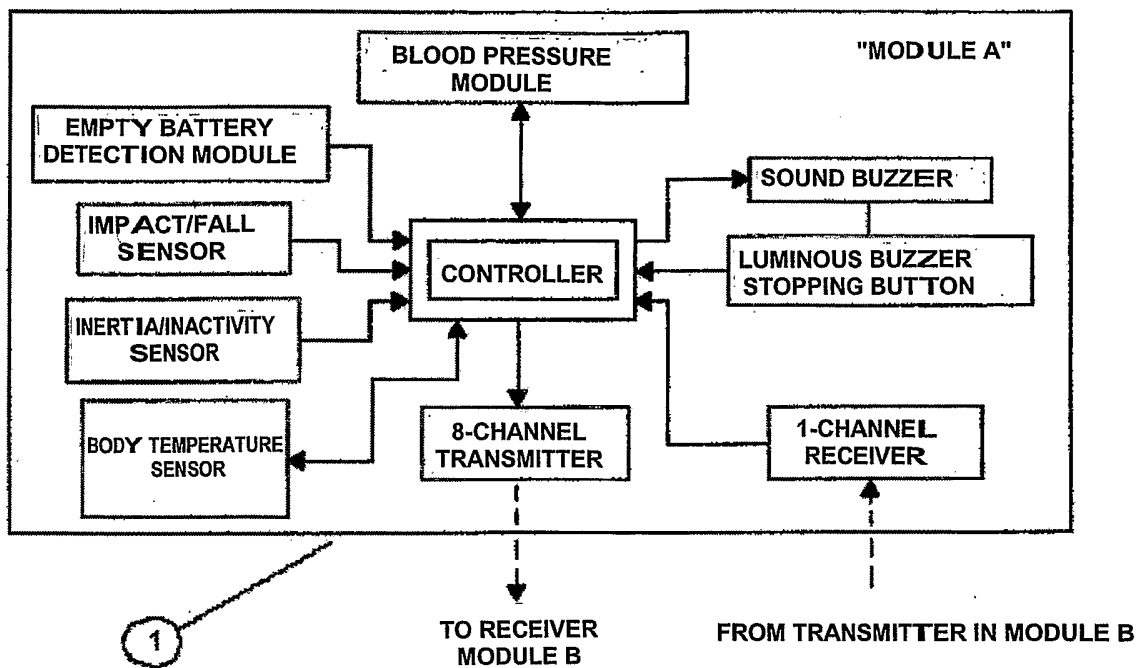


FIG. 2

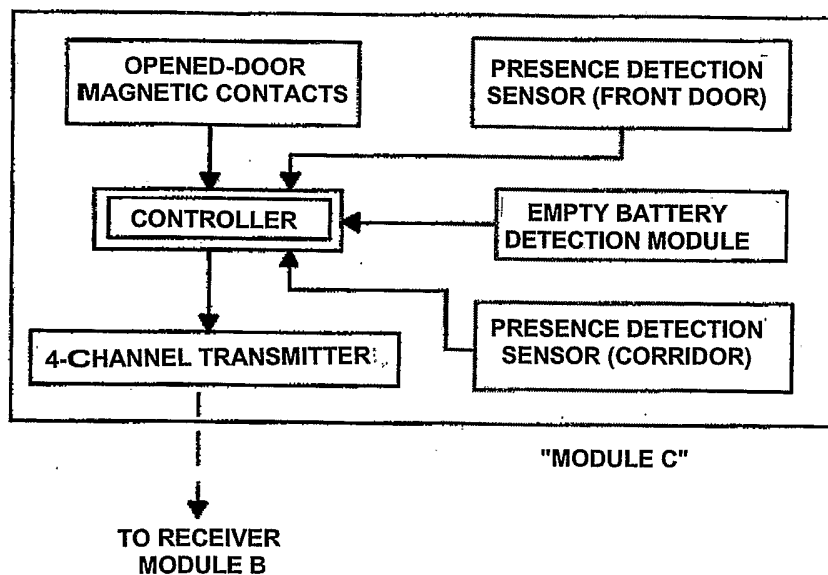


FIG. 4

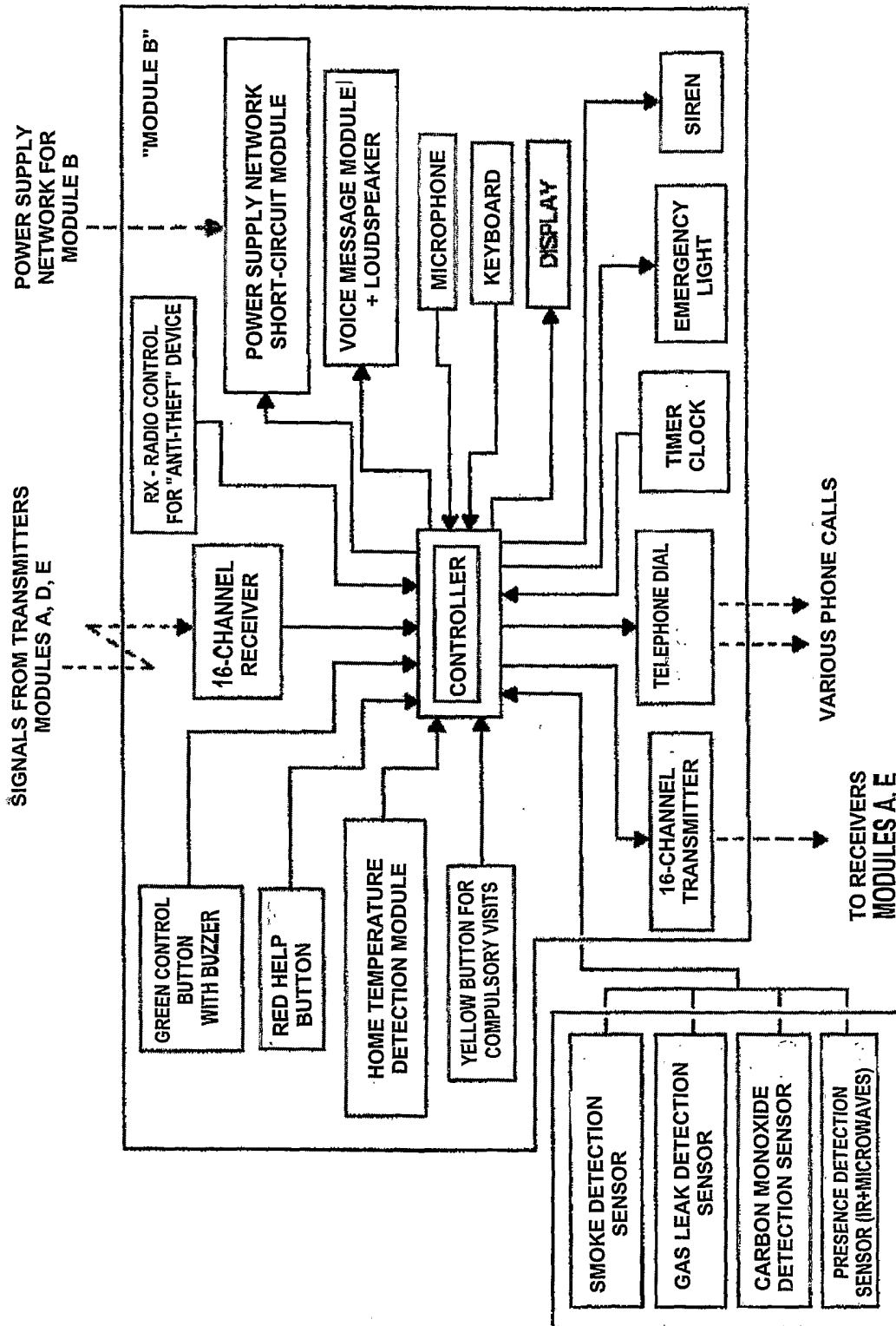


FIG. 3

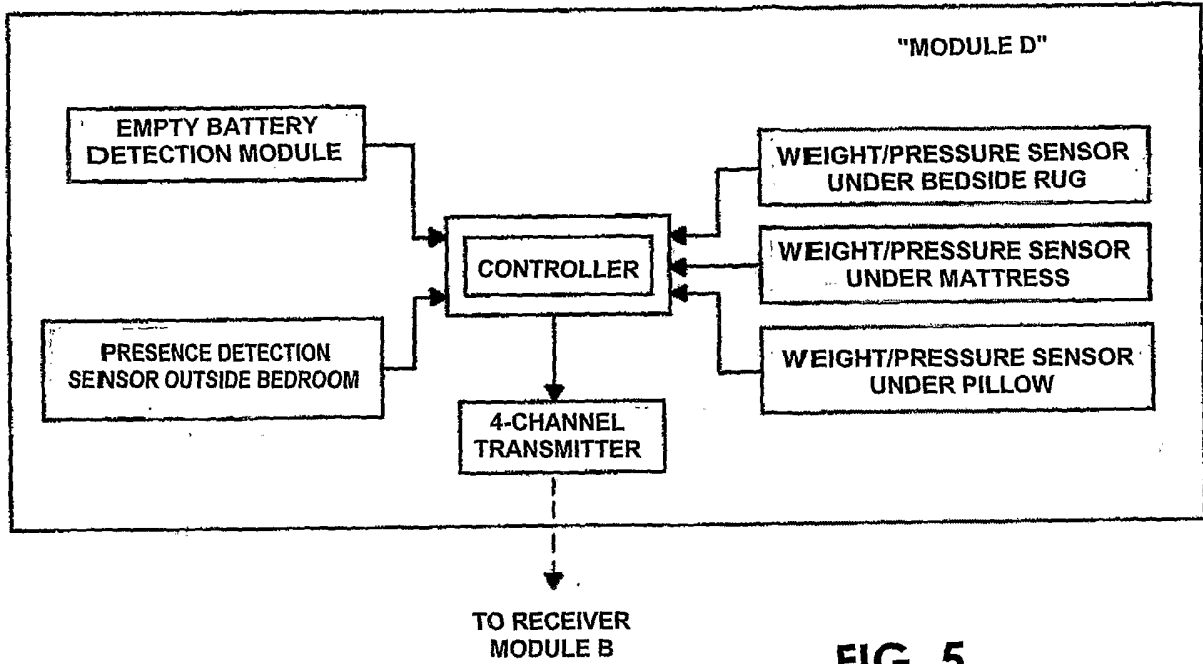


FIG. 5

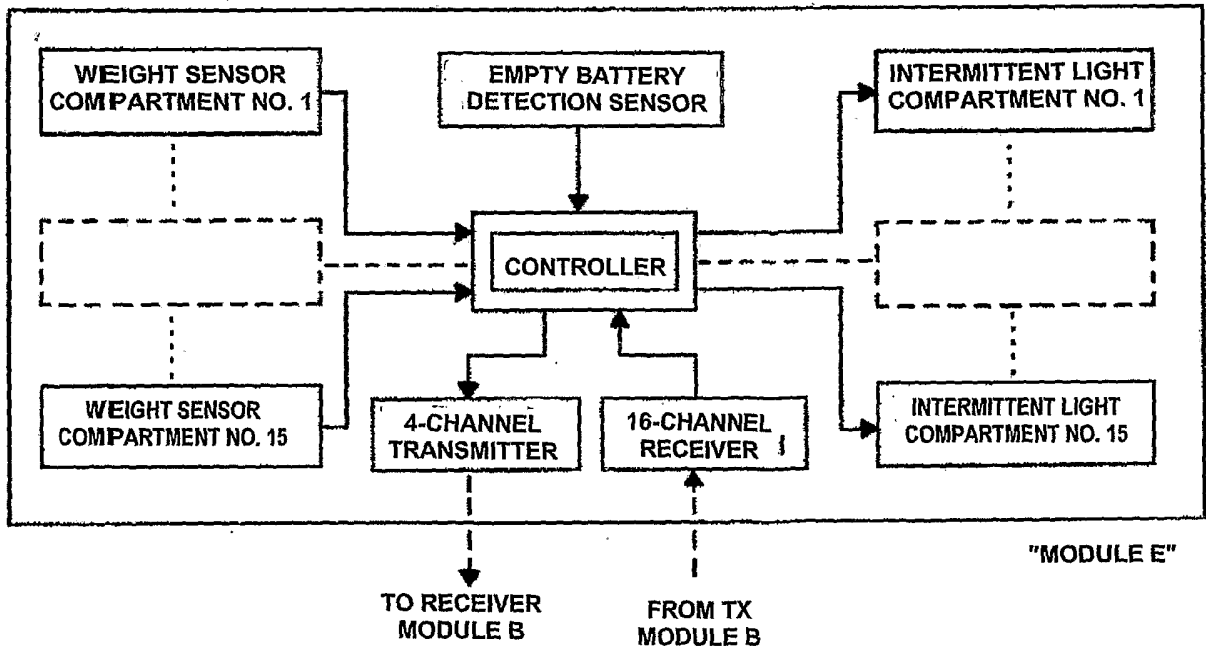


FIG. 6

COMPARTMENT NO. 1	N. 3	N. 5		N. 8	N. 12
		N. 6		N. 9	N. 13
N. 2	N. 4	N. 7		N. 10	N. 14
				N. 11	N. 15

"MEDICATION CONTAINER"

FIG. 7

INTERNATIONAL SEARCH REPORT

IB2004/003060

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H04M11/04 A61B5/00 G08B25/01

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)
 IPC 7 H04M A61B G08B

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	DE 196 39 492 A1 (SENDER, BERND, DIPL.-WIRTSCHAFTSING., 42855 REMSCHEID, DE) 15 May 1997 (1997-05-15) the whole document	1-42
X	DE 44 41 421 A1 (KOMMUNIKATIONSTECHNIK GROTTKE VERTRIEB UND SERVICE, INH. UTE GROTTKE,) 8 June 1995 (1995-06-08) the whole document	1-42
X	DE 100 09 882 A1 (KLAUDTKY, DIETMAR W; WALTER, GEORG) 11 October 2001 (2001-10-11) paragraph '0013! - paragraph '0027!	1-3
A	abstract	21
	----- -/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in 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

4 February 2005

Date of mailing of the international search report

15/02/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

Radoglou, A

INTERNATIONAL SEARCH REPORT

IB2004/003060

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 396 416 B1 (KUUSELA TOM ET AL) 28 May 2002 (2002-05-28) the whole document -----	1,21
A	DE 44 41 907 A1 (HEWLETT-PACKARD CO., PALO ALTO, CALIF., US) 22 June 1995 (1995-06-22) column 5, line 19 - column 9, line 22 -----	1,21

INTERNATIONAL SEARCH REPORT

IB2004/003060

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 19639492	A1	15-05-1997	NONE	
DE 4441421	A1	08-06-1995	DE 9318679 U1	17-02-1994
DE 10009882	A1	11-10-2001	AU 4417901 A DE 10190787 D2 WO 0165810 A1	12-09-2001 12-06-2003 07-09-2001
US 6396416	B1	28-05-2002	FI 2607 U1 AU 3177197 A DE 69728535 D1 DK 907942 T3 EP 1443480 A2 EP 0907942 A1 WO 9749077 A1 JP 2000512414 T	27-09-1996 07-01-1998 13-05-2004 10-05-2004 04-08-2004 14-04-1999 24-12-1997 19-09-2000
DE 4441907	A1	22-06-1995	GB 2285135 A JP 7234982 A	28-06-1995 05-09-1995