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**G08B 13/14**

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(56) Documents Cited:  
**EP 0093463 A1**                    **US 6151493 A**  
**US 6040772 A**                    **US 5589821 A**  
**US 5289163 A**                    **US 4675656 A**

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UK CL (Edition V ) **G4N**  
INT CL<sup>7</sup> **G08B**  
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(54) Abstract Title: **Anti-theft or anti-loss proximity alarm**

(57) An anti-theft or anti-loss proximity alarm system comprising a transmitter and a receiver which receives a radio signal from the transmitter. An audio and/or visual alarm is triggered when the separation of the transmitter and receiver is greater than a predetermined distance or when the signal strength detected by the receiver falls below a predetermined threshold value. The system allows the predetermined distance or threshold value to be adjusted or calibrated. The system is suitable for preventing theft or loss of articles such as luggage, mobile telephones, or computers.

In another embodiment the receiver may have an averaging means and the alarm is triggered when the signal strength, averaged over a predetermined length of time, falls below a predetermined value. Alternatively, the system may have a plurality of transmitters each individually recognisable to the receiver.

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Figure 1

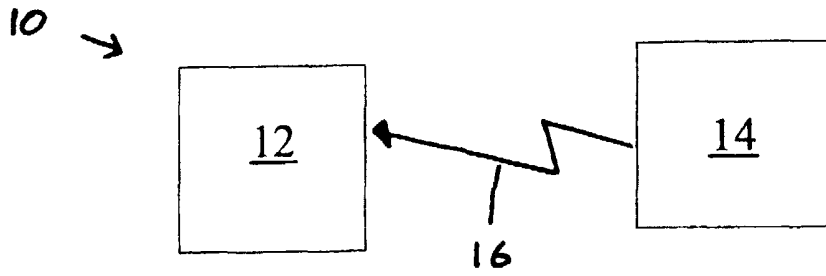


Figure 2

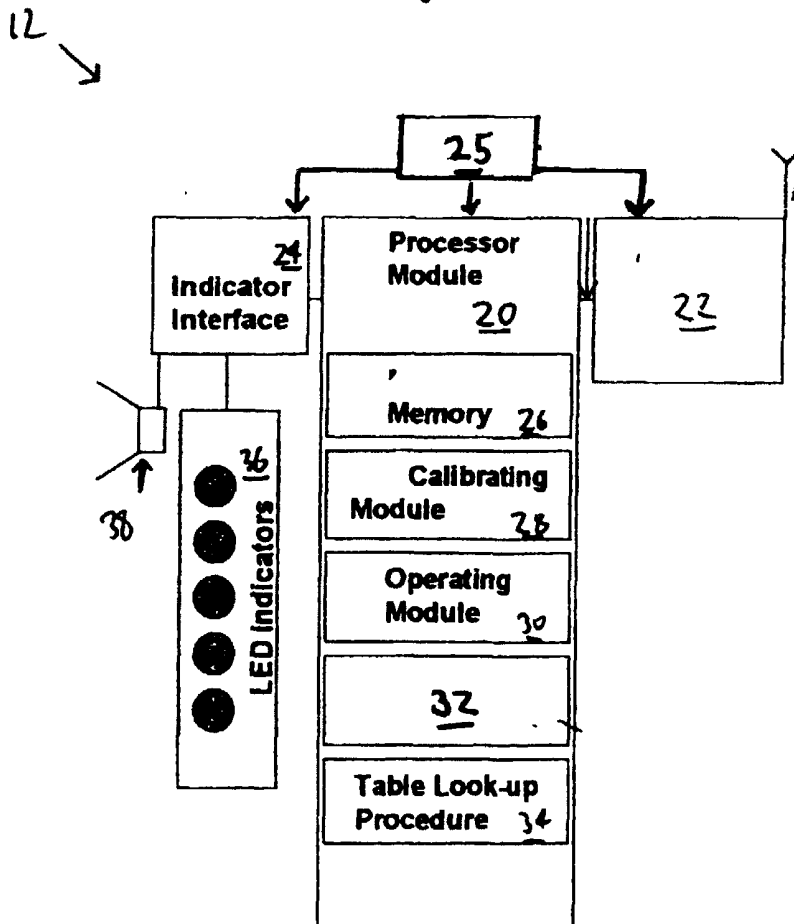


FIGURE 3

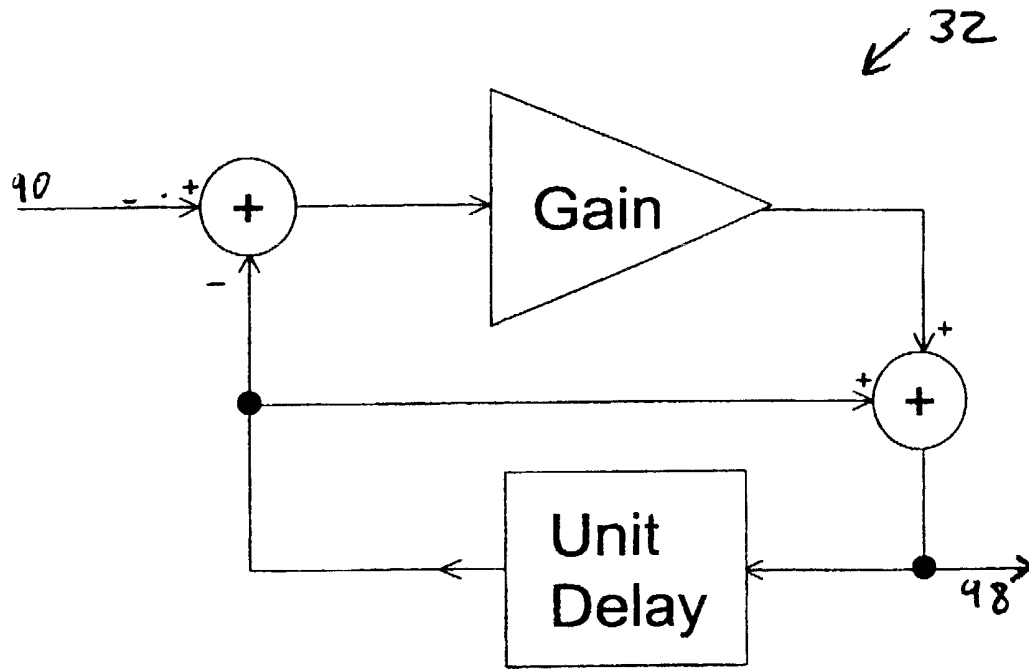


FIGURE 4

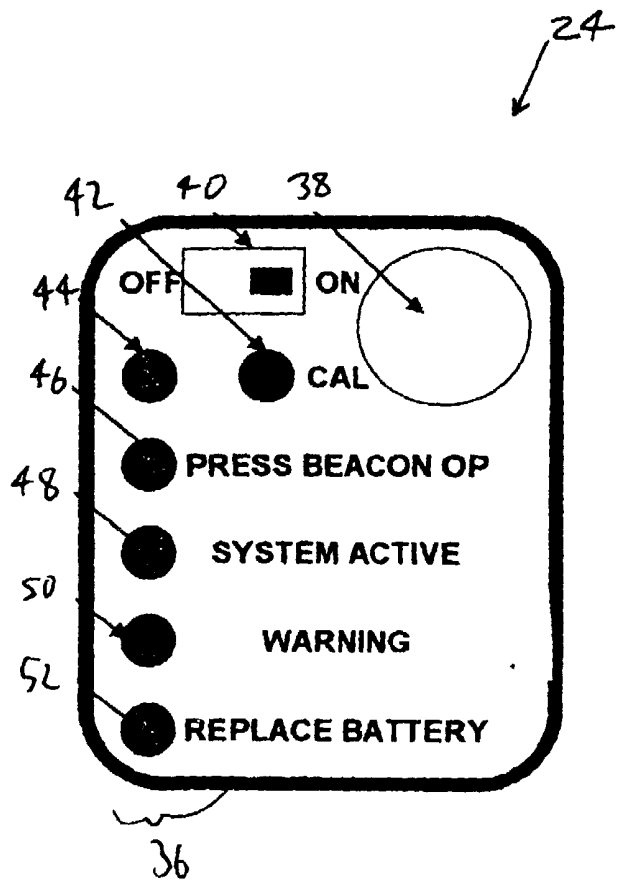


FIGURE 5

↙ 14

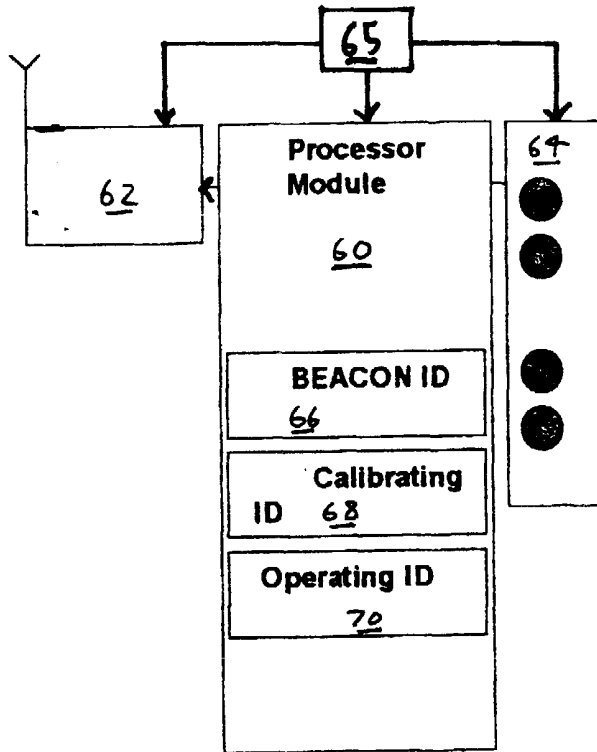


FIGURE 6

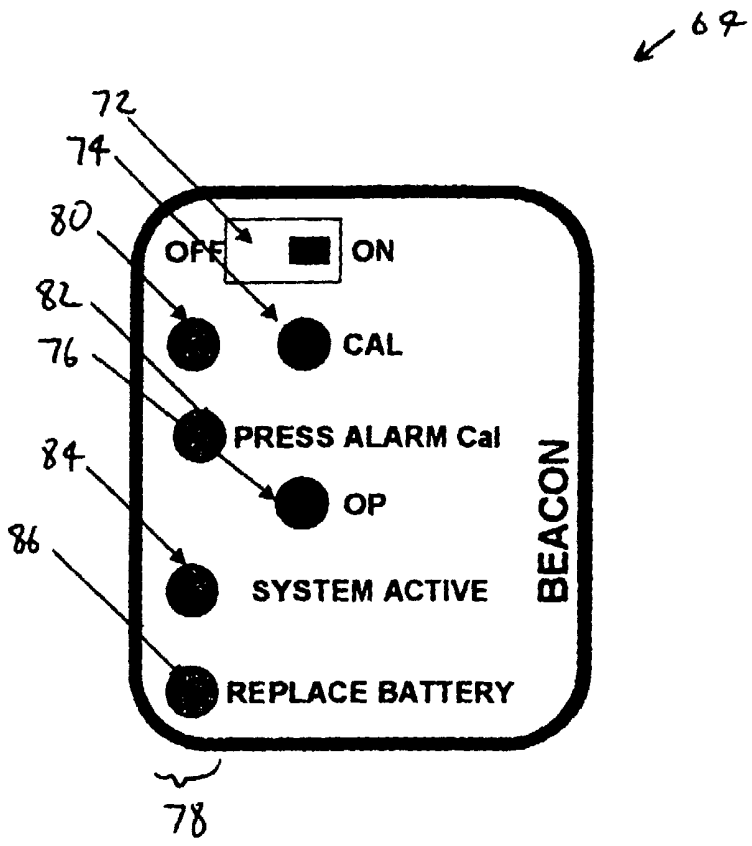


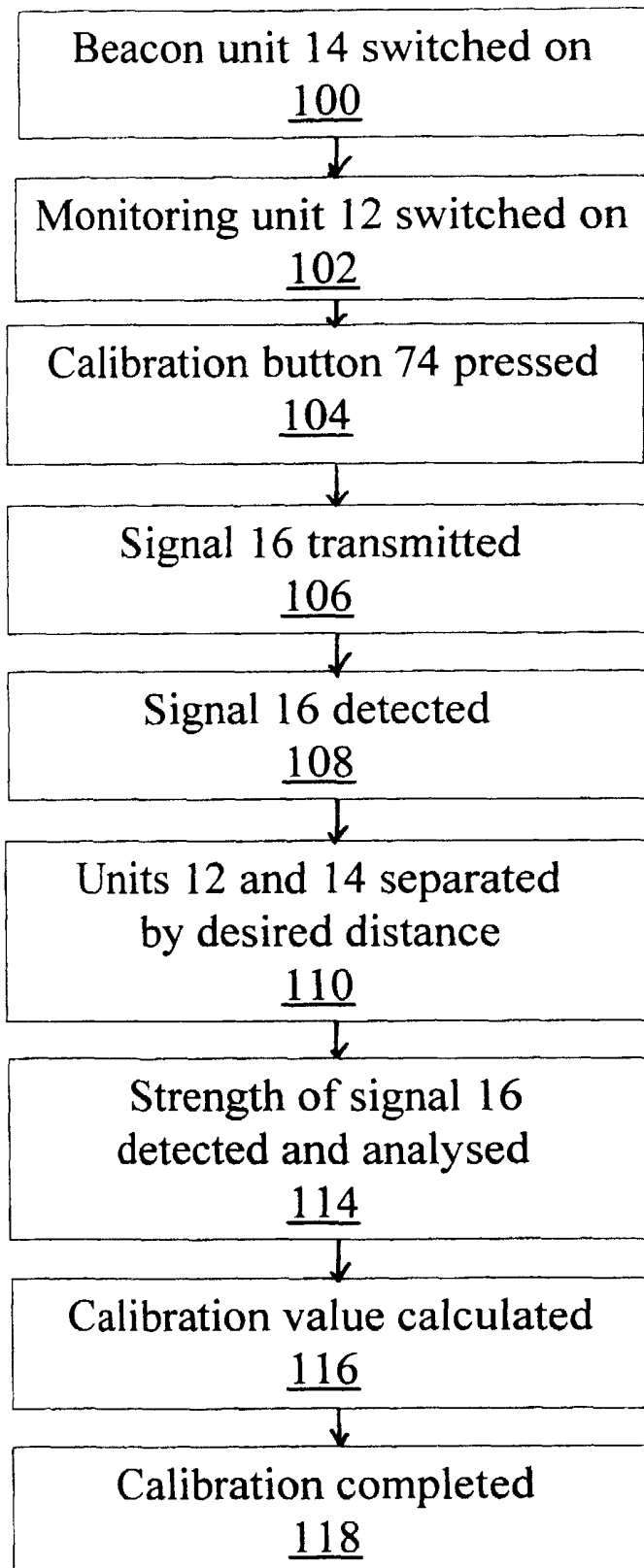
Figure 7

Figure 8

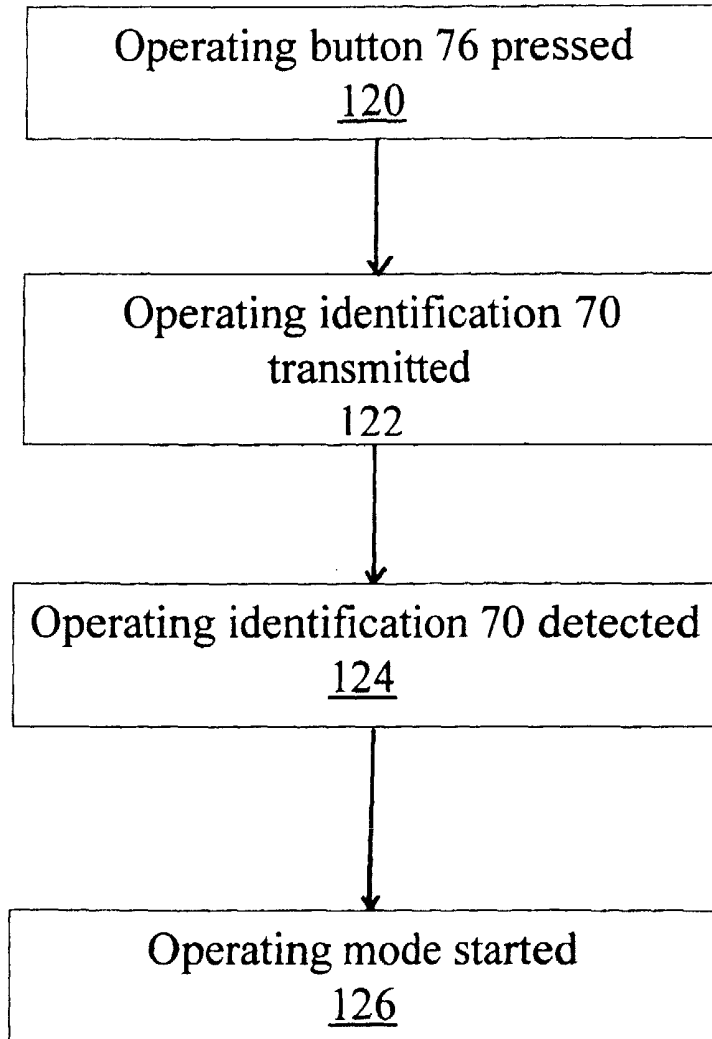




Figure 9

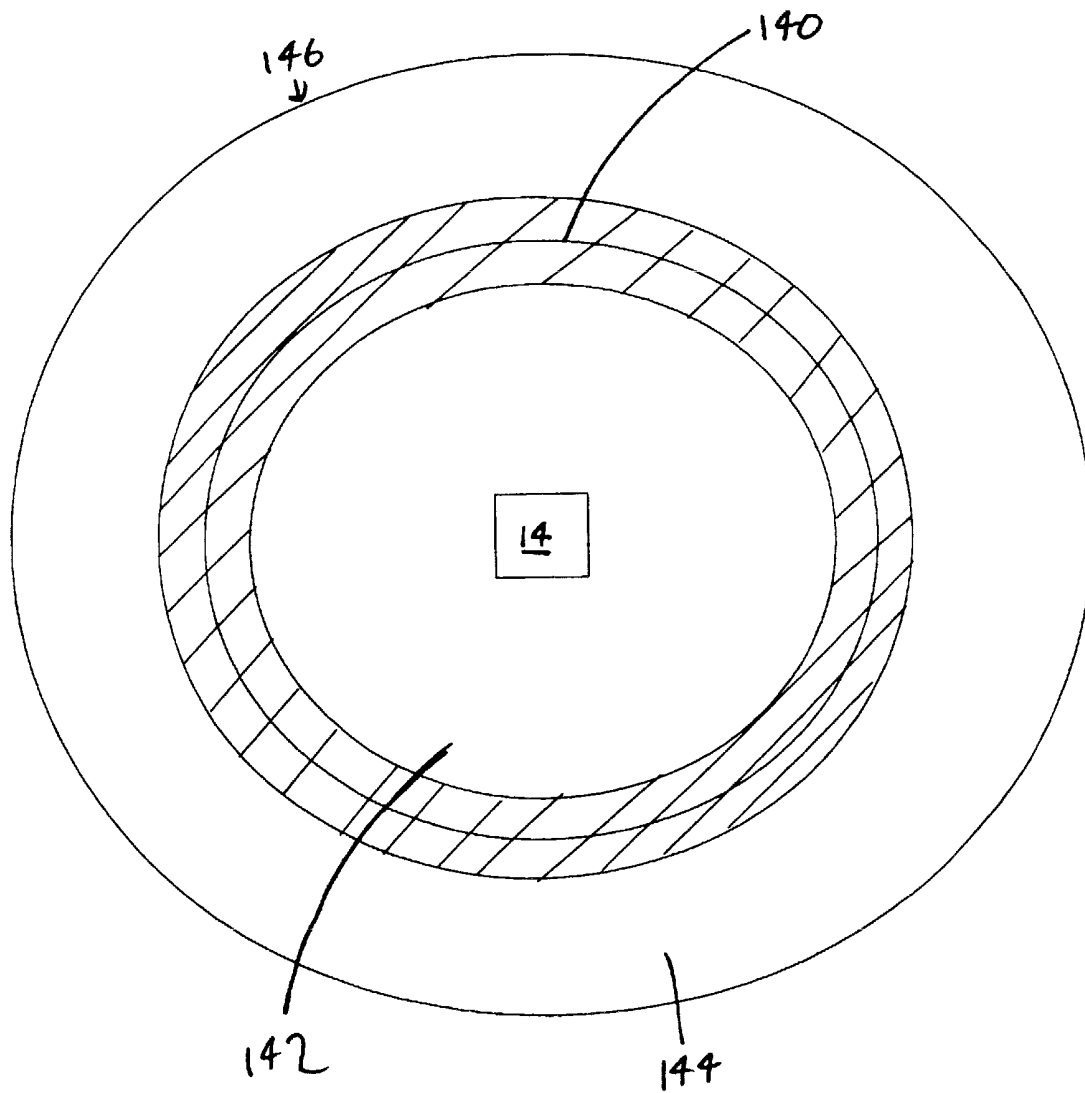
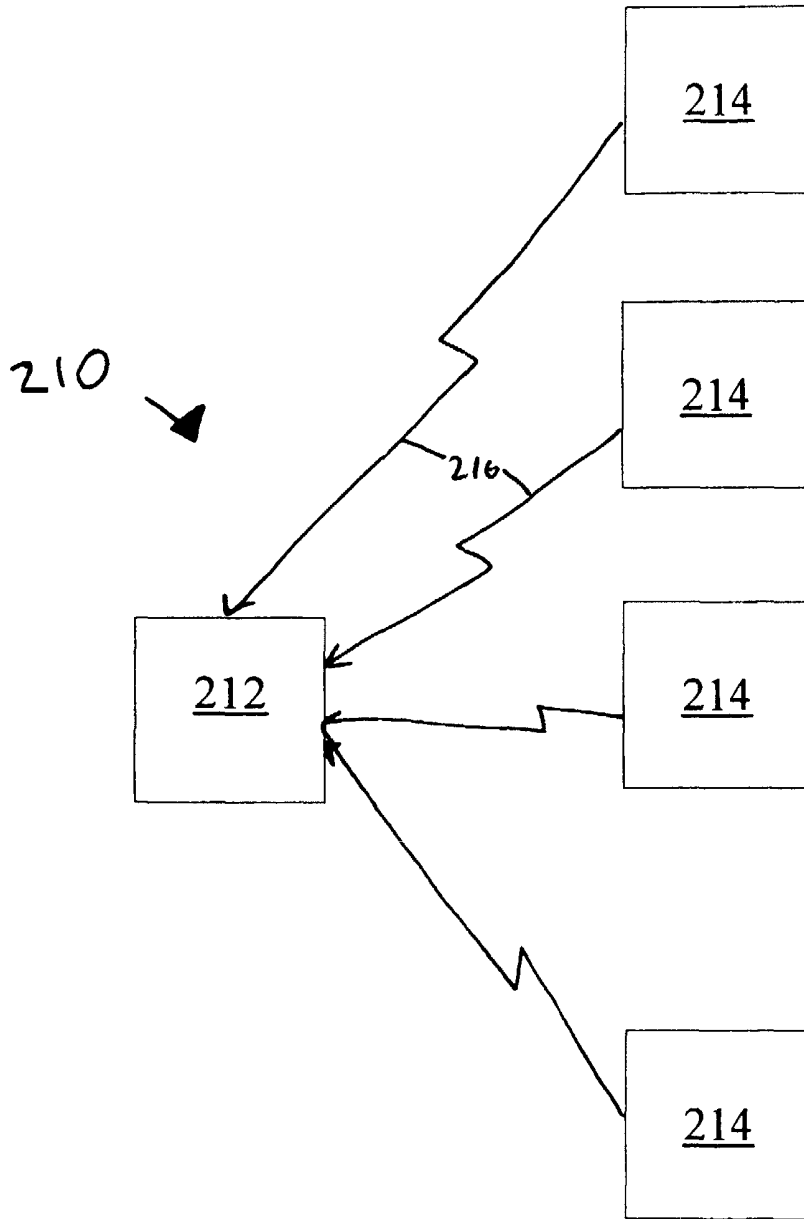


Figure 10



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### Proximity System

This invention relates to proximity systems in particular such systems to help prevent loss or theft of an article, for example by providing an audible alarm.

5

It is known to provide a transmitter attached to an article which provide a signal to a receiver connected to an alarm sounder. The alarm sounder is triggered when the strength of the signal from the transmitter goes below a certain level. Using such a system a user may locate the alarm about his person and be alerted when the article to  
10 which the transmitter is attached is moved far enough away from the receiver that the signal strength drops below the fixed level. This can be useful both in preventing theft and reminding the user he has left the article behind, for example, if he/she leaves behind their luggage when departing a train.

15 It is also known to allow the level of signal strength below which the alarm is triggered to be altered so that the distance that the transmitter and receiver may be separated by before the alarm is triggered is also altered. However, signal strength depends on many factors including environment as well as the distance from the transmitter and therefore there can be no simple correspondence between the level and the distance. A certain  
20 signal strength level may correspond to a suitable distance in one environment but can be unsuitably small or large distance in another environment. The surrounding environment can also cause sudden and temporary changes in the signal strength resulting in the alarm being triggered without the distance between the receiver and transmitter changing.

25

It is an object of the present invention to provide improvements on such known systems.

According to a first aspect of the invention there is provided a proximity system  
30 comprising a transmitter, a receiver for receiving a signal from the transmitter and an alarm triggered when the transmitter and receiver are approximately separated by more

than a predetermined distance, wherein the predetermined distance can be set by separating the receiver and transmitter by a desired distance and calibrating the system to set the predetermined distance as the prevailing desired distance separating the transmitter and receiver.

5

According to a second aspect of the invention there is provided a proximity system comprising a transmitter, a receiver for receiving a signal from the transmitter, a calibrating element or means and an alarm triggered when the strength of the signal received by the transmitter from the receiver falls below a predetermined value, 10 wherein the predetermined value can be set by separating the receiver and transmitter by a desired distance and calibrating the system to set the predetermined signal strength as the prevailing signal strength from the transmitter at the receiver such that the alarm will be triggered when the receiver and transmitter are separated by approximately the desired distance.

15

Preferably the system comprises a beacon unit and a monitoring unit, wherein the beacon unit comprises the transmitter and the monitoring unit comprises the receiver and the alarm. More preferably the beacon unit does not comprise a receiver and preferably the monitoring unit does not comprise a transmitter.

20

Preferably the system comprises a plurality of transmitters preferably each transmitting a different identification code allowing the receiver to separately recognise each transmitter signal, more preferably comprising a plurality of alarms each alarm corresponding to a transmitter and preferably each giving a recognisably different alarm 25 stimulus to a user.

30

Preferably the system comprising an averager which averages the received signal strength over a predetermined length of time and wherein the alarm will not be triggered unless the averaged signal strength fall below a predetermined value.

Preferably the transmitter sends a calibration signal when the calibration function is activated and the system can set the predetermined signal strength from the strength of

the calibration signal. More preferably the calibration function can be deactivated, the predetermined signal strength being set as the average received calibration signal whilst the calibration function is active.

- 5 Preferably the system according to any preceding claim uses the averaged signal and an algorithm to continuously calculate the separation distance of the transmitter and receiver n use with the predetermined value already set.

10 Preferably the transmitter when in use with the predetermined value already set transmits an operating identification signal such that the monitoring device will trigger the alarm when the signal strength falls below a predetermined value.

15 Preferably the alarm comprises an LED and/or is capable of emitting an audible sound when triggered.

20 According to a third aspect of the invention there is provided a proximity system comprising a transmitter, a receiver for receiving a signal from the transmitter, an alarm triggered when the strength of the signal received by the transmitter from the receiver falls below a predetermined value, and an averager which averages the received signal strength over a predetermined length of time and wherein the alarm will not be triggered unless the averaged signal strength falls below a predetermined value.

25 Preferably the system according comprises an electronic device such as a mobile telephone or computer. More preferably the alarm comprises a switch, which when triggered deactivates the electronic device so that at least some of its functions cannot be used and preferably the electronic device is reactivated if the signal returns to a value above a predetermined value and/or the transmitter and receiver are no longer separated by more than the predetermined distance. Preferably still the system comprises a second alarm, comprising a visual indicator such as an LED and/or is  
30 capable of emitting an audible sound, triggered when the transmitter and receiver are approximately separated by more than a predetermined distance.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

- 5 Figure 1 is a schematic diagram of a proximity system according to the invention;
- Figure 2 is a schematic block diagram of the monitoring unit of Figure 1;
- Figure 3 is a view of the averager of Figure 2;
- 10 Figure 4 is view of the display panel of the monitoring unit of Figure 2
- Figure 5 is a schematic block diagram of the beacon unit of Figure 1;
- 15 Figure 6 is view of the display panel of the beacon unit of Figure 3;
- Figure 7 is a flow diagram of the process of calibrating the proximity system of Figure 1;
- 20 Figure 8 is a flow diagram of the process of operating the proximity system of Figure 1;
- Figure 9 is a schematic diagram of the alarm zone of the proximity system of Figure 1; and
- 25 Figure 10 is a schematic diagram a second embodiment of a proximity system according to the invention.

Referring to Figure 1 there is shown proximity system 10 according to the invention comprising a monitoring unit 12 and a beacon unit 14. In use there is a signal 16  
30 transmitted from the beacon unit 14 to the monitoring unit 12. The signal 16 is preferably an electromagnetic signal and more preferably in the radio frequency range such as at 433 MHz.

The monitoring unit 12 as can be seen in Figure 2, comprises a processor module 20 in communication with a receiver 22 and an indicator interface 24, all of which are powered by the power supply 25. The receiver 22 is capable of receiving signal 16 and relaying it to the processor module 20. The processor module 20 can comprise a Peripheral Interface Controller Microprocessor and includes a memory 26, a calibrating module 28, an operating module 30, an averager 32, and an algorithmic/look up element 34. The power supply 25 may comprise a battery with a voltage regulator for example.

10

An example of an averager 32 is shown in Figure 3 in this embodiment a digital filter embodied in software in the processor module 20. The strength of signal 16 is entered into the averager at input 90 after appropriate conversion by the algorithmic element 34. The averager averages this signal strength over a period of time and this averaged signal strength is sent via output 98 to the another part of the processor module 20.

15

Referring to Figures 2 and 4, the indicator interface 24 is shown comprising a series of LED indicators 36 an alarm sounder 38 such as a buzzer or bleeper, a power switch 40 for turning the unit 12 on and off by connecting and unconnecting with the power source 25 and a calibration button 42. The power switch 40 may have a lock position (additional to on and off) which disables the calibration button 42 to stop it being pressed accidentally.

20

In this embodiment there are five monitoring unit LED indicators 36: a calibration indicator 44, a ready to operate indicator 46, an operating (or system active) indicator 48, an alarm indicator 50 and a low power indicator 52 for indicating when the power source is soon to run out. Preferably the alarm indicator 50 comprise a differently coloured LED to the other indicators 36 or is larger or flashes or is in some other way easily and immediately distinguished from them.

25

The beacon unit 14, as shown in Figure 5, comprises a processor module 60 in communication with a transmitter 62 and an indicator interface 64, all of which are

30

powered by a power supply 65. The transmitter 62 is capable of emitting signal 16, at data rates of about 4, 800 bits per second for example. The contents of the signal depend on the information relayed to the transmitter 62 by the processor module 60., and can, for example, be transferred at between 100 and 114,000 bits per second.

5

The processor module 60 can comprise a Peripheral Interface Controller micro and includes a memory containing a beacon identification 66, a calibrating identification 68 and an operating identification 70. The three identifications 66, 68 and 70 can be relayed to the transmitter 62 and be sent via signal 16 to the monitoring unit 12 and may  
10 comprise one or more eight bit characters for example. The beacon identification 66 is generally always sent to allow the monitoring unit 12 to identify the signal 16 as having come from the beacon unit 14. Usually only one of the calibrating identification 68 or operating identification 70 will be carried by signal 16.

15 Referring to Figure 6 there is shown the beacon indicator interface 64 comprising a power switch 72 for turning the unit 14 on and off, a calibration button 74, an operation button 76 and a series of LEDs 78. The power switch 40 may have a lock position (additional to on and off) which disables the calibration button 74 and the operation button 76 to stop either being pressed accidentally.

20

In this embodiment there are four LED indicators 78: a calibration indicator 80, a ready to calibrate indicator 82 (for prompting a user to press the calibration button 42), an operating (or system active) indicator 84, and a low battery indicator 86.

25 The process of calibrating the proximity system 10 is shown in Figure 7. In use the beacon unit 14 is attached to an item which a user wishes to remember to take with him/her or is concerned may be stolen. The beacon unit 14 need not be attached to the item before calibrating but doing so has the advantage that the user can better appreciate the how far he/she can be separated from the item when the proximity system 10 is  
30 operating before the alarm is triggered.



First the beacon unit 14 is switched on using the power switch 72, at step 100, and after a short time the calibration LED 80 will light indicating that the unit 14 is ready to calibrate. Next the user switches on the monitoring unit 12 using power switch 40 at step 102.

5

The user then presses the beacon calibration button 74, step 104, and the transmitter 62 emits a signal 16 carrying the beacon identification 66 and the calibration identification 68 at step 106. This signal 16 reaches the receiver 22 and consequently the beacon signal is detected by the monitoring unit 12. The processor module 20 detects the calibration identification 68 and lights the monitoring calibration indicator 44  
10 indicating that the monitoring unit 12 is ready to calibrate, step 108.

Next at step 110 the monitoring unit 12 is moved away from the beacon unit 14 to approximately the distance of separation at which the user would like the alarm to be  
15 triggered. The calibration button 42 is then pressed on the monitoring unit 12, at step 112, and the processor module 20 starts to detect the strength of signal 16. Power values deduced by the processor module 20 from the signal 16 are converted by the algorithmic module 34 to a value which can be compared with values converted from the signal strength in operation, and this calibration value is stored in the memory 26.  
20 The converted values are sent to the averager 32. After a set period of time, preferably about one to ten seconds, the monitoring unit 12 will stop detecting the signal 16 and stop averaging the values sent to the averager 32, step 114. Alternatively instead of a set period of time the power values are averaged over a set number of readings, such as two hundred and fifty corresponding to about three seconds, of the calibration  
25 identification 68. The ready to operate indicator 46 will light indicating to the user that the beacon operating button 76 should be pressed.

The calibration is then complete and the user is free to begin operation of the proximity system 10 and prompted to by the ready to operate indicator 46 as described above and  
30 preferably also by a sound emitted by the alarm sounder 38.

The process of operating the proximity system 10 following calibration is shown in Figure 8. First at step 120 the user presses the operating button 76 on the beacon unit 14 causing the operating indicator 84 to light and the transmitter 62 to change the signal 16 to carry the operating identification 70, and possibly no longer carry the calibration identification 68, step 122.

The monitoring unit 12 detects the operating signal at step 124. Preferably if the operating signal is not detected within a predetermined time after the completion of the calibration, the stored calibration value is lost and the calibration process must be repeated. Detection of the operating signal results in the operating indicator 48 being lit and the monitoring unit 12 entering an operating mode, step 126. In operating mode the averager 32 and algorithmic module 34 continuously calculates an average signal strength value and compares this with the calibration value in the memory 26.

If the user walks away from the item or the item is moved such that the separation distance between beacon unit 14 and monitoring unit 12 is approximately the alarm distance at which the proximity system 10 was calibrated the prevailing calculated average signal strength value will be comparable to the stored calibration value. When the prevailing value falls significantly below the stored calibration value (the amount below will be a predetermined amount) the alarm is triggered. This causes the alarm sounder 38 to emit a sound, which is preferably continuous and loud enough to alert the user, and the alarm indicator 50 to light/flash. The alarm maybe deactivated by reducing the separation distance back to less than the calibrated distance. The process of the alarm being triggered and deactivated can be repeated an unlimited number of times so long as there is sufficient power remaining at the power source.

The distance of separation of the two units 12 and 14 at which the alarm will or may be triggered is shown in Figure 9. The distance of separation at which the proximity system 10 was calibrated is shown as calibration circle 140 surrounding the beacon unit 14, which calibration circle is in the middle of an alarm zone 148. When the monitoring unit 12 is in the proximal area 142 between the beacon unit 14 and alarm zone 148 the alarm will not trigger. If the monitoring unit is in the distant area 144 between the alarm

zone 148 and the maximum signal range 146, the alarm will be triggered. The alarm will also trigger if the monitoring unit 12 is outside the transmission range 148. If the monitoring unit 12 is inside the alarm zone 148, which is an annulus surrounding the calibration circle 140 the alarm may or may not be triggered depending on environmental factors.

In figure 10 is shown a proximity system 210 according to the invention, substantially similar to proximity system 10 but comprising a plurality of beacon units 214 which may be attached to different items; like components of proximity system 210 are given the two digit reference as for proximity system 10 prefixed by the digit 2 (even if not shown directly in Figure 10).

Each beacon unit 214 has a different beacon identification 266. The memory 226 of the monitoring unit 212 has all of the different beacon identifications stored enabling the processor module 220 to distinguish between the different signals 216 and identify from which beacon unit 214 they originate.

Each beacon unit can be calibrated separately allowing different separation distances to be set.

The monitoring unit 212 is preferably capable of emitting different sounds and/or sound sequences from the alarm sounder 238 each corresponding to a different beacon unit 214 and/or has a number of different LED alarm indicators 250 of different colours or sizes each corresponding to a different beacon unit 214. Having different alarm signals corresponding to different beacon units 214 allows a user to identify which item has been forgotten/stolen.

In a further variation the beacon unit 14 (or 214) or the monitoring unit 12 (or 212) is incorporated within a mobile telephone. Existing features of the mobile telephone can be used such as the transceiver for telephone calls being used as transmitter 22 or receiver 62, the phone processor being programmed to function similarly to processor module 20 or 60, and the phone LCD screen being used instead of indicators 36 or 64.

With the beacon unit 14 incorporated in the mobile phone the monitoring unit 12 can be a separate unit so that it can be carried by the user at all times. The monitoring unit 12 could be incorporated into a wrist watch for example, such that the user would be alerted if he/she has left their mobile phone behind, and the alarm sound might have a  
5 deterring effect on thieves.

Mobile phones typically operate at between 900 MHz and 1900 MHz and the monitoring unit 12 can be designed to operate at the suitable frequency.

10 With the monitoring unit 12 incorporated within the mobile phone the alarm may comprise a switch (or other suitable component) which turns off the phone making inactive to a user. This switch can be instead of or in addition to means for notifying a user through sound and/or light which means could be a second alarm in the beacon unit 14 with the beacon unit 14 comprises a receiver to receive a signal from the mobile  
15 phone that the alarm condition has been triggered.

The switch can be arranged to be switched or activated whenever the alarm signal is triggered and switched back or deactivated when the alarm signal is cancelled. The switch can be incorporated within the phone making it difficult to tamper with and thus  
20 stopping a thief from using the phone should he/she separate it from the monitoring unit; and can for example be implemented substantially in software programmed in a processor module 20.

The beacon unit 14 (or 214) or monitoring unit 12 (or 212) can be incorporated with in  
25 other electronic devices such as laptop computers as well as mobile phones. The alarm incorporated into such devices may also comprise a switch operating in a similar way to the switch described above.

**Claims**

1. A proximity system comprising a transmitter, a receiver for receiving a signal from the transmitter and an alarm triggered when the transmitter and receiver are approximately separated by more than a predetermined distance, wherein the predetermined distance can be set by separating the receiver and transmitter by a desired distance and calibrating the system to set the predetermined distance as the prevailing desired distance separating the transmitter and receiver.
2. A proximity system comprising a transmitter, a receiver for receiving a signal from the transmitter, a calibrating element or means and an alarm triggered when the strength of the signal received by the transmitter from the receiver falls below a predetermined value, wherein the predetermined value can be set by separating the receiver and transmitter by a desired distance and calibrating the system to set the predetermined signal strength as the prevailing signal strength from the transmitter at the receiver such that the alarm will be triggered when the receiver and transmitter are separated by approximately the desired distance.
3. A proximity system according to claim 1 or 2 comprising a beacon unit and a monitoring unit, wherein the beacon unit comprises the transmitter and the monitoring unit comprises the receiver and the alarm.
4. A proximity system according to claim 3 wherein the beacon unit does not comprise a receiver and preferably the monitoring unit does not comprise a transmitter.
5. A proximity system according to any of claims 1 to 4 comprising a plurality of transmitters preferably each transmitting a different identification code allowing the receiver to separately recognise each transmitter signal.
6. A proximity system according to claim 5 comprising a plurality of alarms each alarm corresponding to a transmitter and preferably each giving a recognisably different alarm stimulus to a user.

7. A proximity system according to any preceding claim comprising an averager which averages the received signal strength and wherein the alarm will not be triggered unless the averaged signal strength fall below a predetermined value.
- 5
8. A proximity system according to any preceding claim wherein the transmitter sends a calibration signal when the calibration function is activated and the system can set the predetermined signal strength from the strength of the calibration signal.
- 10
9. A proximity system according to claim 8 wherein the calibration function can be deactivated, the predetermined signal strength being set as the average received calibration signal whilst the calibration function is active.
10. A proximity system according to any preceding claim which uses the averaged signal and an algorithm to continuously calculate the separation distance of the transmitter and receiver n use with the predetermined value already set.
- 15
11. A proximity system according to any of claims 2 to 10 when dependent on claim 2 wherein the transmitter when in use with the predetermined value already set transmits an operating identification signal such that the monitoring device will trigger the alarm when the signal strength falls below a predetermined value.
- 20
12. A proximity system according to any preceding claim wherein the alarm comprises an LED and/or is capable of emitting an audible sound when triggered.
- 25
13. A proximity system comprising a transmitter, a receiver for receiving a signal from the transmitter, an alarm triggered when the strength of the signal received by the transmitter from the receiver falls below a predetermined value. and an averager which averages the received signal strength over a predetermined length of time and wherein the alarm will not be triggered unless the averaged signal strength falls below a predetermined value.
- 30

14. A proximity system according to any preceding claim comprising an electronic device such as a mobile telephone or computer.

5 15. A proximity system according to claim 14 wherein the alarm comprises a switch, which when triggered deactivates the electronic device so that at least some of its functions cannot be used and preferably the electronic device is reactivated if the signal returns to a value above a predetermined value and/or the transmitter and receiver are no longer separated by more than the predetermined distance.

10 16. An proximity system according to claim 15 comprising a second alarm, comprising a visual indicator such as an LED and/or is capable of emitting an audible sound, triggered when the transmitter and receiver are approximately separated by more than a predetermined distance.

15



INVESTOR IN PEOPLE

Application No: GB 0212503.7

14

Examiner: Dr Stephen Richardson

Claims searched: 1-12, 14-16

Date of search: 10 March 2003

### Patents Act 1977 : Search Report under Section 17

#### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1, 3, 5, 8 at least	US 5589821 A	(SALLEN) see col 1, line 43 to col 2 line 48, col 5 lines 12-54, and claim 1.
X	1-3, 5, 6, 12	US 4675656 A	(NARCISSE) see col 2, line 13 to col 3 line 15 and claim 2.
X	1-4, 12, 14	US 6151493 A	(SASAKURA) see col 4, line 52 to col 5, line 30 and col 7, lines 29-55.
X	1-4, 7, 10, 12	US 5289163 A	(PEREZ) see col 4, lines 1-69, claim 10, and abstract.
X	1-4, 5	EP 0093463 A1	(GIVATY) see for example page 3, line 25 to page 4, line 13.
X	1-4, 12	US 6040772 A	(JACKSON) see Figure 5 and col 3, line 65 to col 5 line 16.

#### Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

#### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>v</sup>:

G4N

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

G08B

The following online and other databases have been used in the preparation of this search report:

ONLINE: EPODOC, WPI, PAJ