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(54) SYSTEM FOR MANAGING CONDITIONS

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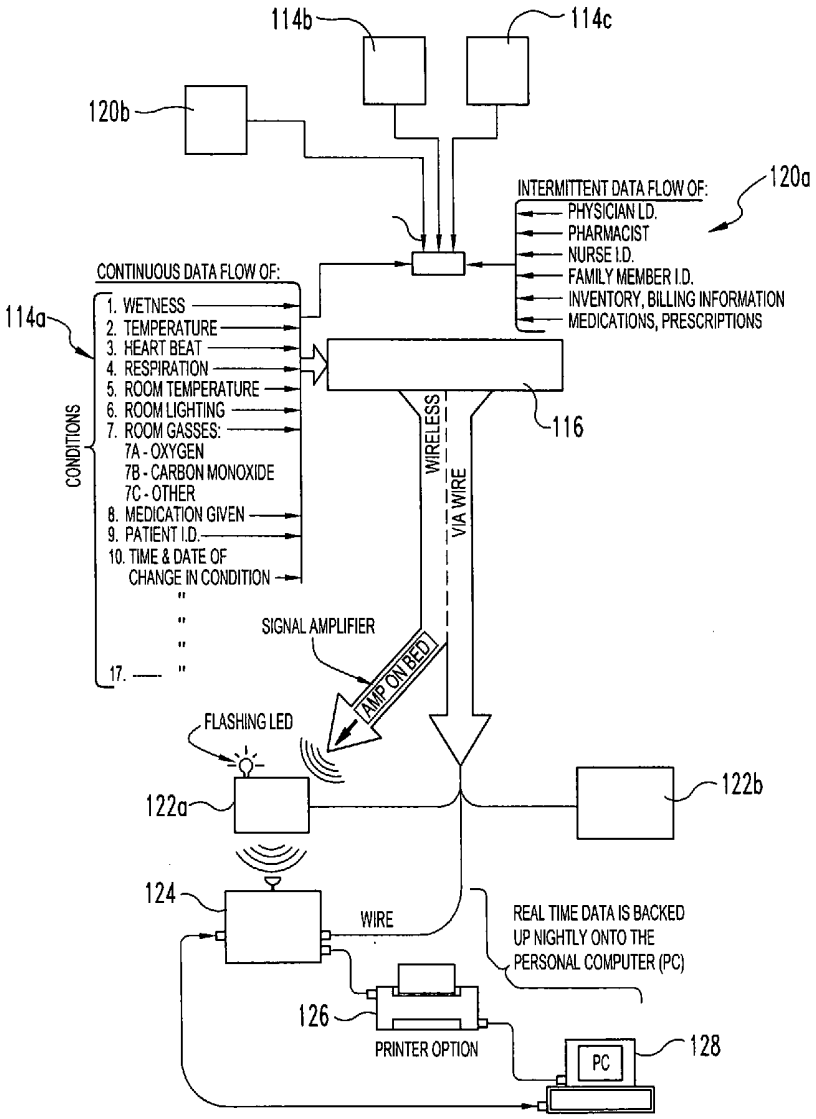
(57) **ABSTRACT**

A condition management system monitors a variety of biological and environmental conditions. Information collected with respect to conditions monitored are processed to create an information hierarchy that controls the operation of various alert devices. Important or critical conditions take precedent over less critical conditions both in terms of the nature of the alert and the processing order.



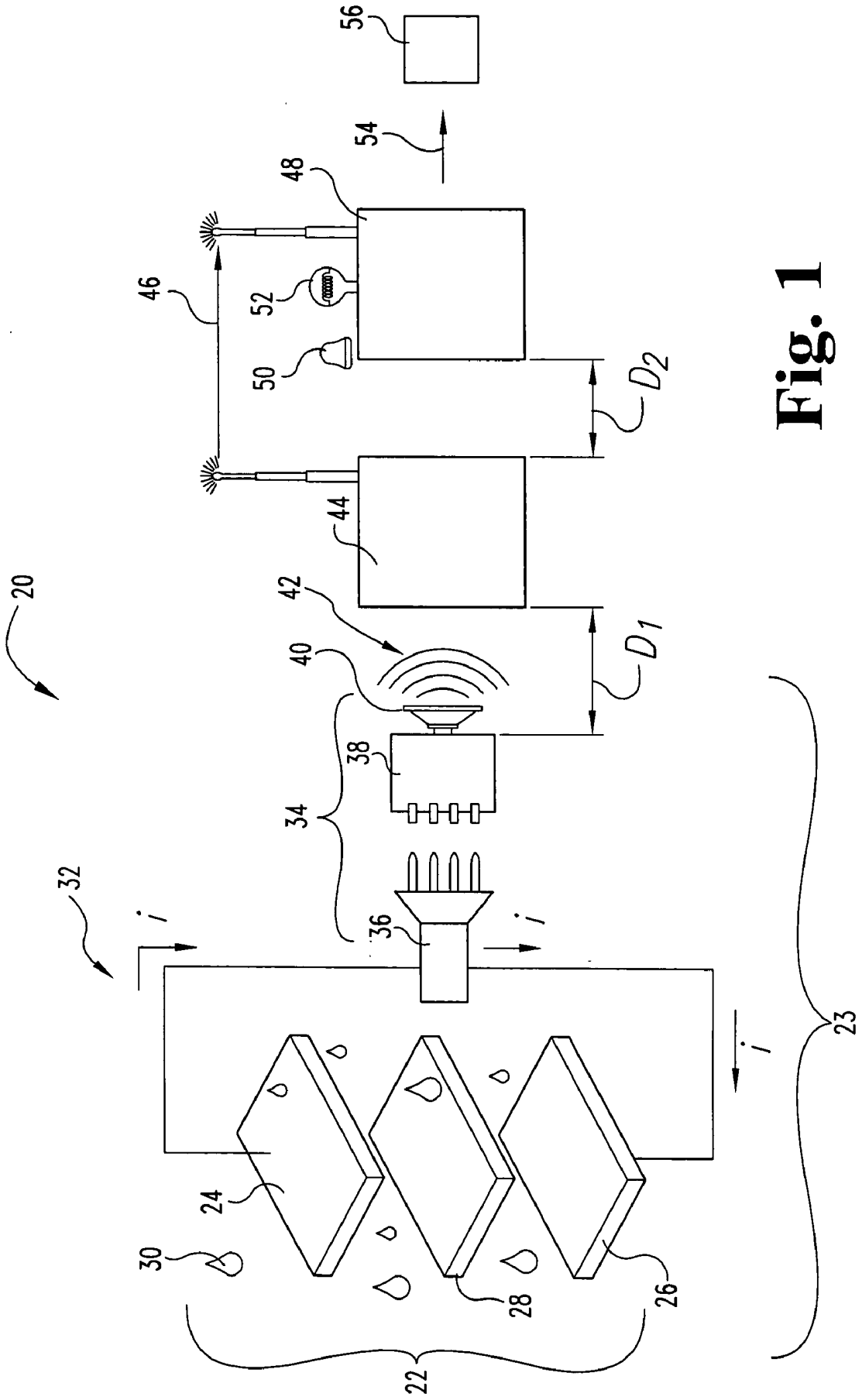


Fig. 1

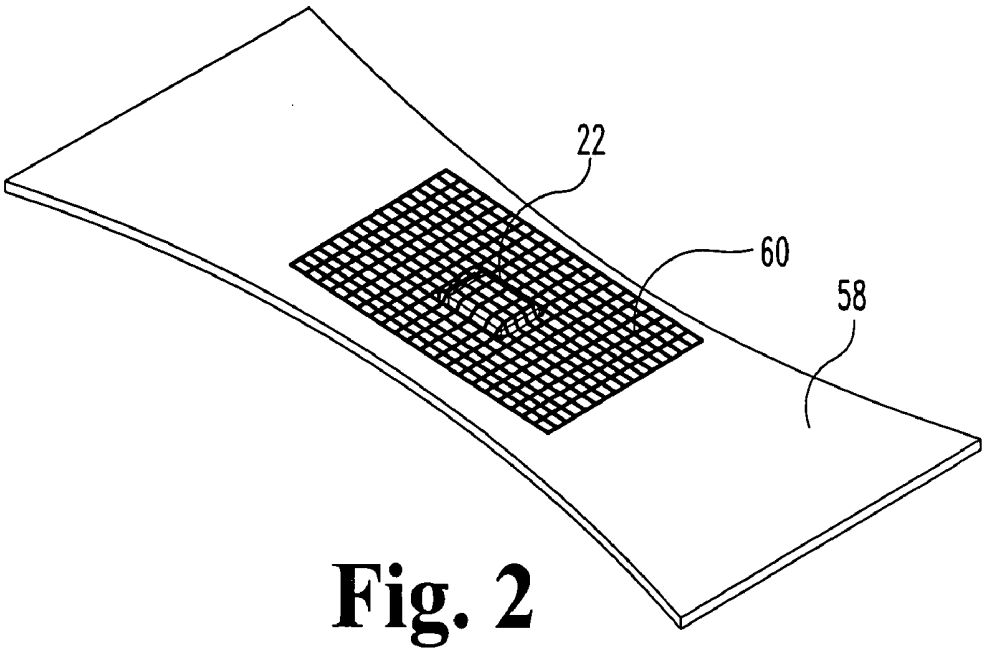


Fig. 2

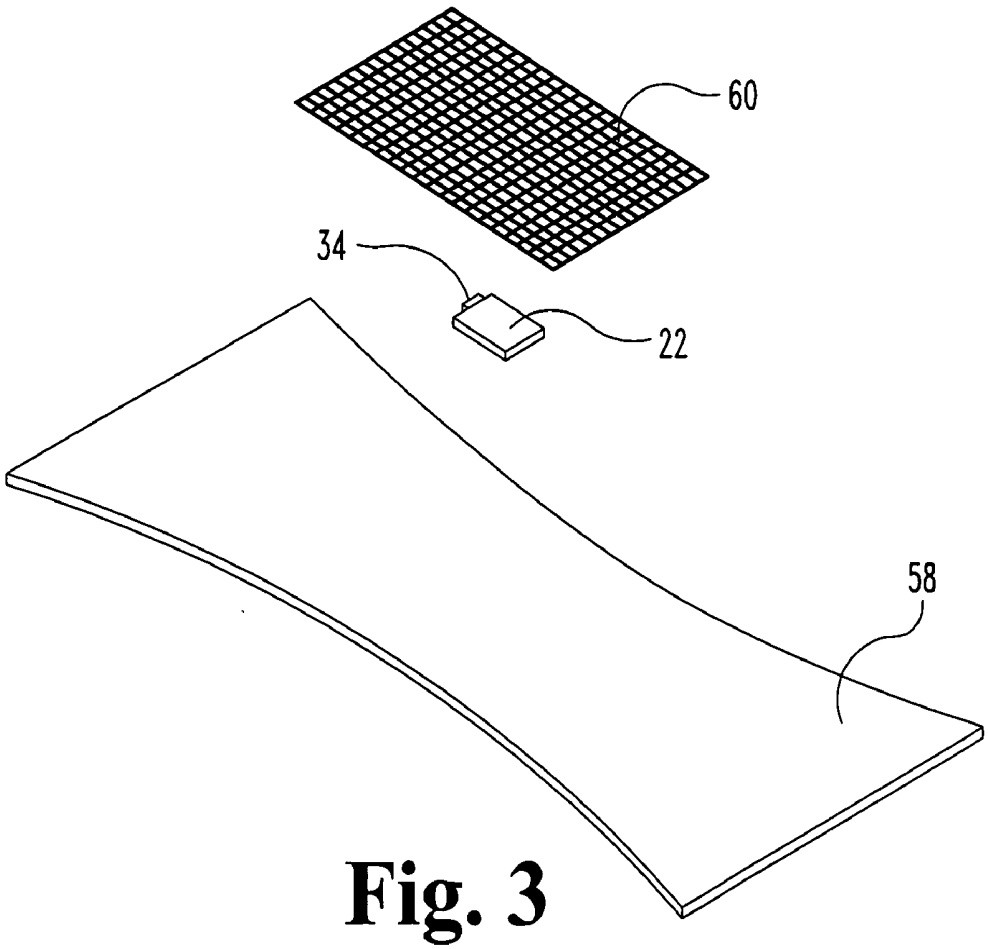


Fig. 3

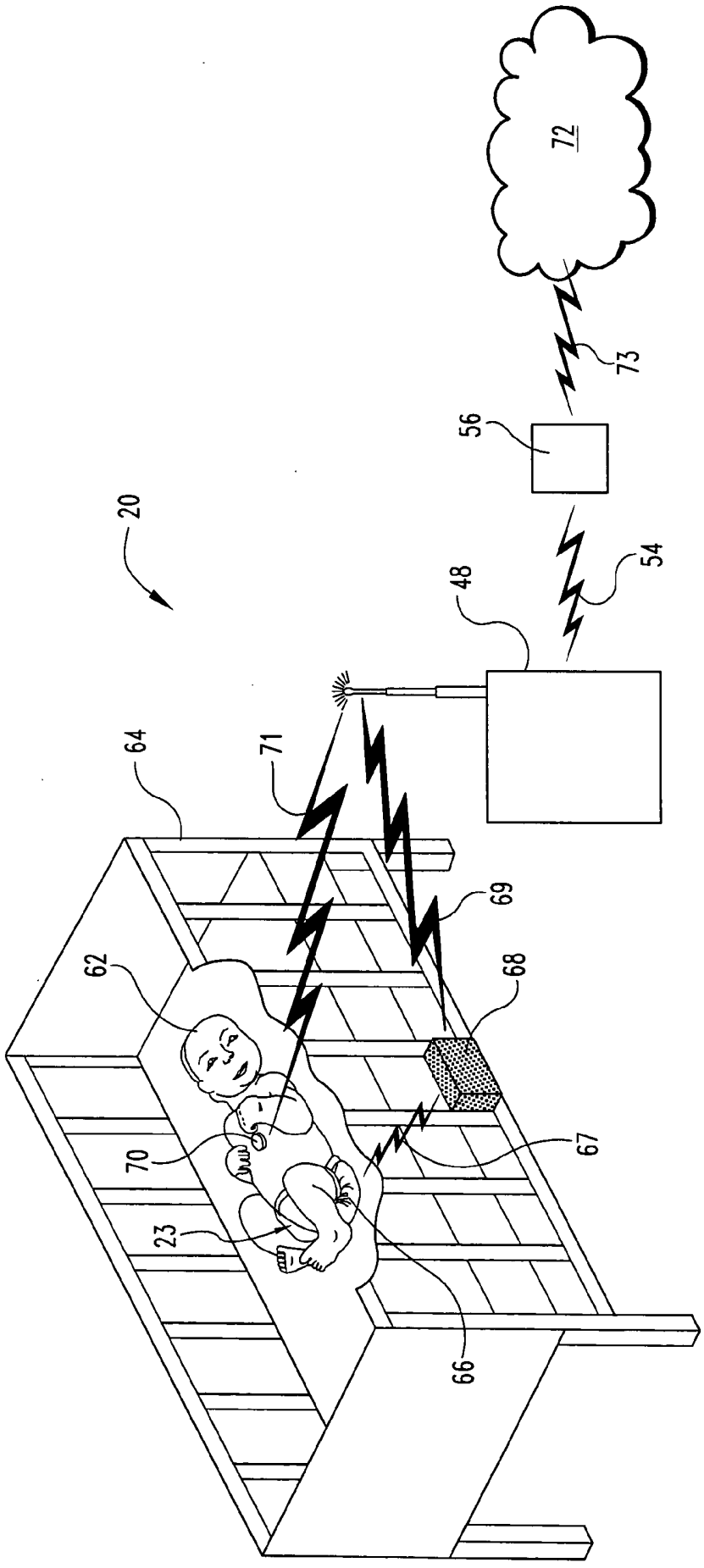


Fig. 4

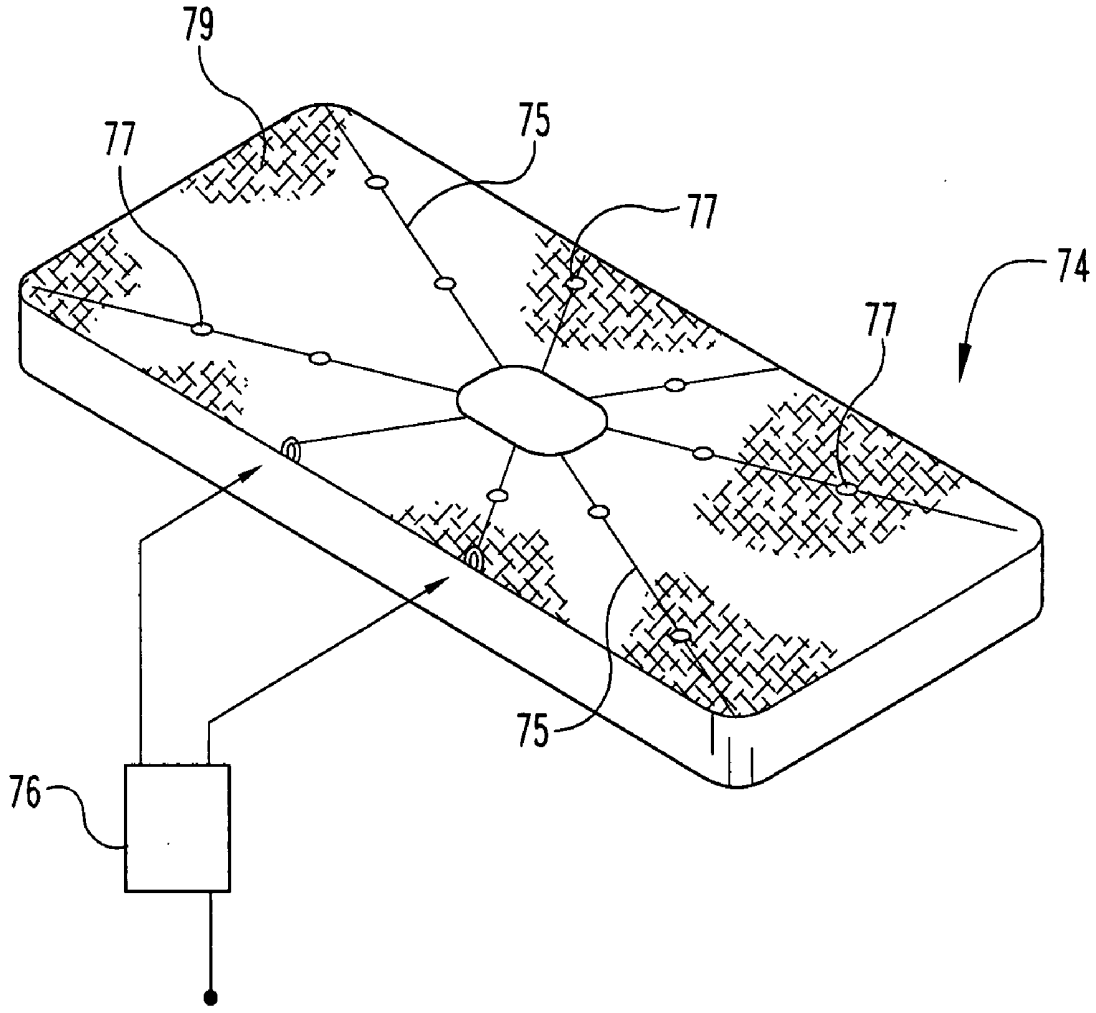


Fig. 5

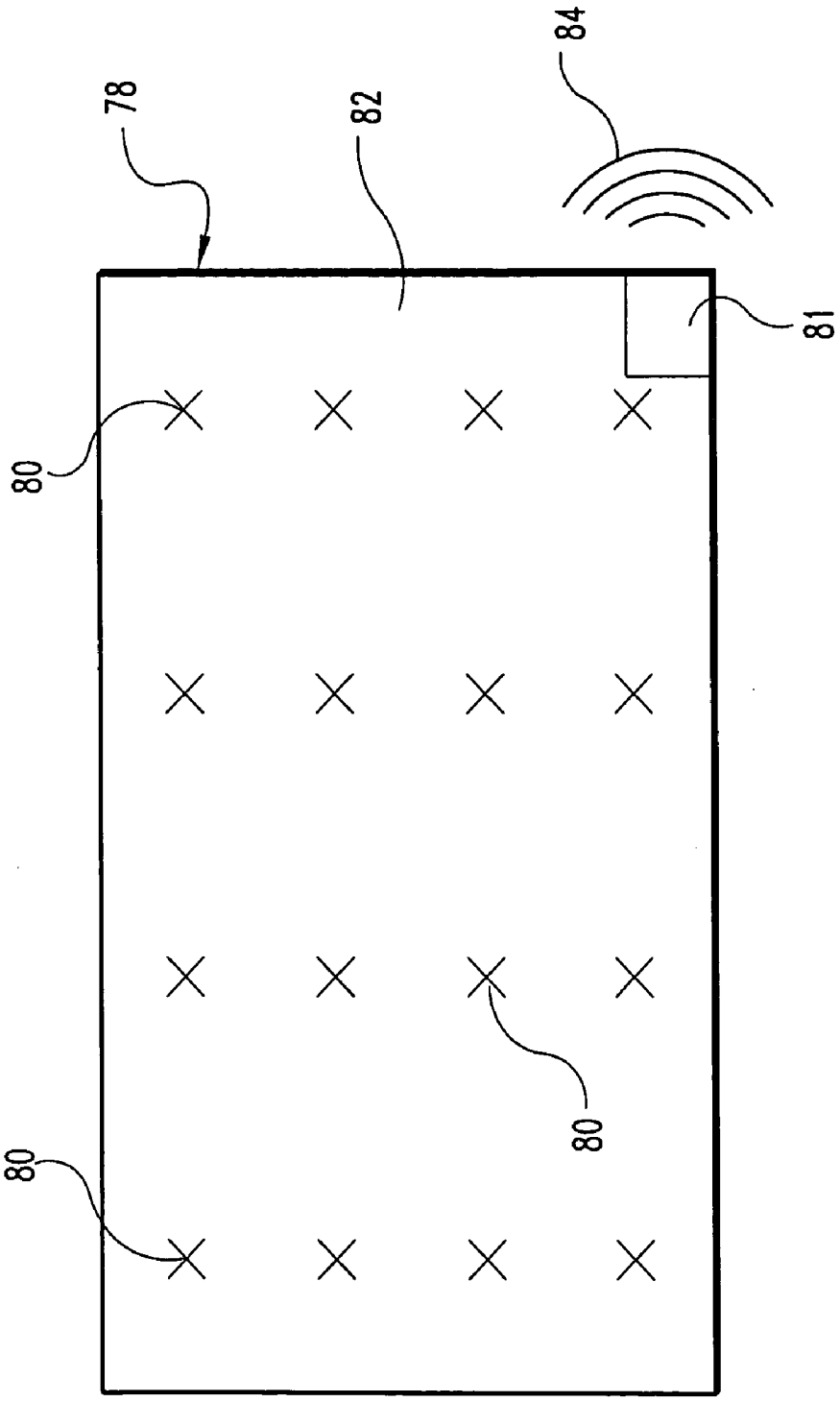


Fig. 6

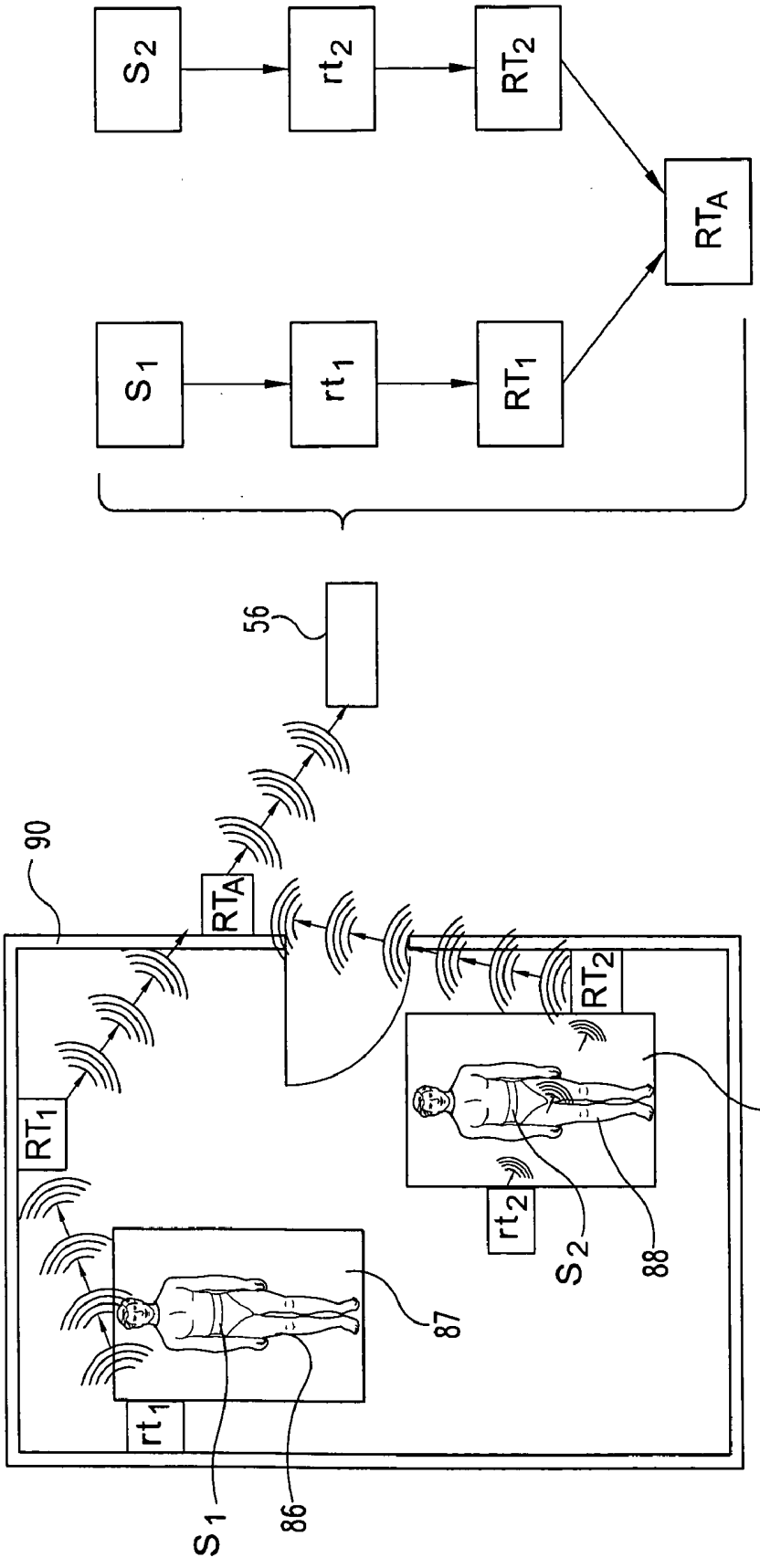

S2
rt2
RT2
RTA
S1
rt1
RT1
56
20
90
RTA
RT2
RT1
89
rt2
S2
88
87
rt1
S1
86

Fig. 7

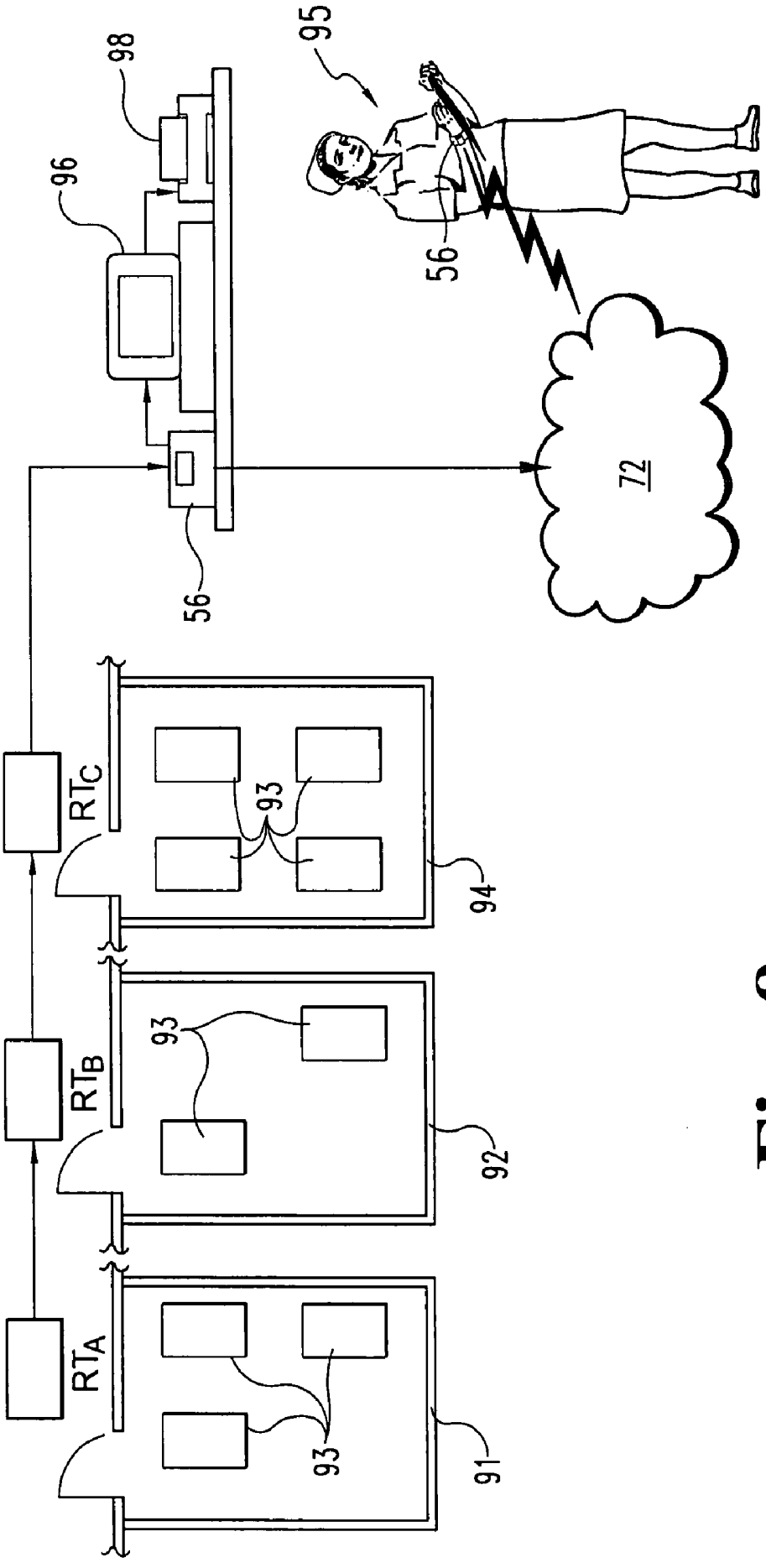


Fig. 8

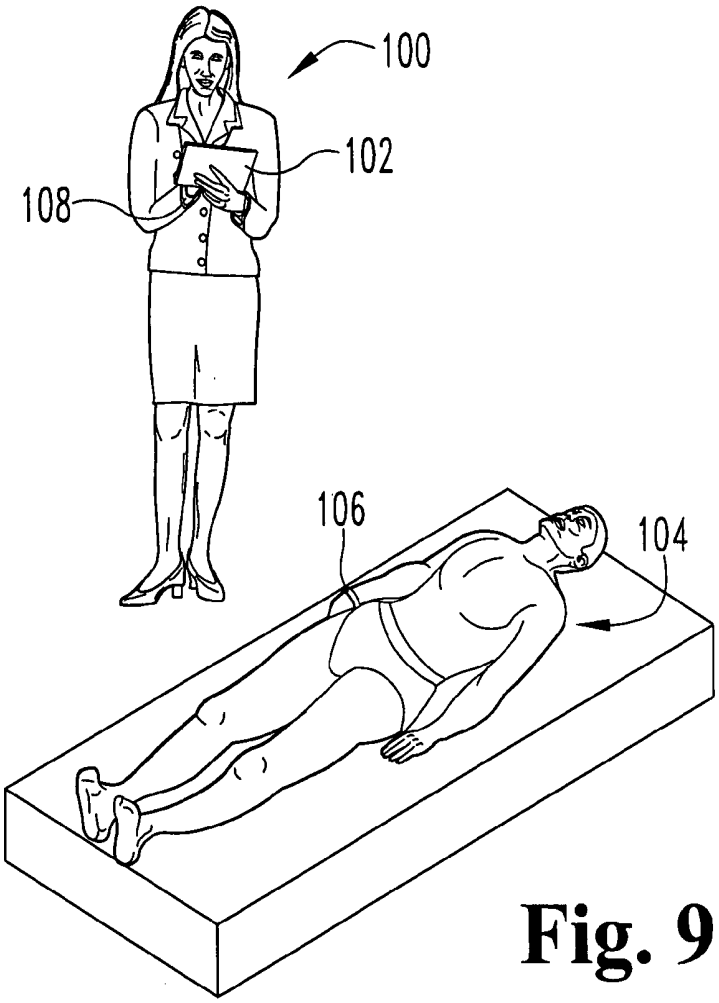


Fig. 9

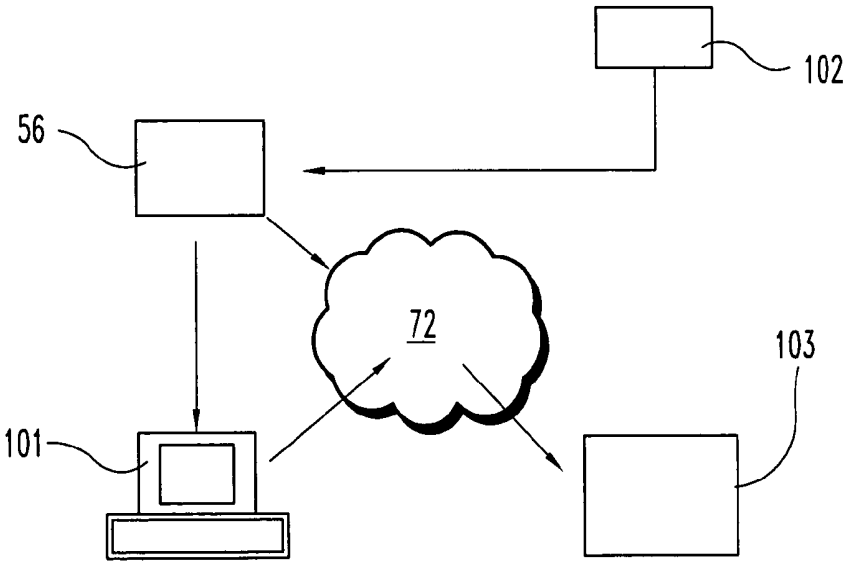


Fig. 10

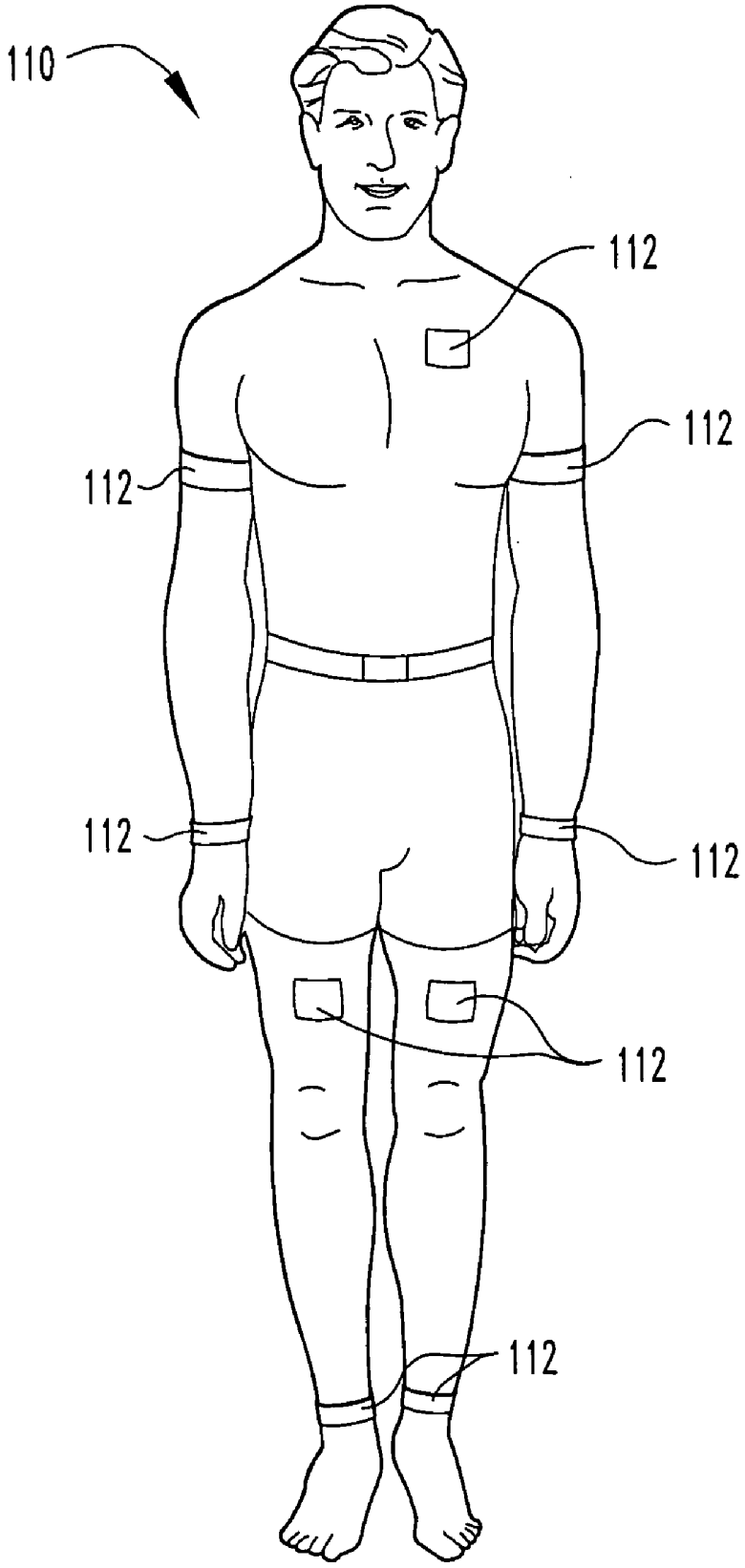


Fig. 11

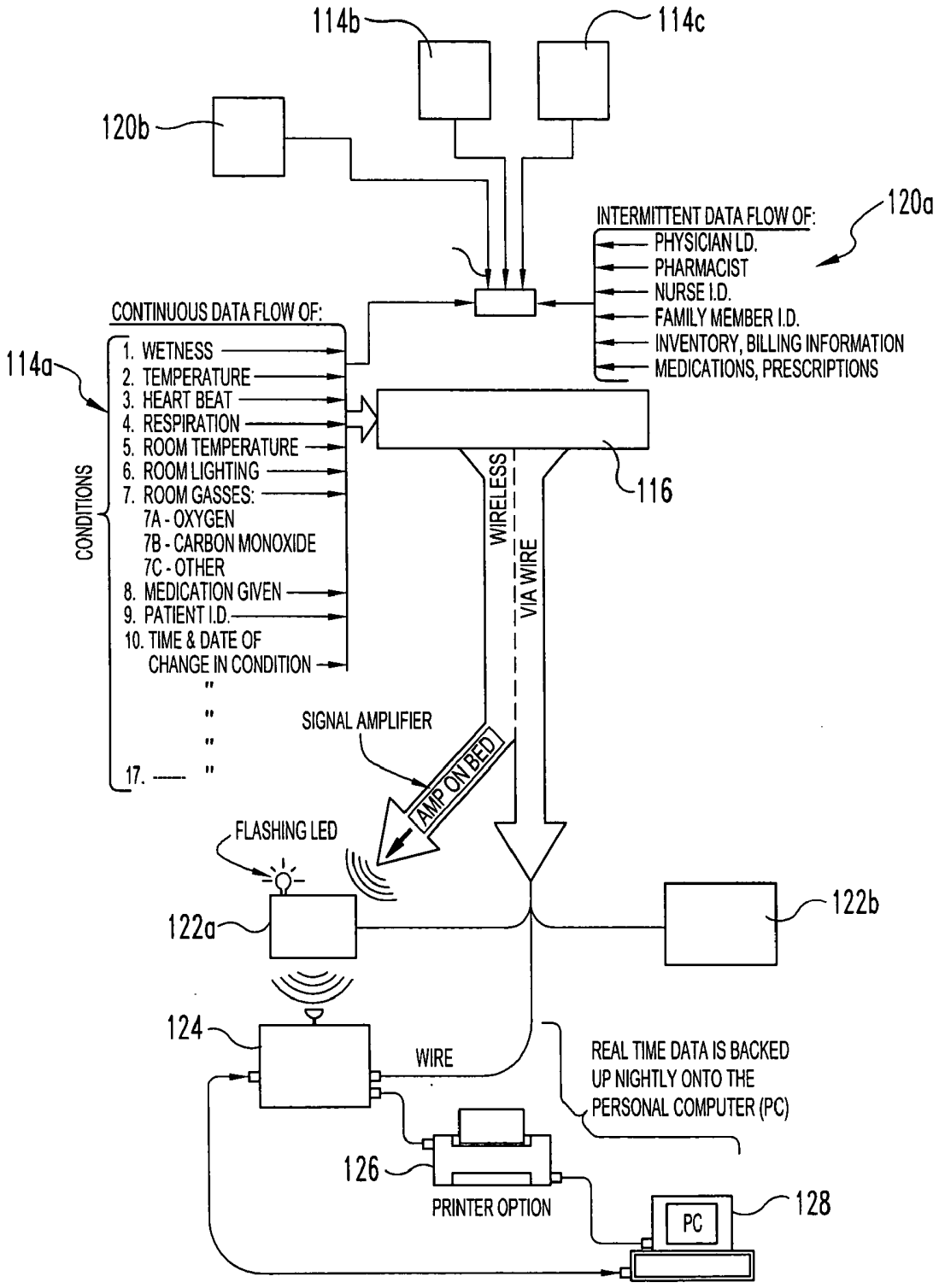

114b
114c
120b
120a
INTERMITTENT DATA FLOW OF:
PHYSICIAN I.D.
PHARMACIST
NURSE I.D.
FAMILY MEMBER I.D.
INVENTORY, BILLING INFORMATION
MEDICATIONS, PRESCRIPTIONS
CONTINUOUS DATA FLOW OF:
114a
1. WETNESS
2. TEMPERATURE
3. HEART BEAT
4. RESPIRATION
5. ROOM TEMPERATURE
6. ROOM LIGHTING
7. ROOM GASSES:
7A - OXYGEN
7B - CARBON MONOXIDE
7C - OTHER
8. MEDICATION GIVEN
9. PATIENT I.D.
10. TIME & DATE OF CHANGE IN CONDITION
17.
CONDITIONS
116
WIRELESS
VIA WIRE
SIGNAL AMPLIFIER
AMP ON BED
FLASHING LED
122a
122b
124
WIRE
REAL TIME DATA IS BACKED UP NIGHTLY ONTO THE PERSONAL COMPUTER (PC)
126
PRINTER OPTION
PC
128

Fig. 12

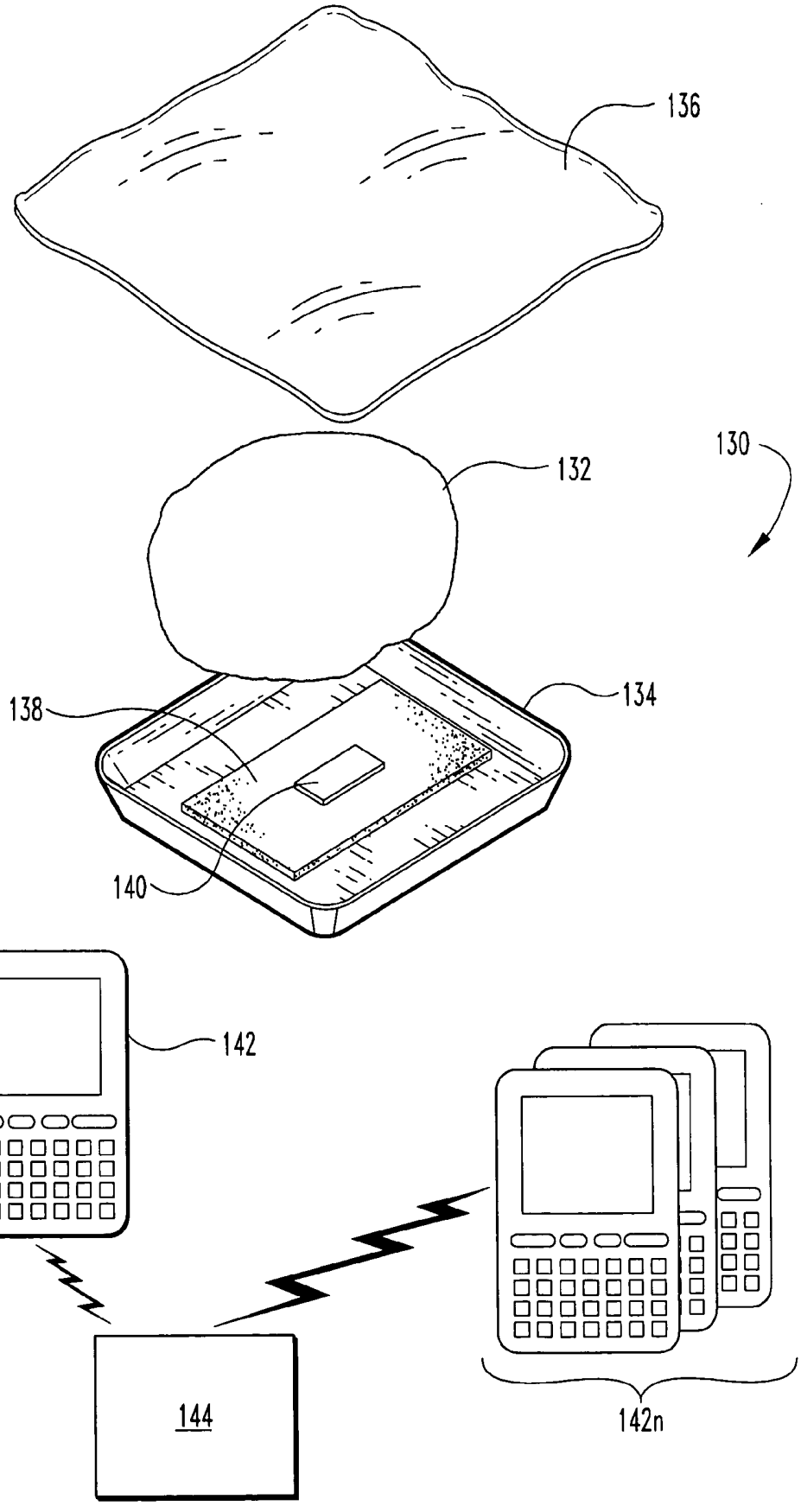


Fig. 13

SYSTEM FOR MANAGING CONDITIONS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims the benefit of U.S. Provisional Application Ser. No. 60/492,547 filed on Aug. 5, 2003, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to methods and apparatus for monitoring and detecting conditions and more particularly to managing the information obtained from such condition monitoring and detecting.

BACKGROUND OF THE INVENTION

[0003] It is becoming increasingly important to be able to accurately monitor the status of a variety of conditions for both people and objects, as well as being able to access and use the information collected in a variety of ways both local and distant from the source of the monitored condition. For example, it is estimated that one third to one half of all nursing home residents are incontinent. Incontinence problems are often neglected, unchecked or otherwise mismanaged by healthcare personnel, thereby causing discomfort and unpleasantness for the patients which often creates further health complications. As an example, many residents suffer from pressure sores (decubitus ulcers) that occur as a result of unrelieved pressure on the skin due to lack of movement. These decubitus ulcers are exacerbated by poorly managed incontinence problems, i.e., failure to change a patient's diaper or bedding when wet.

[0004] The problems in nursing homes and other managed care facilities are not limited to incontinence management. A state of crisis has been recognized in the U.S. among nursing homes, largely attributed to shortages in qualified caregivers. Common problems in care received by patients include, in addition to incontinence, malnutrition, dehydration, irregular and incorrect administration of medication, patients wandering outside of their rooms and abuse of patients by healthcare workers. The poor care received in these institutions is often most frustrating for the patients' loved ones, who often cannot regularly monitor the level of care their friend or family member is receiving.

[0005] Furthermore, the problems associated with monitoring individuals are not limited to nursing homes or health care facilities. They also extend to daycare facilities, nurseries, schools, and even individual homes. When the care of infants or children is involved, problems may arise ranging from a child who wanders unnoticed from their room to an infant who stops breathing while they are supposedly asleep.

[0006] Additionally, there is a growing need to monitor objects or locations as well as individuals. Improper storage and handling of food products may result in sickness or even death of people who eat such food. The fact that improper handling or storage had occurred is often difficult or impossible to determine. If a shopper placed a package of meat on a shelf in another area of a store, a store employee may merely return that package to the meat case without knowing how long the meat had gone unrefrigerated. Another shopper could easily purchase that meat package, never knowing that it had been left unrefrigerated for a potentially lengthy, and unhealthy, length of time.

[0007] It would be desirable to have a system to manage and monitor the conditions of objects and individuals, as well as their environment, and to utilize the information collected to perform functions or alert a responsible party in order to reduce problems that could otherwise become severe if not for the intervention.

SUMMARY OF THE INVENTION

[0008] It is therefore an object of the present invention to provide an apparatus and method for monitoring and detecting the status and/or change of a condition applicable to an object or to an individual. The information collected that relates to the status or change of the condition is managed to provide an appropriate response or remedy to any problems or difficulties that may be detected.

BRIEF DESCRIPTION OF DRAWING

[0009] The above-mentioned and other advantages of the present invention, and the manner of obtaining them, will become more apparent and the invention itself will be better understood by reference to the following description of the embodiments of the invention taken in conjunction with the accompanying drawing, wherein:

[0010] **FIG. 1** is a diagrammatic view of one embodiment of a condition monitoring system in accordance with the present invention.

[0011] **FIG. 2** is a perspective view of a garment having a wetness sensor in accordance with one embodiment of the present invention.

[0012] **FIG. 3** is an exploded perspective view of the garment depicted in **FIG. 2**.

[0013] **FIG. 4** is a perspective diagrammatic view of a practical application of one embodiment of the present invention.

[0014] **FIG. 5** is a perspective view of a sensor in accordance with one embodiment of the present invention.

[0015] **FIG. 6** is a top plan view of a mattress in accordance with one embodiment of the present invention.

[0016] **FIG. 7** is a diagrammatic view illustrating signal flow for a condition monitoring and management system in accordance with one embodiment of the present invention.

[0017] **FIG. 8** is a diagrammatic view illustrating signal flow for the condition monitoring system shown in **FIG. 7**, applied to multiple locations.

[0018] **FIG. 9** is a perspective view of one application in accordance with an embodiment of the present invention.

[0019] **FIG. 10** is a diagrammatic view of a condition monitoring and management system in accordance with one embodiment of the present invention.

[0020] **FIG. 11** is a plan view of an individual wearing sensors in accordance with an embodiment of the present invention.

[0021] **FIG. 12** is a diagrammatic view illustrating multiple features and capabilities of the present invention.

[0022] **FIG. 13** is an exploded diagrammatic view of another embodiment of the present invention related to monitoring of packaged food items.

[0023] Corresponding reference characters indicate corresponding parts throughout the several views.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] The embodiments of the present invention described below are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may appreciate and understand the principles and practices of the present invention.

[0025] Referring now to **FIG. 1**, there is shown one embodiment of a system **20** of the present invention where system **20** is used for detecting and signaling that a person has become incontinent. System **20** illustratively is shown to include a wet cell battery **22**, which further includes, in the example of **FIG. 1**, an anode **24**, a cathode **26** and an absorbent material, such as membrane **28**, disposed therebetween. In one application, battery **22** may be incorporated into a garment, such as a diaper, for example, as shown in **FIGS. 2 and 3**, and as described in more detail below. Membrane **28** is preferably impregnated with a salt, such as NaCl. In operation, when battery **22** becomes wet with urine, the salt in membrane **28** disassociates into positive and negative ions, allowing electrons to travel from the cathode back to the anode, thereby creating a current flow. In this way battery **22** acts as a wetness or incontinence detector. Wet cell batteries are well-known in the art and their operation need not be described in further detail herein. Technology is also available to manufacture paper batteries, as well as paper antennas, with conductive ink, thereby further simplifying the manufacture of the components of system **20**.

[0026] In the illustrated embodiment of **FIG. 1**, anode **24** and cathode **26** may be made from thin foil of suitable dimension, and membrane **28** may be made from cotton cloth, cellulose fibers, non-woven polyethylene or polypropylene, or some other porous, conductive or non-conductive membrane. Anode **24** and cathode **26** may also be made from aluminum, steel, copper, composites of these and other materials suitable.

[0027] In the illustrated embodiment of **FIG. 1**, membrane **28** is impregnated with potassium chloride and sodium chloride in trace amounts, and the assembly of battery **22** is accomplished through a laminated assembly process.

[0028] As shown in **FIG. 1**, current **32** (identified by arrow i) powers annunciation device **34** that is made up of a base or first member **36** through which the current passes, and a second or attachment member **38** that incorporates a speaker **40** which produces an acoustic signal schematically illustrated by sound rings **42**. In the embodiment of **FIG. 1**, device **34** is illustratively made in a combination of hand and automatic assembly and made available by SMT Sales, Inc., 323 Owego Street, Montour Falls, N.Y. 14865 U.S.A. Device **34** may, for example, include a semiconductor timer, such as that identified by the designation LM555 (available from National Semiconductor), which can be used to measure the degree of wetness based on the timer output frequency.

[0029] While device **34** is shown in the embodiment in **FIG. 1** as producing acoustic signal **42**, it would be readily recognized by one of ordinary skill in the art that current **32** generated by battery **22** could be used to power a wide variety of signal producing devices, including but not limited to, radio frequency transmitters, light bulbs, light emitting diodes

[0030] (LEDs), infrared transmitters, electromagnetic devices and the like. If device **34** is configured to produce an acoustic signal, for example, an acoustic converter **44** is preferably positioned a distance D_1 from device **34**. Distance D_1 will be chosen based on the volume of the acoustic signal produced by device **34**. In the illustrated embodiment of **FIG. 1**, converter **44** is made in a combination of hand and automatic assembly and made available by SMT Sales, Inc., 323 Owego Street, Montour Falls, N.Y. 14865 U.S.A. In one application, for example, converter **44** may be mounted to the bed of the patient wearing battery **22** and device **34**. The combination of battery **22** and device **34** are referred to herein as sensor **23**. Sensor **23** may be manufactured as part of a diaper and made disposable, e.g., with a paper battery and paper antenna, or it may be implemented in a reusable smart card that is inserted into a slot formed into the diaper during manufacture. The smart card could also store condition information for use at a later time.

[0031] Converter **44** receives acoustic signal **42**, amplifies it and converts it to a radio signal **46** that is transmitted to transceiver **48**. The distance between converter **44** and transceiver **48**, shown in **FIG. 1** as D_2 Clearly, D_2 can be much greater than D_1, as D_1 is limited by the signal volume or loudness of speaker **40** of device **34**. In the illustrated embodiment of **FIG. 1**, transceiver **48** is made in a combination of hand and automatic assembly and made available by SMT Sales, Inc., 323 Owego Street, Montour Falls, N.Y. 14865 U.S.A. It should also be appreciated that system **20** may be designed and constructed to eliminate device **34**, such that detection of wetness by battery **22** directly causes converter **44** to transmit a signal to transceiver **48**.

[0032] In one application of the present invention, transceiver **48** may be located outside the room of a patient and mounted to a wall, for example. Transceiver **48** may be configured with one or more signal-producing devices, such as audible device **50** and/or light **52**. Transceiver **48** may also relay a signal to a base station **56**. In one embodiment, base station **56** is located at a health care facility nurse's station. Base station **56** may be configured to receive signals **54** from multiple transceivers, collectively designated as **48**, that are located within different patient rooms in the same facility, or from different facilities entirely.

[0033] In another embodiment, base station **56** may be represented as a bracelet mounted, necklace mounted, belt mounted, or wall mounted device, any of which may incorporate a light bulb or buzzer, for example, to provide an immediate alert signal, or base **56** may contain electronic or computer memory storage for storing signals and data.

[0034] Turning now to **FIGS. 2 and 3**, battery **22** can be installed in a garment **58**, such as a diaper, absorbent pad, sleeping garment, bed pad, wound dressing or bandage. Mesh **60** is preferably selected from a material that will spread or wick urine or some other body fluid to battery **22**, thereby activating it. That is, until membrane **28** becomes wet, battery **22** does not generate a current. Many suitable

materials for mesh **60** are known in the art, such as, but not limited to, polyester and natural fibrous materials. In the illustrated embodiment of **FIGS. 2 and 3**, garment **58** is made of multiple layers of nonwoven, spunbond polyethylene and polypropylene, laminated to multiple layers of absorbent cellulosic material. Battery **22** is inserted within the mesh layers in a combination of hand and automatic assembly and made available by SMT Sales, Inc., 323 Owego Street, Montour Falls, N.Y. 14865 U.S.A.

[**0035**] Conditions other than wetness alone may also be monitored. A variety of testing apparatus or components may also be incorporated within sensor **23**. For example, the specific gravity of the urine may be measured to determine if the patient is dehydrated. Other measurements, such as urine pH, muscle contraction, and the amount of urine expelled, can be used to determine other health or body conditions. Other tests or measurement would be readily apparent to one skilled in the art.

[**0036**] With reference to **FIG. 4**, the benefits of system **20** are shown. Infant **62** in crib **64** is shown wearing a garment **66** having sensor **23**, as described above. Although **FIG. 4** shows an infant, system **20** is equally applicable to adults as well, with a bed being substituted for crib **64**. When infant **62** (or adult, as the case may be) urinates, battery **22** in sensor **23** generates a current, which in turn produces a signal **67**, e.g., acoustic or otherwise. Detector **68** (which corresponds in function to converter **44** in **FIG. 1**) illustratively converts signal **67** received from sensor **23** to a radio frequency signal **69**, amplifies it, and transmits it to transceiver **48**. In turn, transceiver **48** relays a signal **54** to base **56**. In the embodiment illustrated in **FIG. 4**, base **56** may be a central station in a day care facility, for example. Base **56** may receive multiple signals **54** from multiple transceivers **48** that are located in different rooms of the facility, for example. An operator positioned at base **56** may dispatch a caregiver to perform some service, such as changing the diaper of infant **62**, when an appropriate signal **54** is received.

[**0037**] Other conditions of infant **62**, or of the environment surrounding infant **62** can also be monitored, including blood pressure, respiration rate, body and room temperature, lighting, etc., as described in more detail below. As one example, a sensor **70** may monitor heartbeat. Sensor **70** may also be made available by SMT Sales, Inc., 323 Owego Street, Montour Falls, N.Y. 14865 U.S.A. Sensor **70** may be configured to send a signal **71** to transceiver **48** when the infant's heartbeat stops or becomes irregular. Transceiver **48** thereafter transmits a signal **54** to base **56**. Advantageously, system **20** can be linked to a communications network, for example, the internet as shown by reference numeral **72**. That is, information received by base **56** can be in turn transmitted to the internet, as signal **73** in **FIG. 4**, by conventional means, such as a computer or wireless device that may be incorporated in base **56**. If infant **62** is being watched at a day-care facility, the infant's parents could log on to a specific web site to check whether the infant's diapers are timely being changed. The parents could also check other vital signs that may be monitored, such as respiration, heart rate and body temperature. These capabilities are similarly advantageous for private residences, nursing homes and other facilities. Significantly, the invention provides a powerful tool for family members or others to determine the current state of health (e.g., fever, dehydration) as well as to ensure that their loved ones are receiving proper care.

[**0038**] Turning to **FIG. 5**, a mattress **74** may be configured such that it produces a signal in response to a multiplicity of conditions, including, for example, the presence of blood, wetness due to incontinence, heart rate, respiration, body temperature, lack of movement, and the like. In the illustrated embodiment of **FIG. 5**, mattress **74** is a typical bed mattress that has micro-filament conductive wires **75** interspersed throughout the surface of the mattress in variable patterns and in physical contact with multiple, dispersed microsensors **77**. **FIG. 5** shows a cotton textile overlay **79**, such as a typical fitted bed sheet, that has microfilaments **75** and sensors **77** sewn or screen printed onto textile sheet **79**. Each microfilament wire **75** uses the same principal condition detection method described with respect to **FIG. 1**. Signals indicative of the condition detected by the microsensors are conducted via microfilaments **75** to connectors **81** that are connected to transmitter **76** in either a detachable or permanently attached manner.

[**0039**] In the illustrated embodiment of **FIG. 5**, transmitter **76** may be employed to power the sensors **77** in mattress **74**, or sensors **77** in mattress **74** may be "passive."**FIG. 6** presents another example of a mattress **78** which includes multiple transducers (i.e., sensors) **80** disposed within a "smart pad"**82** placed on top of mattress **78**. Transducers **80** could be configured, for example, to detect movement, or lack thereof, in a bed. Further, transducers **80** may be configured to detect where specifically on the bed a patient is located or whether the patient is no longer in the bed. Transducers **80** may further be configured to generate a signal that is applied to annunciator **81** which in turn produces acoustic signal **84** to alert a caregiver that a particular condition has been detected. Transducers **80** may comprise a variety of different types of transducers for monitoring and detecting a variety of conditions. Annunciator **81** is therefore configured to receive signals from different types of transducers, and may be capable of determining to which condition a particular signal relates. In this way, annunciator **81** may generate different types of signals, e.g., light, bell, horn, depending upon the seriousness of the condition that is being monitored. For example, diaper wetness may cause annunciator **81** to initially turn on a light, while a sudden drop in heart rate or respiration may indicate a critically serious heath problem, such that annunciator **81** sounds a loud horn or buzzer. Annunciator **81** may also sound a buzzer or bell if a patient who has experienced diaper wetness is not attended to within a reasonable period of time following the light being lit. In this way, system **20** discriminates between signals based on their seriousness initially as well as any escalating seriousness that may result from lack of response given to earlier alert signals.

[**0040**] **FIGS. 7 and 8** illustrate some of the capabilities of system **20** in accordance with an embodiment of the present invention. As shown, a patient **86** in bed **87** of room **90** is wearing a garment with sensor S_1 (such as sensor **23** as shown in **FIG. 1**). Upon occurrence of a condition (e.g., incontinence), sensor S_1 provides a signal to rt_1 (such as converter **44** as shown in **FIG. 1**). In turn, rt_1 provides a signal to RT_1 (which corresponds to transceiver **48** as shown in **FIG. 1**). Patient **88** and bed **89** are also located in room **90** and are similarly configured with sensor S_2, converter rt_2

and transceiver RT_2. An intermediate transceiver RT_A can be positioned outside room **90** as shown. RT_A can provide multiple functions, including producing a signal exterior to room **90** to alert an attendant or other passerby that there is a condition in room **90** that must be checked and attended; and transmitting data to a base station **56**. Signal flow for room **90** is represented in a flowchart on the right hand side of **FIG. 7**. As can be seen, transceiver RT_A acts as an information collector or hub, and may discriminate between the signals from RT_1 and RT_2 in order to process the signal indicating the most serious or critical condition vis-à-vis patients **86** and **88**.

[**0041**] As shown in **FIG. 8**, information can be relayed among several rooms **91**, **92** and **94**, each having one or more beds designated as **93** and configured to provide appropriate condition-identifying signals, to transceivers RT_A, RT_B and RT_C. Information may also be collected from each patient, or for each room, by attendant or caregiver **95** via a wrist or neck-worn base **56** as described in connection with **FIG. 1**. Transceivers RT_A, RT_B and RT_C (. . . RT_n) can relay their signals to base station **56** serially (as shown) or directly. Base stations **56** may relay the information to internet **72** , as shown, via a telephone or cable modem, or via an acceptable wireless protocol, such as the Bluetooth wireless protocol administered by Bluetooth SIG, Inc. Data is also received and stored by computer **96**, which in turn is connected to printer **98** that may be used to generate hard copy reports.

[**0042**] The system of the present invention can also be used to help a caregiver, physician, pharmacist or nurse to administer aid to a patient. With reference to **FIG. 9**, an illustrative example shows a patient **104** being treated by a nurse **100**. Nurse **100** is equipped with a personal digital assistant ("PDA") **102**. One type of PDA is manufactured by 3COM and sold under the Palm brand. Other suitable PDAs are mobile phones, cellular phones and pagers. PDA **102** is configured with a recognition system that confirms nurse **100** is treating the correct patient. One such recognition system may include a fingerprint recognition pad, a heartbeat identification receiver/scanner, or some other device that can accurately verify the identify of a patient. Patient **104** may also be configured with a bracelet **106**, or some other type of wearable device, which includes patient data and is capable of transmitting the same to PDA **102**. Nurse **100** may also wear a bracelet **108** that includes identification information about nurse **100** that may also be transferred to PDA **102**.

[**0043**] Once PDA **102** reads or otherwise obtains information about patient **104**, either by means of bracelet **106** or by a recognition system such as those described, PDA **102** may provide instructions for nurse **100** to administer treatment such as medicine to patient **104**. PDA **102** may then prompt nurse **100** to confirm that the medicine has been administered, thereby creating a patient record.

[**0044**] **FIG. 10** illustrates how information such as that acquired from nurse **100** can be managed. As shown, patient data and treatment information stored on PDA **102** may be made available in real time on the internet, for example, to family members of the patient, or to the patient's physician or healthcare provider management or medical payor, such as a medical insurance company. As illustratively shown in **FIG. 10**, information from PDA **102** is transferred to base station **56**, which may upload that information to internet **72** directly, or through intermediate means, such as computer **101**. The information is then made available to authorized persons, as described above, via internet access device **103**, such as a computer, PDA, or cellular telephone, for example. Base station may also initiate a call to emergency medical personnel, or to a patient's family, should the status of a condition warrant it. For example, if an incontinent patient had not be changed for a long period of time, base station **56** could initiate a call to the patient's spouse or other family member informing them, perhaps through a computer-generated message, that their loved one was not receiving proper care.

[**0045**] As made clear from **FIG. 11**, the present invention is not limited to the monitoring and management of any particular patient condition. As shown, many conditions can be monitored, such as blood pressure, brain activity, blood oxygen saturation, heart rate, respiration, incontinence, body temperature, muscle activity, impact (indicating a fall has occurred), medication history, treatment history, and patient location, or environmental conditions, such as ambient or room temperature, humidity, carbon monoxide level, to name just a few. **FIG. 11** shows a representative patient **110** having a number of sensors, all designated **112**, located proximal to or in contact with his body. Sensors **112** communicate with devices such as converter **44** and transceiver **48** in order to provide the necessary patient condition data which is then processed in a manner that generates appropriate alert signals in an appropriate hierarchical order indicative of the degree of criticality of the status of the condition being monitored. One application could be to use system **20** as a conventional audible baby monitor along with an indictor, such as a light, to indicate some other condition, such as wetness. In this way, a parent or caregiver hearing a baby cry over the monitor would have additional information to determine the reason for crying.

[**0046**] **FIG. 12** provides a flowchart that illustrates through one example many of the features of the present invention and their relation to one another. The figure also illustrates data flow from the point of sensing of a condition to various data output devices. List **114***a* includes a number of possible conditions that may be monitored or measured by the system of the present invention. List **114***a* is not intended to be all inclusive, but only to act as representative examples of monitorable conditions. Typically each condition will be associated with a separate sensor, but some sensors may be sufficiently sophisticated or complex to monitor multiple conditions. Output signals from the sensors associated with list **114***a* are applied to processor **116**, which may include devices similar to converter **44** and transceiver **48**, or some other device or circuitry that performs similar functions. Other patients having their own associated lists, such as lists **114***b* and **114***c*, for example, may also provide information to processor **116**. Verification of patient identity may be done by verifier **118** through fingerprint recognition or some other form of identity recognition. Caregiver or authorized person information, represented by lists **120***a* and **120***b*, may also be verified by verifier **118**. Proper verification of patient and, in some cases, authorized persons, may be required by verifier **118** before processor **116** accepts information from the sensors associated with lists **114***a*, **114***b* or **114***c*, or those persons associated with lists **120***a* or **120***b*.

[0047] In accordance with an aspect of the present invention, processor **116** identifies and discriminates the items of information that are generated by the various sensors. The signal hierarchy, as described previously, may determine the type of alert that is activated, e.g., light, buzzer, horn, notification at nurses station, as well as any escalation of alert that may be needed due to a failure to timely respond to a lower level alert. The hierarchy may also be used to determine who has access to particular information. For example, information concerning room temperature may not be made available to the patient's family, but certainly body temperature or heart rate would most likely be made available. Processor **116** also determines the order in which signals should be processed from different patients and/or different rooms or locations. The information hierarchy created by processor **116** controls the operation of alert displays **122***a* and **122***b*. The information from processor **116** may be transmitted or otherwise transferred to various devices, such as alert devices **122***a* and **122***b* (and possibly many other alert devices as well), by either wired or wireless means. Alert device **122***a* is shown as also incorporating wireless transmission means, which may be via cellular phone communications, or via the internet, for example, that communicates with receiver **124**. Receiver **124** may also receive information signals by hardwire means as well. Receiver **124** is illustratively shown as being connected to a printer **126** and an computer **128**, although connection to other devices, by wired or wireless means, is also contemplated.

[0048] The examples given have primarily dealt with the monitoring of conditions related to infants, or to patients in health care facilities. Monitoring of individuals for other purposes is also contemplated by the present invention, such as the location of students within a school, locating a nursing home patient who wanders unnoticed out of a facility, aiding in finding abducted children or children who run away from home, or any number of other possible purposes.

[0049] Existing technology that can be useful in implementing embodiments of the present invention is available from Westinghouse lighting Systems Division under the name Retrolux. This technology incorporates wireless communications technology associated with fluorescent lighting fixtures and bulbs that may be used to provide the necessary communications link for the devices in system **20** described herein. Outdoor alert signs or billboards may also be used in connection with this technology.

[0050] In accordance with another aspect of the present invention, condition monitoring is not limited to conditions associated with individuals. Conditions of animals or objects may be monitored as well, with physical location and body conditions of animals in homes, zoos and in the wild being desirable. **FIG. 13** illustrates a monitoring system **130** which is used to monitor the condition of an object, for example, the quality of the environment in which the meat or other food is packaged. System **130** illustratively includes a selection or cut of meat **132** , e.g., steak or roast, conventionally packaged with a foam tray **134** and plastic overwrap **136**. Pad **138**, which may be used to control moisture within the package, is disposed between meat **132** and tray **134**. A sensor **140** is placed within the package and preferably in contact with meat **132**. Sensor **140** may also be incorporated within pad **138** for manufacturing purposes. Sensor **140** may be configured to monitor or measure one or more characteristics, such as, for example, current temperature, maximum temperature, moisture content, or bacterial count. Other characteristics may also be monitored as desired.

[0051] Information from sensor **140** may be collected via known, conventional means, such as by rf tagging technology, visual inspection (e.g., sensor **140** may be visible through a transparent area of tray **134**) that indicates a particular condition, or other means that cause sensor **140** and any associated circuitry to transmit or otherwise transfer information to a collection device. Such a collection device might take the form of a PDA, or a wrist-worn receiver. In **FIG. 13**, collection device is shown as PDA **142** incorporating wireless communication technology. Information collected by PDA **142** may be transmitted to a base station **144**, which may also collect information from a number of other PDAs, illustratively shown as PDA **142***n*. PDA **142** and/or base station **144**, in accordance with an aspect of the present invention, processes the collected information and creates an information hierarchy that is used to generate alert signals that are applied to various alert systems. For example, an indication that a loaf of bread were hard or stale might generate a message to the department manager that stock should be replaced when convenient. An indication that high bacteria level were found in a package of meat could generate an alarm that required immediate action to remove that package before it was inadvertently purchased by a customer who might later become ill. Other examples of object monitoring will be apparent to one skilled in the art and are intended to be included within the scope of this disclosure.

[0052] While preferred embodiments incorporating the principles of the present invention has been disclosed hereinabove, the present invention is not limited to the disclosed embodiments. Instead, this application is intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

What is claimed is:

1. A condition monitoring system comprising:

at least one monitor for providing at least one indication of at least one condition;

a detector, adapted to receive a plurality of indications from a plurality of monitors, for receiving said at least one indication and producing a signal indicative of said at least one condition and said at least one indication; and

a receiver responsive to said detector signal for generating at least one alert signal and applying said at least one alert signal to a particular one of a plurality of alert devices, said particular alert device determined by at least one of said at least one condition and said at least one indication.

2. The system described in claim 1, wherein said at least one condition comprises incontinence.

3. The system described in claim 1, wherein said at least one condition comprises body temperature.

4. The system described in claim 1, wherein said at least one condition comprises blood pressure.

5. The system described in claim 1, wherein said at least one condition comprises heart rate.

6. The system described in claim 1, wherein said at least one condition comprises respiration rate.

7. The system described in claim 1, wherein said at least one condition comprises degree of movement.

8. The system described in claim 1, wherein said at least one condition comprises physical location.

9. The system described in claim 1, wherein said at least one condition comprises ambient temperature.

10. The system described in claim 1, wherein said at least one condition comprises moisture content.

11. The system described in claim 1, wherein said at least one condition comprises a bacteria level.

12. The system described in claim 1, wherein said at least one condition comprises a maximum exposure temperature.

13. The system described in claim 1, wherein said at least one alert signal comprises an audible alarm.

14. The system described in claim 1, wherein said at least one alert signal comprises the initiation of a telephone call.

15. The system described in claim 1, wherein said at least one alert signal is accessible via the internet.

16. A method for monitoring a condition comprising the steps of:

generating at least one indication of at least one condition;

receiving said at least one indication and producing a signal indicative of said at least one condition and said at least one indication; and

generating at least one alert signal responsive to said condition indicative signal and applying said at least one alert signal to a particular one of a plurality of alert devices, said particular alert device determined by at least one of said at least one condition and said at least one indication.

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摘要(译)

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