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(54) **TEMPERATURE MEASURING DEVICE**

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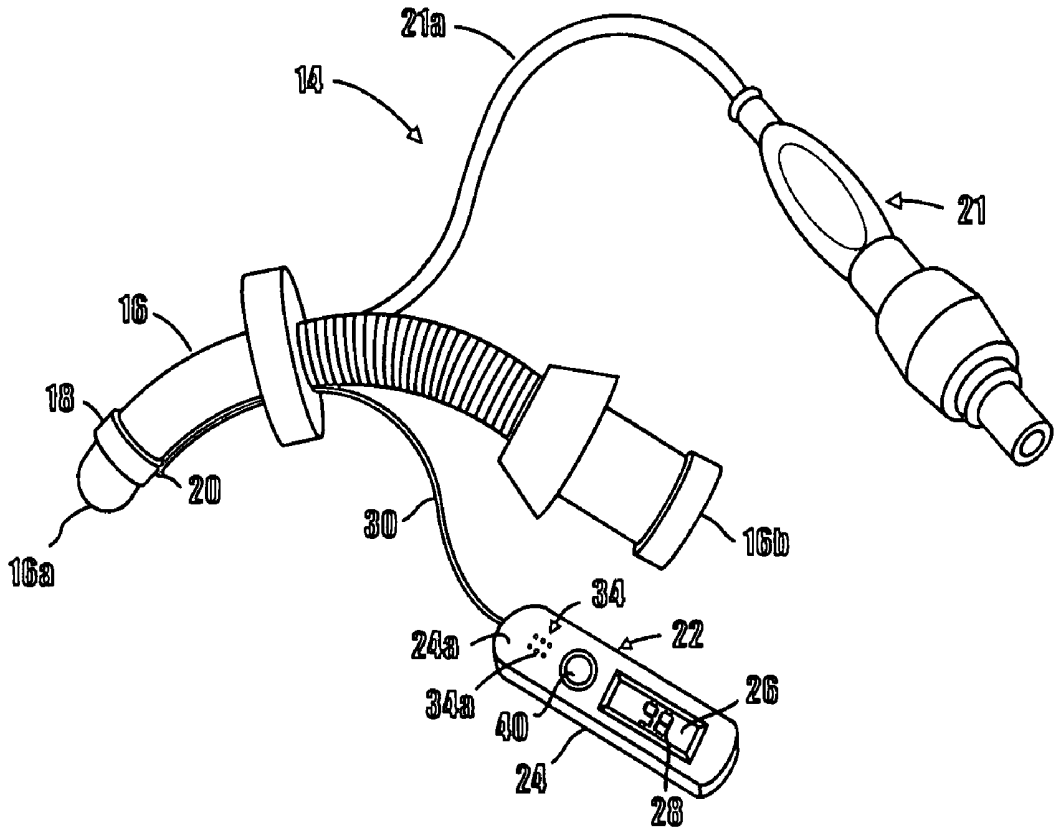
(57) **ABSTRACT**

An apparatus for accurately measuring the body temperature of a patient at the tracheal wall of the patient. The apparatus includes a novel handheld temperature readout assembly that is easy to use by the caregiver and one which clearly and accurately displays the temperature of the patient. The handheld temperature readout assembly includes a handheld housing having a viewing window and a light emitting diode temperature display that is carried by the housing and is readily viewable through the viewing window of the handheld housing for displaying the patient temperature. The apparatus also includes a built-in alarm system to alert to high and low body temperatures.



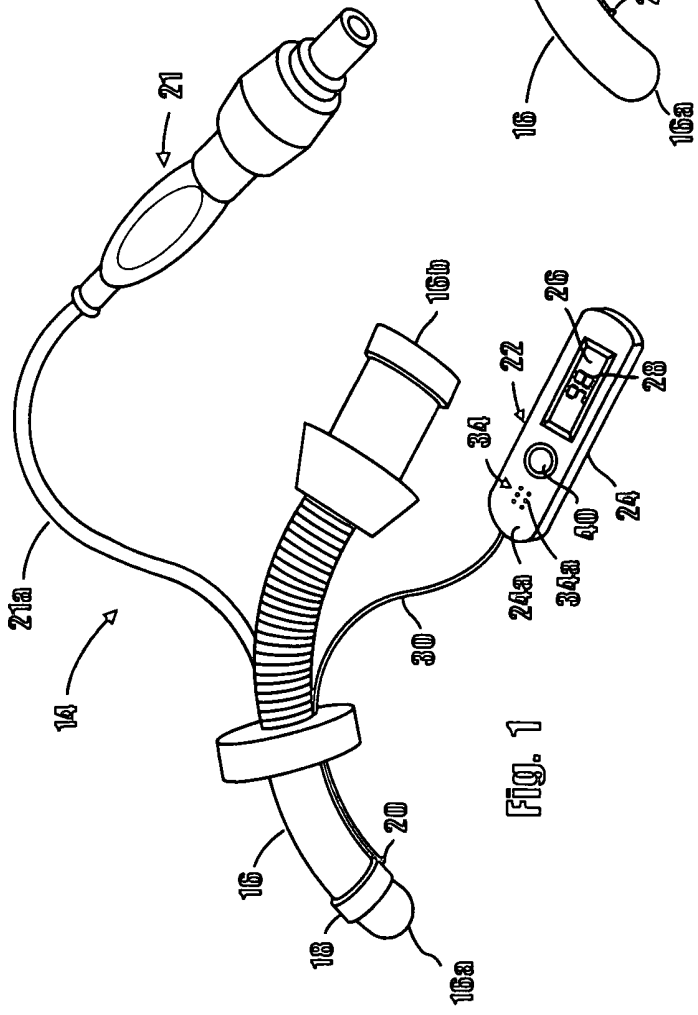
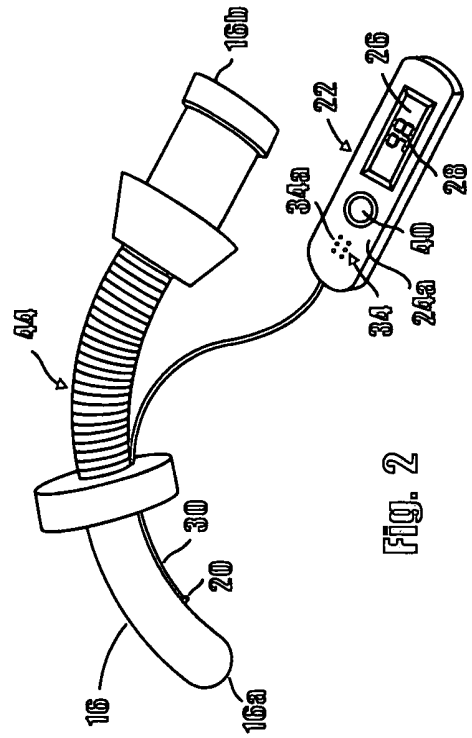

14
21
21a
16b
16
16a
18
20
22
24
24a
26
28
30
34
34a
40
44

Fig. 1


16b
16
16a
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24a
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34
34a
40
44

Fig. 2

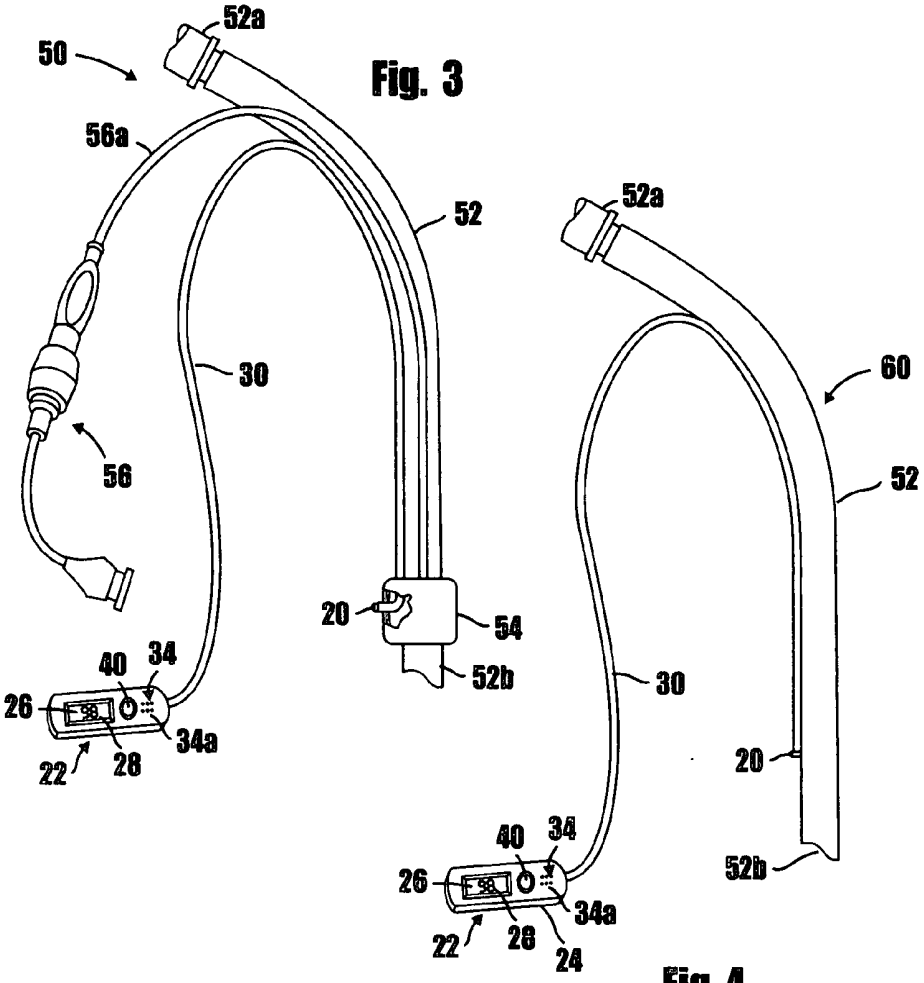

Fig. 3

Fig. 4

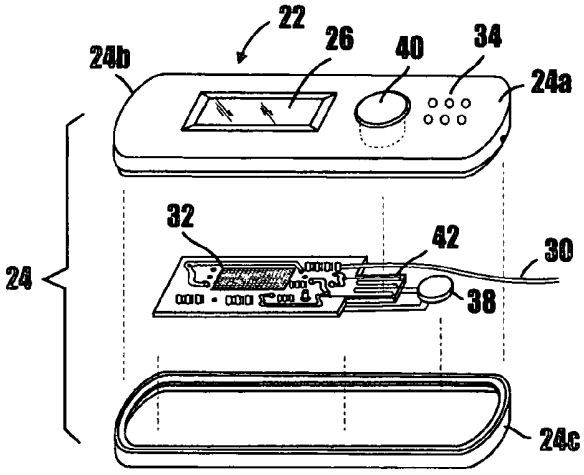

Fig. 5

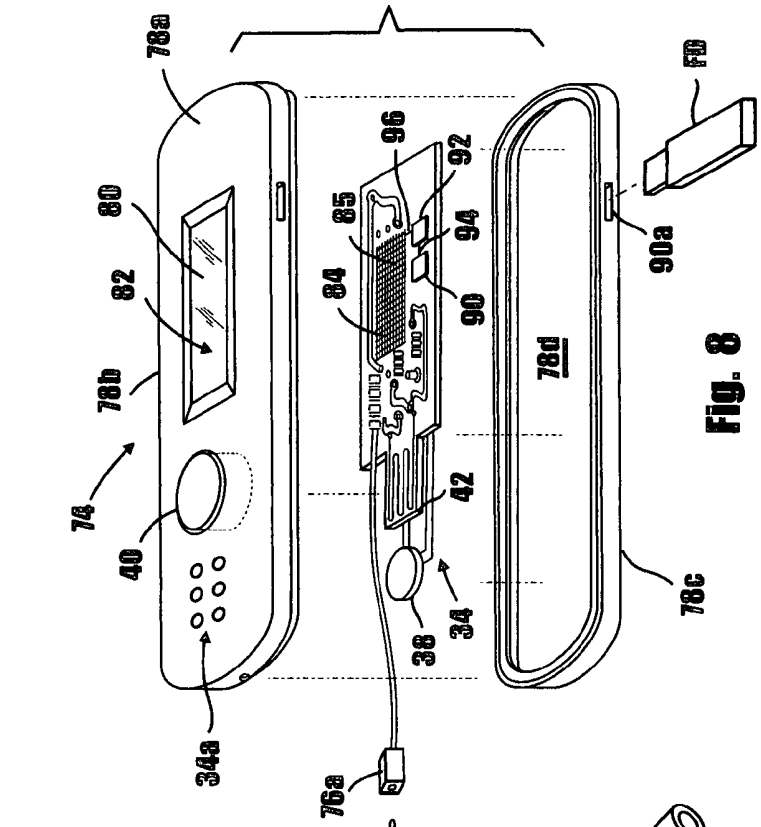

Fig. 8

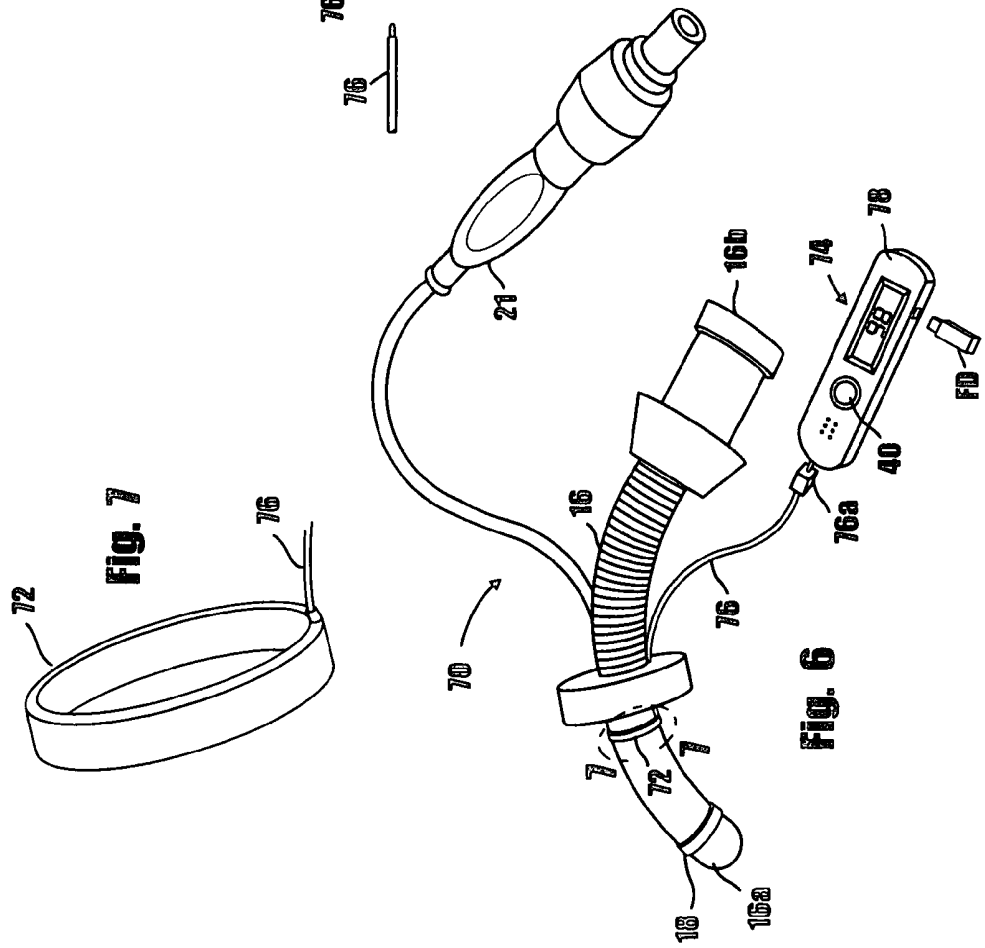

Fig. 6

Fig. 7

TEMPERATURE MEASURING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a Continuation In Part Application of co-pending application Ser. No. 12/930,129 filed Dec. 29, 2010.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

[0003] Not Applicable

BACKGROUND OF THE INVENTION

[0004] 1. Field of the Invention

[0005] The present invention relates generally to apparatus for measuring body temperature. More particularly, the invention concerns an apparatus for measuring tracheal temperatures.

[0006] 2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 1.98

[0007] A number of different types of temperature measuring apparatus using various types of temperature sensing devices such as thermisters, thermocouples and resistance temperature sensors have been suggested in the past. Typically, the prior art temperature sensing devices are placed under the arm, in the ear or in the rectum. Additionally, temperature is sometimes measured by temporal scanning techniques.

[0008] Special problems exist in measuring and monitoring the temperature of neonatal and pediatric patients. For example, neonatal intensive care units typically confine newborns in an incubator until their temperature stabilizes and their body weight reaches a desired number. As a general rule, their temperature is monitored by a probe connected by way of an adhesive-like patch to their body and to an electrical monitor that has a digital readout. Once the temperatures and body weight of the neonate reaches an acceptable number, the neonate is placed in an open bassinet (baby crib). When in the bassinet, the neonate's temperature is typically monitored by the nurse using a disposable battery powered digital thermometer that is placed under the baby's axilla (armpit). During this process, the baby's arm has to remain still and close to the body in order to obtain accurate temperature readings. Due to their medical condition, many neonates are irritable and have a hyper-active (Moro) startle reflex, making it difficult for them to hold still and thereby causing inaccurate temperature readings. Additionally, having a thermometer held under the armpit further upsets the neonate, resulting in crying which often causes an abnormal temperature result. Since much of the care that is given to the neonate is based on temperature findings, inaccurate temperature readings can adversely affect the neonate's care and treatment outcome.

[0009] By way of example, doctors' orders based on temperature findings would read as follows:

[0010] 1. Blood cultures×2 for all temperatures above 102° F. (Fahrenheit).

[0011] 2. Acetaminophen (per body weight) every 4 hours, if needed, for temperatures>(greater) than 102° F. (Fahrenheit) after blood cultures.

[0012] With the foregoing in mind, an inaccurate temperature reading would prevent:

[0013] 1. The proper care being implemented (for example, no lab work ordered to determine the organism).

[0014] 2. The starting of an antibiotic earlier in treatment, preventing possible sepsis (organism traveling via the blood stream and causing potential organ damage, failure, and possible death).

[0015] 3. Early fever detection and treatment to prevent febrile seizures [seizures caused by elevated body temperatures (fevers)] and possible brain damage as a result of hypoxia from the seizure, causing deprivation of oxygen to the brain.

[0016] It is the foregoing problems that the apparatus of the present invention seeks to at least partially address.

[0017] When the patient, and particularly a neonatal or pediatric patient, is to be fitted with a tracheal tube, a unique opportunity is presented to use the apparatus of the present invention to accurately measure the patient's body temperature in the trachea.

[0018] By way of brief background, a tracheal tube is a catheter that is inserted into the trachea for the purpose of establishing and maintaining a patient airway and to ensure the adequate exchange of oxygen and carbon dioxide. Many different types of tracheal tubes are available. For example, an endotracheal tube is a specific type of tracheal tube that is nearly always inserted through the mouth (orotracheal) or nose (nasotracheal). Another common type of tracheal tube is a tracheostomy tube, which is a curved tube that is inserted into a tracheostomy stoma (the hole made in the neck and windpipe).

[0019] By being able to check the patient's body temperature from a temperature measuring device as part of their ET (endotracheal) tubes and trach (tracheostomy) tube, the doctor would have accurate data to implement patient care by and more frequent monitoring for critical patients, those with fragile medical conditions, and those that need more frequent monitoring. This would allow the paramedics to provide a quick and accurate assessment at the scene for the patient's care and to relay the information to the doctor.

[0020] Additionally, an alarm on the ET tube or trach tube functions to alert the caregiver that there is a temperature elevation (fever) and provides prompt notice of a spike in body temperature that might otherwise be delayed in detecting.

[0021] Having an alarm to alert that there is a lower than therapeutic body temperature (hypothermia), especially in newborns, can be life saving. Hyperthermia can occur rapidly and without warning.

BRIEF SUMMARY OF THE INVENTION

[0022] By way of brief summary, the apparatus of the present invention is specially designed for use with:

[0023] (a) intubated patients having an endotracheal tube manually inserted via the nares (nasal opening) and via the mouth into the trachea for artificial ventilation of the lungs during cardio pulmonary resuscitation, drowning, electrocutions, traumas and similar life-threatening situations;

[0024] (b) patients with a trach (tracheostomy) tube inserted surgically through the neck into the trachea, held in place by a trach tie (belt-like) device in hospital units and/or at home.

[0025] With the foregoing in mind, the apparatus of the invention can be used in emergency rooms, in all levels of pediatric and neonatal (newborn) intensive care units, in adult intensive care units including, but not limited to cardiac, surgical, and medical, in all levels of care and in any unit of the hospital where frequent and close monitoring of a patient's temperature is vital to their care and will produce a better outcome for the patient.

[0026] Additionally, the apparatus of the invention can effectively be used for patients on ECMO (extra corporeal membrane oxygenation) that require close monitoring and in situations where the patient exhibits respiratory distress, weak or diseased heart or lungs that require artificial means of removing carbon monoxide from their lungs and exchanging it for oxygenated blood through a mechanical filter hooked up via large veins by an intravenous catheter (tube). In this latter instance, it has long been recognized that these vein puncture access sites are a source of infection and lead to sepsis resulting in up to 25% fatalities. By having a less time consuming and more accurate way to monitor the temperatures of these patients, infections could be detected earlier and patient outcomes would be improved.

[0027] In light of the foregoing, it is an object of the present invention to provide an apparatus for accurately measuring the body temperature of a patient at the tracheal wall of the patient.

[0028] Another object of the invention is to provide an apparatus of the aforementioned character that is self-contained and does not have to be interconnected with expensive monitoring equipment.

[0029] Another object of the invention is to provide an apparatus of the character described that can be used in any medical setting as well as in the home care environment and one that can be used by a relatively untrained caregiver.

[0030] Another object of the invention is to provide an apparatus as described in the preceding paragraphs that includes a built-in alarm system to alert to high and low body temperatures.

[0031] Another object of the invention is to provide an apparatus of the class described that includes a novel handheld temperature readout assembly that is easy to use by the caregiver and one which clearly and accurately displays the temperature of the patient. More particularly, it is an object of the invention to provide such an apparatus in which the handheld temperature readout assembly includes a handheld housing having a viewing window and a light emitting diode temperature display that is carried by the housing and is readily viewable through the viewing window of the handheld housing for displaying the patient temperature.

[0032] Another object of the invention is to provide an apparatus of the character described that includes an inflatable cuff that is disposed about the interior end of the tracheal tube.

[0033] Another object of the invention is to provide a uniquely configured temperature sensor in the form of a generally annular shaped component that is connected to the tracheostomy tube and is arranged to engage a substantial portion of the interior trachea wall of the patient when the tube is in position within the trachea of the patient.

[0034] Another object of the invention is to provide an apparatus of the character described in the preceding paragraphs in which the handheld temperature readout of the apparatus is spaced apart from and is easily maneuvered relative to the tracheostomy tube.

[0035] Another object of the invention is to provide a uniquely configured temperature sensor of the character described in the preceding paragraph that is removably interconnected with the improved handheld temperature readout assembly by means of a quick connect, disconnect connector assembly.

[0036] Another object of the invention is to provide an apparatus of the class described in the preceding paragraphs in which, should the handheld temperature readout assembly malfunction, or fail, it can be quickly and easily replaced through operation of the quick connect, disconnect connector assembly.

[0037] Another object of the invention is to provide an apparatus for accurately measuring the body temperature of a patient at the tracheal wall of the patient in which the handheld temperature readout assembly includes a Universal Serial Bus (USB) port that is housed within the device housing and is accessible through a universal serial bus port access opening provided in one side of the device housing.

[0038] Another object of the invention is to provide an apparatus of the character described in the preceding paragraph in which the handheld temperature readout assembly further includes a USB controller of conventional design that is housed within the device housing and is operably interconnected with the electronic processor of the integrated circuit board of the handheld temperature readout assembly. With this construction, when desired, temperature data stored within the electronic processor can be downloaded into a USB data storage device, such as a commercially available flash drive.

[0039] The foregoing, as well as other objects of the invention, will be achieved by the apparatus illustrated in the accompanying drawings and described in the specification which follows.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0040] FIG. **1** is a generally perspective view of one form of the temperature measuring apparatus of the invention.

[0041] FIG. **2** is a generally perspective view of an alternate form of the temperature measuring apparatus of the invention.

[0042] FIG. **3** is a generally perspective view of still another form of the temperature measuring apparatus of the invention.

[0043] FIG. **4** is a generally perspective view of yet another form of the temperature measuring apparatus of the invention.

[0044] FIG. **5** is an enlarged, generally perspective exploded view of one form of the handheld temperature readout module of the apparatus of the invention.

[0045] FIG. **6** is a generally perspective view of another alternate form of the temperature measuring apparatus of the invention.

[0046] FIG. **7** is a greatly enlarged, generally perspective view of the area designated in FIG. **6** as **7-7**.

[0047] FIG. **8** is an enlarged, generally perspective exploded view of the handheld temperature readout module of the apparatus of the invention shown in FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

[0048] Referring to the drawings and particularly to FIGS. **1** and **5**, one form of the temperature measuring apparatus of the invention for measuring the temperature of the patient is there illustrated and generally designated by the numeral **14**. This form of the apparatus here comprises a tracheostomy

tube **16** that has a curved interior end portion **16***a* and an exterior end **16***b*. The interior end **16***a* of the tube is constructed and arranged to enter the trachea of the patient via a tracheostomy stoma in a conventional manner well understood by those skilled in the art. Provided on the interior end portion **16***a* of the tube is a conventional, inflatable cuff **18** that is so constructed and arranged as to engage the wall of the trachea of the patient when inflated. As illustrated in FIG. **1** of the drawings, a temperature sensor **20** in the form of a temperature-responsive element is connected to the inflatable cuff **18** and is arranged to engage the trachea wall of the patient when the tube is in position within the trachea of the patient and the cuff is inflated. While the temperature sensor or temperature responsive element **20** can take various forms well known by those skilled in the art, the temperature sensor here comprises a conventional thermistor. Interconnected with inflatable cuff **18** by means of an elongated fill tube **21***a* is a conventional hand operated pump assembly **21**.

[0049] An important feature of the apparatus of the present invention is a handheld temperature readout assembly **22** that is operably interconnected with the temperature sensor **20** and functions to clearly and accurately display the temperature of the patient.

[0050] In the present form of the invention, the novel temperature readout assembly **22** comprises a handheld housing **24** having a viewing window **26** and a light emitting diode temperature display **28** that is carried by the housing and is clearly viewable through the viewing window **26**. Temperature display **28** displays the temperature detected by the temperature sensor **20**, which in a manner well understood by those skilled in the art, converts ambient temperature into an electronic signal. As illustrated in FIGS. **1** and **5** of the drawings, an electrical connector **30** interconnects the temperature sensor **20** with a printed circuit board **32** that includes an electronic processor of conventional design, which is operably associated with the light emitting diode temperature display **28**. In a manner well understood by those skilled in the art, the electronic processor of the printed circuit board **32** converts the electronic signals from temperature sensor **20** into digital signals that are displayed by temperature display **28**. Printed circuit board **32** is also operably interconnected with a built-in alarm system **34** of conventional construction that is housed within housing **24** and functions to alert the caregiver to high and low patient body temperatures detected by the temperature sensor **20**. Alarm system **34** includes a speaker array **34***a* that is mounted on the upper wall **24***a* of housing **24** and functions to alert the caregiver to high and low body temperature readings.

[0051] As illustrated in FIG. **5** of the drawings, housing **24** includes an upper portion **24***b* and a lower portion **24***c* that are removably connected to the upper portion so as to permit the caregiver to gain access to the power source, or battery **38** that powers the light emitting diode temperature display **28**, the printed circuit board **32** and the built-in alarm system **34**. A conventional pushbutton switch **40**, which is carried by the upper portion **78***b* of the housing, operates a power switch **42** that is operably associated with the printed circuit board and functions to control the electrical connection between the battery **38** and the printed circuit board. While the apparatus of the invention illustrated in FIG. **1** of the drawings is usable with various types of patients, the apparatus illustrated is particularly well-suited for use in connection with neonates that are confined within an incubator. In such a situation, the handheld temperature readout of the apparatus can be easily operated and read by the caregiver and has been proven to be vastly superior to the more complex temperature readout devices typically found in conventional neonatal incubators.

[0052] Turning next to FIG. **2** of the drawings, another form of the temperature measuring apparatus of the invention for measuring the temperature of the patient is there illustrated and generally designated by the numeral **44**. This form of the apparatus is similar in most respects to the apparatus illustrated in FIG. **1** of the drawings and like numerals are used in FIG. **2** to identify like components. The primary difference between this latest form of the invention and the earlier described embodiment resides in the fact that the embodiment of FIG. **2** does not include an inflatable cuff and therefore does not include a pump apparatus for inflating the inflatable cuff.

[0053] As in the earlier form of the invention, this latest embodiment comprises a tracheostomy tube **16** that is substantially identical in construction and operation to that previously described. As before, the curved interior end portion **16***a* of the tube **16** is constructed and arranged to enter the trachea of the patient via a tracheostomy stoma in a conventional manner well understood by those skilled in the art. Disposed on the interior end portion **16***a* of the tube is a temperature sensor **20** that is substantially identical in construction and operation to the previously described temperature sensor and is arranged to engage the trachea wall of the patient when the tube is in position within the trachea of the patient.

[0054] Operably associated with the temperature sensor **20** is a handheld temperature readout assembly **22** that is also substantially identical in construction and operation to that previously described. Once again, the novel temperature readout assembly **22** of this latest form of the invention comprises a handheld housing **24** having a viewing window **26** and a light emitting diode temperature display **28** that is carried by the housing and is clearly viewable through the viewing window **26**. Temperature display **28** displays the temperature detected by the temperature sensor **20** which, in a manner well understood by those skilled in the art, converts ambient temperature into an electronic signal. An electrical connector **30** interconnects the temperature sensor **20** with a printed circuit board **32** that is housed within housing **24**.

[0055] Referring now to FIG. **3** of the drawings, yet another form of the temperature measuring apparatus of the invention for measuring the temperature of the patient is there illustrated and generally designated by the numeral **50**. This form of the apparatus is also similar in some respects to the apparatus illustrated in FIG. **1** of the drawings and like numerals are used in FIG. **3** to identify like components. The primary difference between this latest form of the invention and the earlier described embodiments resides in the fact that the embodiment of FIG. **3** comprises an endotracheal tube **52** rather than a tracheostomy tube. Endotracheal tube **52** has an exterior end portion **52***a* and an interior end portion **52***b* that are constructed and arranged to enter the trachea of the patient in a conventional manner via the mouth (orotracheal) or nose (nasotracheal).

[0056] Connected to the interior end portion **52***b* of the tube is a conventional, inflatable cuff **54** that is so constructed and arranged as to engage the wall of the trachea of the patient when inflated. As illustrated in FIG. **3** of the drawings, a temperature sensor **56** in the form of a temperature-responsive element is connected to the inflatable cuff **54** and is arranged to engage the trachea wall of the patient when the

inner end portion **52***b* of the tube is in position within the trachea of the patient and the cuff is inflated. While the temperature sensor or temperature responsive element **56** can take various forms well known by those skilled in the art, the temperature sensor here comprises a conventional thermocouple. Interconnected with inflatable cuff **54** by means of an elongated fill tube **56***a* is a hand operated pump assembly **21** of a conventional construction.

[0057] As before, an important feature of the apparatus of this latest form of the invention is a handheld temperature readout assembly **22** that is operably interconnected with the temperature sensor **56** and functions to clearly and accurately display the temperature of the patient such as an infant. Temperature readout assembly **22**, which is substantially identical in construction and operation to that previously described, comprises a handheld housing **24** having a viewing window **26** and a light emitting diode temperature display **28** that is carried by the housing. Temperature display **28** displays the temperature detected by the temperature sensor **56** which, in a manner well understood by those skilled in the art, converts ambient temperature into an electronic signal. As illustrated in FIGS. **3** and **5** of the drawings, an electrical connector **30** interconnects the temperature sensor **56** with a printed circuit board **32** that includes an electronic processor of conventional design which is operably associated with the light emitting diode temperature display **28**. In a manner well understood by those skilled in the art, the electronic processor of the printed circuit board **32** converts the electronic signals from temperature sensor **56** into digital signals that are displayed by temperature display **28**. Printed circuit board **32** is also operably interconnected with a built-in alarm system **34** of conventional construction that is housed within housing **24** and functions to alert the caregiver to high and low patient body temperatures detected by the temperature sensor **20**. Alarm system **34** includes a speaker array **34***a* that is mounted on the upper wall **24***a* of housing and functions to alert the caregiver to high and low body temperature readings.

[0058] Turning now to FIG. **4** of the drawings, yet another form of the temperature measuring apparatus of the invention is there illustrated and generally designated by the numeral **60**. This form of the apparatus is similar in most respects to the apparatus illustrated in FIG. **3** of the drawings and like numerals are used in FIG. **4** to identify like components. The primary difference between this latest form of the invention and the embodiment of FIG. **3** resides in the fact that the embodiment of FIG. **4** does not include an inflatable cuff and therefore does not include a pump apparatus for inflating the inflatable cuff.

[0059] As in the earlier form of the invention, this latest embodiment comprises a tracheostomy tube **52** that is substantially identical in construction and operation to that previously described. As before, the interior end portion **52***b* of the tube **52** is constructed and arranged to enter the trachea of the patient via the mouth (orotracheal) or nose (nasotracheal) in a conventional manner well understood by those skilled in the art. Connected to the interior end portion **52***b* of the tube is a temperature sensor **20** that is arranged to engage the wall of the patient's trachea and is substantially identical in construction and operation to the previously described temperature sensor **20**.

[0060] Operably associated with the temperature sensor **20** is a handheld temperature readout assembly **22** that is also substantially identical in construction and operation to that previously described. Once again, the novel temperature readout assembly **22** of this latest form of the invention comprises a handheld housing **24** having a viewing window **26** and a light emitting diode temperature display **28** that is carried by the housing and is clearly viewable through the viewing window **26**. Temperature display **28** displays the temperature detected by the temperature sensor **20** which, in a manner well understood by those skilled in the art, converts ambient temperature into an electronic signal. An electrical connector **30** interconnects the temperature sensor **20** with a printed circuit board **32** that is housed within housing **24**.

[0061] Once again, the apparatus illustrated in FIGS. **4** and **5** is particularly well-suited for use in connection with neonates. In such use, the handheld temperature readout of the apparatus can be easily operated read by the caregiver in the hospital and in the home and has been proven to be vastly superior to the more complex temperature readout devices typically found in neonatal temperature measuring devices.

[0062] Referring next to FIGS. **6**, **7** and **8** of the drawings, still another form of the temperature measuring apparatus of the invention for measuring the temperature of the patient is there illustrated and generally designated by the numeral **70**. This form of the apparatus is also similar in some respects to the apparatus illustrated in FIG. **1** of the drawings and like numerals are used in FIGS. **6**, **7** and **8** to identify like components. The primary difference between this latest form of the invention and the earlier described embodiments resides in the provision of an improved sensor component **72** and an improved handheld temperature readout assembly **74** that is operably interconnected with the temperature sensor **72**.

[0063] This latest form of the apparatus of the invention here comprises a tracheostomy tube **16** that has a curved interior end portion **16***a* and an exterior end **16***b*. The interior end **16***a* of the tube is constructed and arranged to enter the trachea of the patient via a tracheostomy stoma in a conventional manner well understood by those skilled in the art. Provided on the interior end portion **16***a* of the tube is a conventional, inflatable cuff **18** that is so constructed and arranged as to engage the wall of the trachea of the patient when inflated. As before, inflatable cuff **18** is connected to and is inflatable by a conventional hand operated pump assembly **21**.

[0064] As illustrated in FIGS. **6** and **7** of the drawings, a differently configured temperature sensor in the form of temperature-responsive element **72** is connected to the tracheostomy tube **16** in the manner shown in FIG. **6** and is arranged to engage a substantial portion of the interior trachea wall of the patient when the tube is in position within the trachea of the patient. Temperature sensor **72** here comprises a generally annular shaped component that is operably interconnected with improved handheld temperature readout assembly **74** by means of an electrical connector **76**. The novel configuration of the sensor provides highly accurate patient temperature readings.

[0065] An important feature of the alternate form of the apparatus of the present invention **70** is the improved, handheld temperature readout assembly **74** that is operably interconnected with the temperature sensor **72** by means of the elongated, flexible electrical connector **76**. As illustrated in FIG. **6** of the drawings assembly **74**, which functions to clearly and accurately display the temperature of the patient, is spaced apart from and is freely and independently movable relative to tracheostomy tube **16**. Assembly **74** here comprises a handheld housing **78** having a viewing window **80** and a light emitting diode temperature display **82** that is

carried by the housing and is clearly viewable through the viewing window **80**. Temperature display **82** displays the temperature detected by the temperature sensor **72**, which in a manner well understood by those skilled in the art, converts ambient temperature into an electronic signal.

[0066] As illustrated in FIGS. **6** and **8** of the drawings, electrical connector **76** interconnects the temperature sensor **72** with an integrated printed circuit board **84** via a quick connect, disconnect assembly **76***a* of conventional construction. This quick connect assembly enables the handheld temperature readout assembly **74** to be quickly and easily connected to and disconnected from the temperature sensor **72**. Printed circuit board **84** includes an electronic processor **85** of conventional design, which is operably associated with the light emitting diode temperature display **82**. In a manner well understood by those skilled in the art, the electronic processor of the printed circuit board **84**, which includes data storage capability, converts the electronic signals from temperature sensor **72** into digital signals that are displayed by temperature display **82**. Printed circuit board **84** is also operably interconnected with a built-in alarm system **34** of conventional construction that is housed within housing **78** and functions to alert the caregiver to high and low patient body temperatures detected by the temperature sensor **72**. Alarm system **34** includes a speaker array **34***a* that is mounted on the upper wall **78***a* of housing **78** and functions to alert the caregiver to high and low body temperature readings.

[0067] As illustrated in FIG. **8** of the drawings, housing **78** includes an upper portion **78***b* and a lower portion **78***c* that is removably connected to the upper portion so as to define an internal chamber **78***d*. This construction permits the caregiver to gain access to the power source, or battery **38** that powers the light emitting diode temperature display **82**, the printed circuit board **84** and the built-in alarm system **34** all of which are housed within internal chamber **78***d*. A conventional pushbutton switch **86**, which is carried by the upper portion **78***b* of the housing, operates a power switch **88** that is operably associated with the printed circuit board **84** and functions to control the electrical connection between the battery **38** and the printed circuit board. As before, while the apparatus of the invention illustrated in FIG. **6** of the drawings is usable with various types of patients, the apparatus illustrated is particularly well-suited for use in connection with neonates that are confined within an incubator. In such a situation, the handheld temperature readout of the apparatus can be easily maneuvered relative to the patient and can be expeditiously operated and read by the caregiver. Additionally, should the handheld temperature readout assembly malfunction, or fail, it can be quickly and easily replaced through operation of the quick connect assembly **76***a*.

[0068] Another important feature of the improved, handheld temperature readout assembly **74** of this latest form of the invention resides in the provision of a Universal Serial Bus (USB) port **90** that is housed within the housing **78** and is accessible through a universal serial bus port access opening **90***a* provided in one side of the housing. Interconnected with port **90** is a USB controller **92** of conventional design that is housed within housing **78** and is interconnected with port **90** by a connector **94**. Controller **92** is, in turn, operably interconnected with the electronic processor **85** of the integrated circuit board by means of a connector **96** (FIG. **8**). With this construction, when desired, temperature data stored within the electronic processor can be downloaded in a manner well understood by those skilled in the art into a USB data storage device, such as a commercially available flash drive "FD".

[0069] Having now described the invention in detail in accordance with the requirements of the patent statutes, those skilled in this art will have no difficulty in making changes and modifications in the individual parts or their relative assembly in order to meet specific requirements or conditions. Such changes and modifications may be made without departing from the scope and spirit of the invention, as set forth in the following claims.

1. A temperature measuring apparatus usable by a caregiver for measuring the body temperature of the patient at the tracheal wall of the patient comprising:

(a) a tracheal tube having an interior end and an exterior end, said interior end being constructed and arranged to enter the trachea of the patient and to engage the trachea wall;

(b) a generally annular shaped temperature sensor interconnected with and circumscribing said tracheal tube proximate said interior end thereof, said temperature sensor being so constructed and arranged so as to engage a substantial portion of the trachea wall of the patient; and

(c) a handheld temperature readout assembly operably interconnected with said temperature sensor for displaying the temperature of the patient, said readout assembly being spaced apart from and freely movable relative to the tracheal tube and comprising:

(i) a handheld housing having an internal chamber and a viewing window;

(ii) an integrated circuit board housed within said internal chamber, said integrated circuit board including an electronic processor having data storage capability;

(iii) a light emitting diode temperature display carried by said housing and being viewable through said viewing window of said handheld housing for displaying the temperature detected by said temperature sensor; and

(iv) an alarm system carried by said handheld housing for alerting the caregiver to high and low body temperature readings, said alarm system comprising a speaker array mounted on said handheld housing

2. The apparatus as defined in claim **1** in which said handheld temperature readout assembly is removably interconnected with said temperature sensor by a quick connect assembly.

3. The apparatus as defined in claim **1** in which said handheld temperature readout assembly further includes a universal serial bus port and a universal serial bus controller operably associated with said universal serial bus port, said universal serial bus controller being operably associated with said electronic processor.

4. The apparatus as defined in claim **1** further including an inflatable cuff disposed proximate said interior end of said tracheal tube, said inflatable cuff being so constructed and arranged as to engage the wall of the trachea of the patient when inflated.

5. The apparatus as defined in claim **4** further including an elongated fill tube connected to said inflatable cuff.

6. The apparatus as defined in claim **1** in which said tracheal tube comprises an endotracheal tube.

7. A temperature measuring apparatus usable by a caregiver for measuring the body temperature of an infant at the tracheal wall of the infant comprising:

(a) a tracheal tube having an interior end and an exterior end, said interior end being constructed and arranged to enter the trachea of the infant and to engage the trachea wall;

(b) a generally annular shaped temperature sensor interconnected with and circumscribing said tracheal tube proximate said interior end thereof, said temperature sensor being so constructed and arranged so as to engage a substantial portion of the trachea wall of the patient; and

(c) a handheld temperature readout assembly operably interconnected with said temperature sensor for displaying the temperature of the patient, said readout assembly being spaced apart from and freely movable relative to the tracheal tube and comprising:

(i) a handheld housing having an internal chamber and a viewing window;

(ii) an integrated circuit board housed within said internal chamber, said integrated circuit board including an electronic processor having data storage capability;

(iii) a light emitting diode temperature display carried by said handheld housing and being viewable through said viewing window of said handheld housing for displaying the temperature detected by said temperature sensor;

(iv) an alarm system carried by said handheld housing for alerting the caregiver to high and low body temperature readings, said alarm system comprising a speaker array mounted on said handheld housing; and

(v) an inflatable cuff disposed proximate said interior end of said tracheal tube, said inflatable cuff being so constructed and arranged as to engage the wall of the trachea of the infant when inflated.

8. The apparatus as defined in claim **4** further including an elongated fill tube connected to said inflatable cuff.

9. The apparatus as defined in claim **7** in which said handheld temperature readout assembly is removably interconnected with said temperature sensor by a quick connect assembly.

10. The apparatus as defined in claim **7** in which said handheld temperature readout assembly further includes a universal serial bus port and a universal serial bus controller operably associated with said universal serial bus port, said universal serial bus controller being operably associated with said electronic processor.

11. The apparatus as defined in claim **10** in which said handheld housing includes a universal serial bus port access opening.

12. A temperature measuring apparatus usable by a caregiver for measuring the body temperature of a patient at the tracheal wall of the patient comprising:

(a) a tracheal tube having an interior end and an exterior end, said interior end being constructed and arranged to enter the trachea of the patient and to engage the trachea wall;

(b) a generally annular shaped temperature sensor interconnected with and circumscribing said tracheal tube proximate said interior end thereof, said temperature sensor being so constructed and arranged so as to engage a substantial portion of the trachea wall of the patient;

(c) a handheld temperature readout assembly operably interconnected with said temperature sensor for displaying the temperature of the patient, said readout assembly being spaced apart from and freely movable relative to the tracheal tube and comprising:

(i) a handheld housing having an internal chamber and a viewing window;

(ii) an integrated circuit board housed within said internal chamber, said integrated circuit board including an electronic processor having data storage capability;

(iii) a light emitting diode temperature display carried by said handheld housing and being viewable through said viewing window of said handheld housing for displaying the temperature detected by said temperature sensor;

(iv) an alarm system carried by said handheld housing for alerting the caregiver to high and low body temperature readings, said alarm system comprising a speaker array mounted on said handheld housing; and

(v) a universal serial bus port and a universal serial bus controller operably associated with said universal serial bus port, said universal serial bus controller being operably associated with said electronic processor;

(d) an inflatable cuff disposed proximate said interior end of said tracheal tube, said inflatable cuff being so constructed and arranged as to engage the wall of the trachea of the infant when inflated; and

(e) an elongated fill tube connected to said inflatable cuff.

13. The apparatus as defined in claim **12** in which said handheld temperature readout assembly is removably interconnected with said temperature sensor by a quick connect assembly.

14. The apparatus as defined in claim **12** in which said handheld housing includes a universal serial bus port access opening for receiving universal serial bus data storage device.

15. A temperature measuring apparatus for measuring the temperature of an infant comprising:

(a) a tracheal tube having an interior end and an exterior end, said interior end being constructed and arranged to enter the trachea of the infant and to engage the trachea wall;

(b) a temperature sensor interconnected with said tracheal tube proximate said interior end thereof, said temperature sensor being so constructed and arranged so as to engage the trachea wall of the infant;

(c) a handheld temperature readout assembly operably interconnected with said temperature sensor for displaying the temperature of the infant, said readout assembly comprising:

(i) a handheld housing having a viewing window;

(ii) a light emitting diode temperature display carried by said housing and being viewable through said viewing window of said handheld housing for displaying the temperature detected by said temperature sensor; and

(d) a switch operably associated with said temperature display for activating said temperature display.

16. The apparatus as defined in claim **7** in which said temperature sensor comprises a thermistor.

17. The apparatus as defined in claim **7** in which said temperature sensor comprises a thermocouple.

18. The apparatus as defined in claim **7** in which said tracheal tube comprises a tracheostomy tube.

19. The apparatus as defined in claim **7** in which said tracheal tube comprises an endotracheal tube.

20. The apparatus as defined in claim **7** further including an inflatable cuff disposed proximate said interior end of said tracheal tube, said inflatable cuff being so constructed and arranged as to engage the wall of the trachea of the infant when inflated.

21. The apparatus as defined in claim **12** further including means carried by said tracheal tube for inflating said inflatable cuff.

22. A temperature measuring apparatus for measuring the temperature of a neonate comprising:

(a) a tracheostomy tube having a curved interior portion and an exterior portion connected to said curved interior portion, said interior portion being constructed and arranged to enter the trachea of the neonate and to engage the trachea wall of the neonate;

(b) a temperature sensor comprising a thermistor connected to said interior portion of said tracheostomy tube, said temperature sensor being so constructed and arranged so as to engage the trachea wall the neonate; and

(c) a handheld temperature readout assembly operably associated with said temperature sensor for displaying the temperature of the neonate, said readout assembly comprising:

(i) a handheld hollow housing having an outer wall having a viewing window;

(ii) a light emitting diode temperature display carried by said housing and being viewable through said viewing window of said handheld housing for displaying the temperature detected by said temperature sensor; and

(iii) a switch operably associated with said light emitting diode of said temperature display for activating said light emitting diode.

23. The apparatus as defined in claim **14** further including an inflatable cuff connected to said interior portion of said tracheal tube, said inflatable cuff being so constructed and arranged as to engage the wall of the trachea of the neonate when inflated.

* * * * *

专利名称(译)	温度测量装置		
公开(公告)号	US20140024962A1	公开(公告)日	2014-01-23
申请号	US13/932916	申请日	2013-07-01
[标]申请(专利权)人(译)	邓莉萨		
申请(专利权)人(译)	邓恩，LISA A.		
当前申请(专利权)人(译)	邓恩，LISA A.		
[标]发明人	DUNN LISA A		
发明人	DUNN, LISA A.		
IPC分类号	A61B5/01 A61M16/04 A61B5/00		
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外部链接	Espacenet USPTO		

摘要(译)

一种用于精确测量患者气管壁处患者体温的装置。该装置包括一个新颖的手持式温度读出组件，该组件易于由护理人员使用，并且能够清楚准确地显示患者的体温。手持式温度读出组件包括手持式外壳，该手持式外壳具有观察窗和由外壳承载的发光二极管温度显示器，并且可通过手持式外壳的观察窗容易地看到，以显示患者体温。该装置还包括内置警报系统，以警告高低体温。