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(54) EAR THERMOMETER WITH ILLUMINATION

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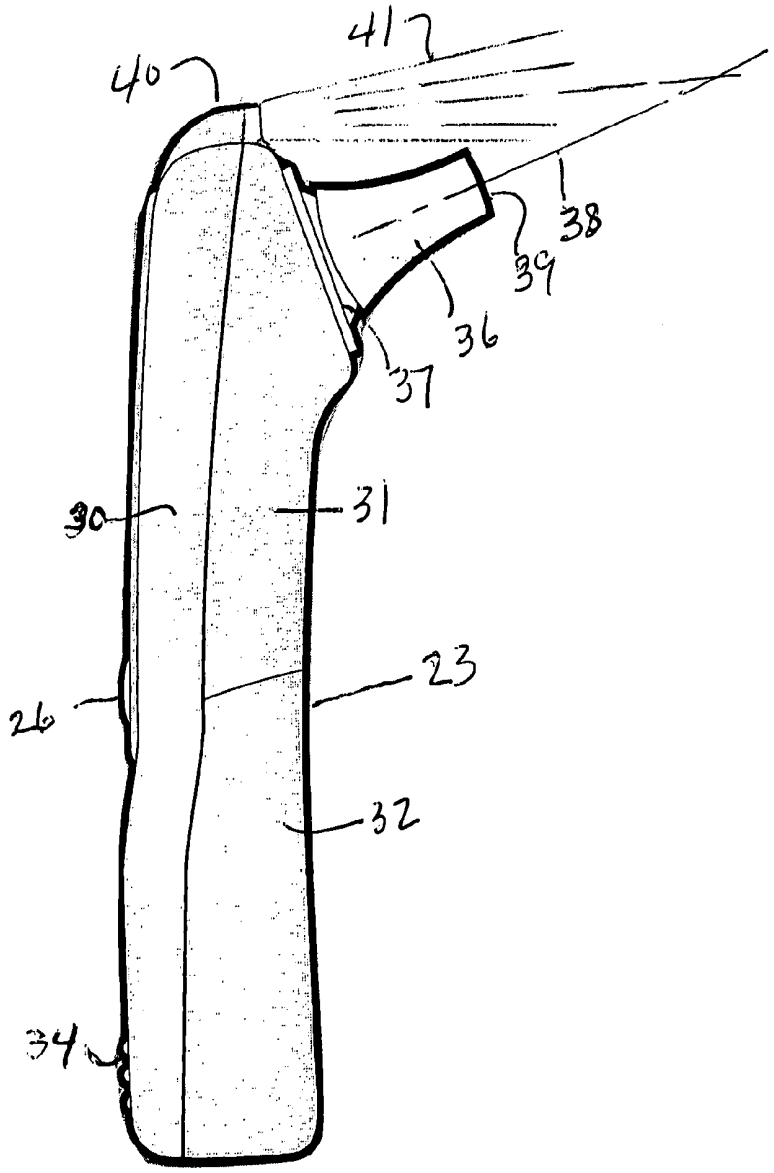
(57) ABSTRACT

An ear thermometer has a light source to illuminate the field in front of the tip of the probe, such as the area around the ear canal, or the entire ear, to assist in insertion of the probe into the ear canal. The light source may consist of an incandescent lamp or one or more LEDs of the bright type, and application of the illumination may be controlled by a user activated switch to conserve battery life. The light source may be disposed in a raised protrusion on the housing of the thermometer such as near the top of the housing to supply divergent rays of light to the field of interest, such as the ear.



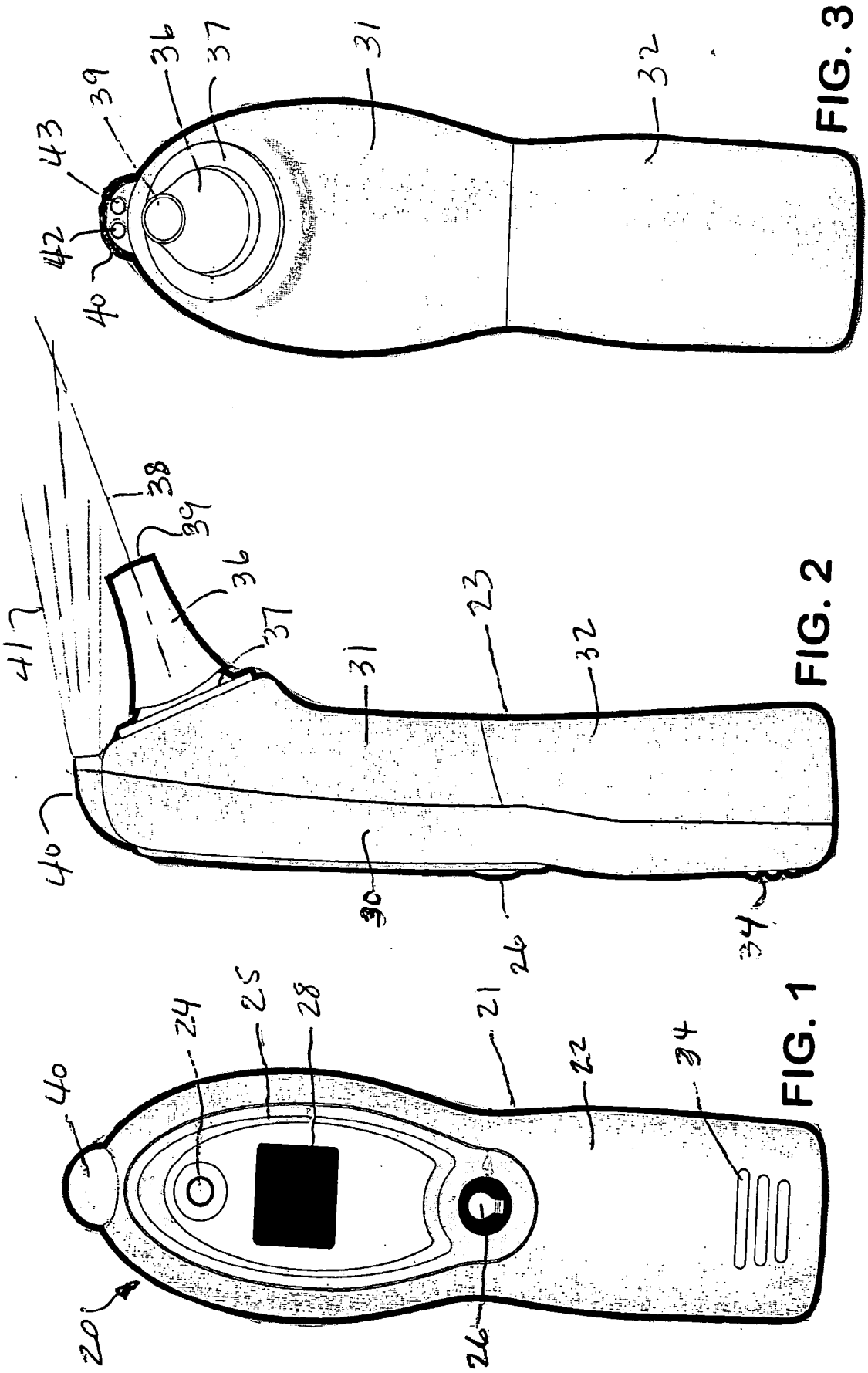

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FIG. 1
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FIG. 3

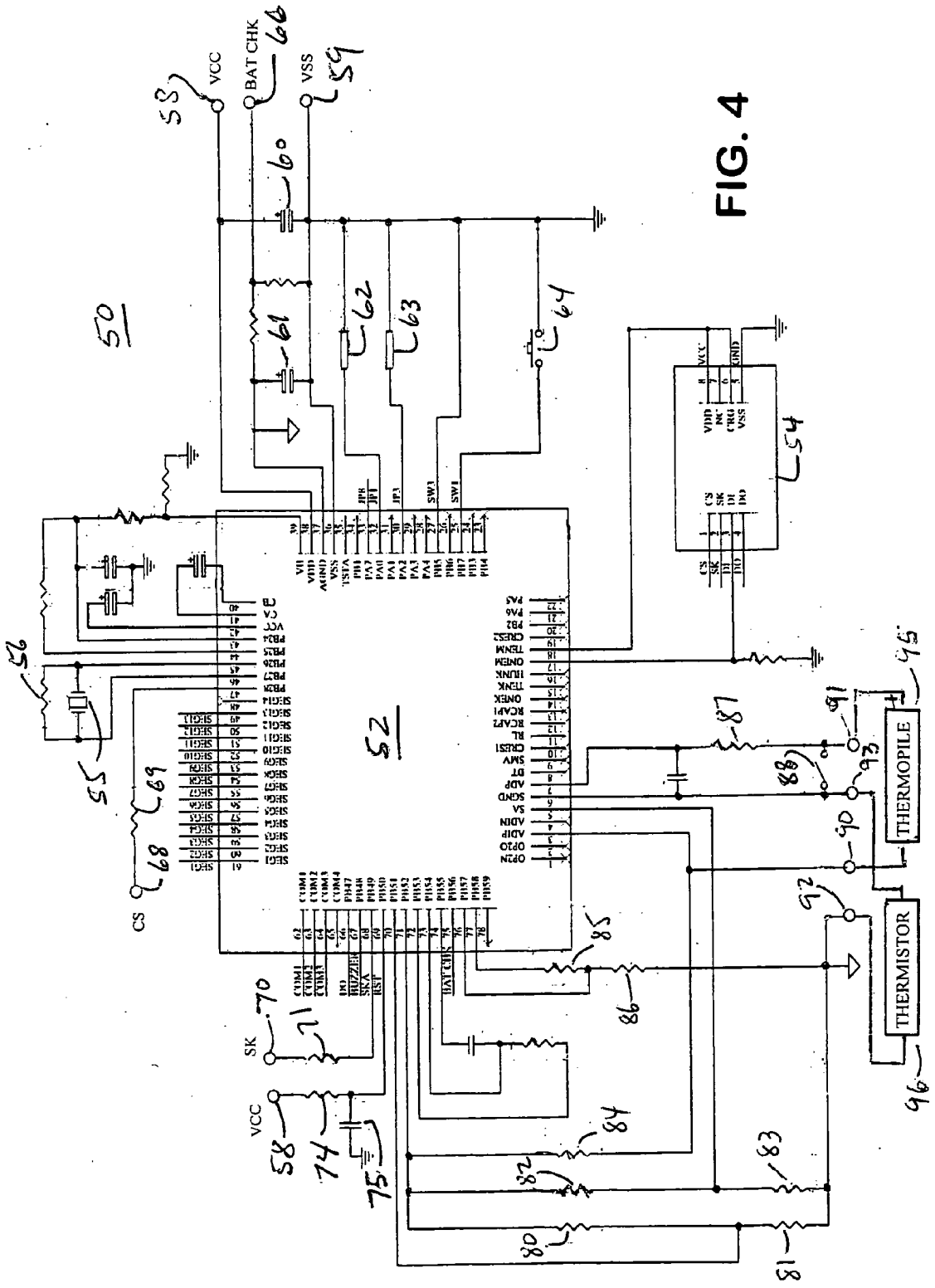

FIG. 4

EAR THERMOMETER WITH ILLUMINATION

FIELD OF THE INVENTION

[0001] This invention generally relates to measurement of the body temperature of a human with an ear thermometer. More particularly, this invention relates to an ear thermometer with an illumination feature.

BACKGROUND OF THE INVENTION

[0002] Infrared thermometers for measuring the temperature of the human body are in wide-spread use. Such thermometers are typically inserted partially into the ear canal to measure the temperature in the interior of the ear, and, hence, the body temperature.

[0003] Some prior art patents disclose the use of illumination in an ear instrument. U.S. Pat. No. 4,494,881 to Everest discloses a sighting system for an infrared thermometer that provides a visible light beam that is parallel with path of the infrared rays through the optics of this system. The optics in this system are complex and relatively expensive, such as Cassegrainian lens systems, Fresnel lenses, beam splitters and the like. This system also has the undesirable effects of introducing visible light energy into the ear canal, which can interfere with accurately measuring the temperature with infrared techniques. Furthermore, the visible light for guiding the probe of the infrared thermometer into the ear canal must be seen from the side since the body or housing of the thermometer blocks any direct view into the ear canal as the probe nears the ear. Thus, if the light beam of Everest is directly into the ear canal, it may be difficult to see it from the side. Thus, use of a narrow and apparently collimated visible light beam directly into the ear canal, as proposed by Everest, is not an effective means of assisting the insertion of the probe of the thermometer into the ear canal.

[0004] U.S. Pat. No. 5,209,757 to Klug et al. teaches an illuminated ear cleaning device with an incandescent light bulb at the end of a tube near a cleaning tip. However, this technique cannot be applied to an infrared thermometer because the light bulb would block the end of the probe through which infrared radiation needs to be received by the thermometer. Moreover, if the radiation emitted by the light bulb is in the path of the infrared radiation from the ear, inaccuracies would be introduced in measuring the infrared radiation.

[0005] Many persons, including medical personnel, prefer infrared ear thermometers over electronic oral thermometers because of the convenience and the rapid temperature measurement that the infrared ear thermometers offer. Typically, a hygienic plastic sleeve may be placed over the tip of the probe before each use of the thermometer, the probe itself may be disposable, or the tip of the probe can be cleaned with alcohol.

[0006] However, there is often a need to measure temperature with an ear thermometer when the room is dark, such as at nighttime or in rooms with poor ambient light levels. For example, it may be desirable to take the temperature of an infant, child or adult without disturbing their sleep, as by turning on lights in the room. But, without adequate light, it is also difficult to properly position the ear thermometer near the ear and into the ear canal of the person.

[0007] There is therefore a need for an ear thermometer with a light feature that provides enough illumination to properly position the thermometer in or near the ear, without flooding the room with light that may be annoying to the person.

[0008] It is therefore a general object of the present invention to provide an ear thermometer with an illumination feature to provide sufficient illumination to properly position the ear thermometer for insertion of the probe tip into the ear.

[0009] It is another object of the present invention to provide such an illumination feature that is integral with the ear thermometer and easy to use.

[0010] A further object of the present invention is to provide such an illumination feature for an ear thermometer that may be selected when desired or needed.

[0011] Yet another object of the present invention is to provide an illumination feature wherein the direction of the illumination is forward of the probe tip of the ear thermometer.

[0012] Another object of the present invention is to provide a divergent pattern of illumination from a light source for illuminating at least the area of the ear around the ear canal, and, preferably, the entire ear.

SUMMARY OF THE INVENTION

[0013] The present invention is directed to an improved ear thermometer with illumination to assist in inserting a probe of the thermometer into the ear canal of a human being. The thermometer has a housing that may consist of multiple housing portions. A display for displaying a measured temperature is disposed on a rear side of the housing. A tapered probe is disposed on the front side of the housing, typically at an oblique angle thereto. Preferably, the probe is also pivotally and/or rotationally mounted to the front side of the housing to permit some movement of the housing of the thermometer while the probe is inserted into the ear canal. A display is also disposed on the housing for displaying a measured temperature.

[0014] In accordance one aspect of the present invention, a light source is disposed on the housing to supply illumination in front of the tip of the probe to illuminate at least the area around the ear canal as the tip of the probe is being inserted therein. A separate switch is preferably disposed on the housing to control when the light source is actuated, thereby conserving battery power. The light source may include an incandescent lamp or one or more light emitting diodes (LEDs) of the bright type. The illumination provided by the light source is in the form of divergent rays to illuminate a substantial area of the ear, and preferably the entire ear.

[0015] In accordance with another aspect of the present invention, the light source may be disposed in a raised protrusion on the housing, such as at the top end thereof. The illumination from the light source is generally directed forwardly of the tip of the probe to illuminate the field in front thereof. An axis may be defined through the probe. At least some of the illumination provided by the light source will intersect with the axis in front of the tip of the probe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with the further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings, in the several figures in which like reference numerals identify like elements, and in which:

[0017] **FIG. 1** is a back elevational view of a first embodiment of an ear thermometer in accordance with the present invention;

[0018] **FIG. 2** is a side elevational view of the first embodiment of the ear thermometer shown in **FIG. 1**;

[0019] **FIG. 3** is a front elevational view of the first embodiment of the ear thermometer shown in **FIGS. 1 and 2**; and

[0020] **FIG. 4** is an electronic schematic diagram of the circuitry utilized in the electronic thermometers of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Referring to the Figures, and particularly to **FIG. 1**, a preferred embodiment of an ear thermometer, generally designated **20**, is constructed in accordance with the present invention. The operative controls, including a power on/off switch **24** and an illumination switch **26** are disposed on the backside **22** of the housing **21** of thermometer **20**. Switches **24** and **26** may be of the push button type. In the illustrated embodiment of **FIG. 1**, a display **28** is disposed between switches **24** and **26**. However, it will be readily apparent that the location of switches **24** and **26** and display **28** may be arranged in other configurations and/or locations on the housing **21**. A decorative bezel **25** may be disposed around some or all of the switches **24** and **26** and display **28**, if desired.

[0022] Display **28** may of the liquid crystal display (LCD) type and provide a variety of indicia for informing the user of the temperature measurements and of the operating modes. For example, it may have numerical indicia to numerically display a measured temperature and it may also have alpha indicia, such as an "L" to indicate that the measured temperature is below the normal temperature range such as below about 32° C. (89.6° F.), and an "H" to indicate that the measured temperature is above the normal temperature range such as about 43° C. (109.4° F.). Display **28** may also have indicia, such as "C" to indicate that the measured temperature is in degrees Celsius and "F" to indicate that the measured temperature is in degrees Fahrenheit. Additionally, display **28** may include an "M" to indicate that the displayed temperature is from memory. For example, when the thermometer **20** is first turned on, it is desirable to display the last measured temperature in case it was not previously recorded or to remind the user of the prior temperature.

[0023] As seen in **FIG. 2**, the housing **21** may constitute separate portions that are formed from a polymer via well-known thermoplastic molding techniques. In this embodiment, backside **22** may be a unitary housing portion **30** and the front side **23** may comprise an upper housing portion **31** and a lower housing portion **32**. Lower housing portion **32** may be removable for access to a battery compartment to periodically replace batteries that supply operating power to internal electronic circuitry **50**. The electronic circuitry **50** is further described below in connection with **FIG. 4**. The housing portions **30-32** engage and secure to each other, such as by interlocking tabs or other known means of snapping thermoplastic housings together. Various other structures are also available for the housing portions **30-32**, which would not necessitate a three-part structure for the housing **21**.

[0024] Preferably, as shown in **FIGS. 1-3**, housing **21** is tapered near the middle, and is of reduced cross-sectional area thereat, to facilitate better gripping and handling of the thermometer **20**. For example, the tapered middle of housing **21** assists in holding thermometer **21** when the user has moist hands by preventing the thermometer from slipping from the grasp of the user. In this respect, the housing **21** may also be provided with a plurality of raised ribs **34**, which further assist in retaining the thermometer in the user's hand. In the illustrated embodiment, these ribs are at the lower end of rear housing portion **30**, but such ribs may also be disposed along other areas of housing **21**, if so desired.

[0025] With reference to **FIGS. 2 and 3**, the upper front housing portion **31** has a tapered or truncated cone-shaped probe **36** projecting outwardly from housing portion **31**. For example, housing portion **31** may have a boss **37** integrally molded therewith to which probe **36** attaches. An end or tip **39** of probe **36** is of a size and shape suitable for insertion into the ear of a patient to measure the patient's temperature. Preferably, probe **36** is attached to the front housing portion **31** by a ball and socket connection, and at an oblique angle to the front housing portion **31**. Probe **36** can then swivel upward, downward or side to side for ease in inserting the probe into the ear canal of the patient and to permit some movement of the thermometer **20** while the probe **36** is inserted into the patient's ear. An axis **38** may be defined in the longitudinal direction of probe **36**. Preferably, probe **36** can also freely rotate about axis **38** for more convenient and comfortable use of the thermometer **20**, and to permit rotational movement of the thermometer **20** while the probe **36** is inserted into the patient's ear. The tip **39** of probe **36** has a generally transparent lens or window through which infrared rays pass to temperature sensors in the probe.

[0026] In accordance with one aspect of the present invention, illumination is provided at or in front of the tip **39** of the probe **36** to assist in inserting probe **36** into a patient's ear canal to measure the patient's temperature. To this end, an elongated protrusion **40** is formed at or near the top of housing **21**, such as at the top ends of housing portions **30** and **31**. The location of the light source on the housing **21** is not critical and other locations may also be suitable, such as on the front housing portion **31** below the probe **36**, on the sides of front housing portion **31**, or the like. However, the top of the housing is preferred because this location generally provides a minimal shadow of the probe tip as the probe **36** is being inserted into the ear canal for thermometers of the type illustrated in **FIGS. 1-3** with an obliquely mounted probe.

[0027] A light source **42-43** in the form of an incandescent lamp or one or more LEDs are contained in protrusion **40**

and are oriented to provide divergent rays **41** of illumination toward and in front of the tip **39** of probe **36**. Light source **42-43** thus provides an area of illumination in front of probe **36** to assist in inserting the probe into the patient's ear, especially in lower ambient lighting circumstances, such as in the evening hours or in rooms with low ambient light levels. This also obviates the need to turn on other lighting in the room, which may undesirably disturb the patient.

[**0028**] At least some of the rays **41** of illumination provided by the light source **42-43** will generally intersect with the axis **38** of probe **36** forwardly of the tip **39** of probe **36**. If LEDs are used for the light source **42-43**, the LEDs are preferably of the bright variety to provide sufficient illumination in the darkest environments. Of course, light source **42-43** is only activated to provide illumination when illumination switch **26** is actuated to the on position, which saves on current drain of the batteries and extends normal battery life.

[**0029**] The electronic circuitry **50** for operating the thermometer **20** is shown in the schematic diagram of **FIG. 4**. The principal component of circuitry **50** is a microcontroller, generally designated **52**, which may be of part number FS9712 commercially available from Fortune Semiconductor Company of Taipei, Taiwan. Of course, other microprocessor or microcontroller part numbers, including from other vendors, may also be suitable for this application. An electrically erasable PROM (EEPROM) memory IC **54** provides non-volatile memory for microcontroller **52**. EEPROM **54** is commercially available from Microchip Technology, Inc. of Chandler, Ariz. and other semiconductor manufacturers under industry part number 93LC66. An external crystal **55** and resistor **56** set the clock rate of microcontroller **55** at about 4 MHz.

[**0030**] Positive operating power, such as from a DC battery, is received at terminals VCC **58** for operation of microcontroller **52** and its associated circuitry. Similarly, negative operating power is received at terminal VSS **59**. Capacitors **60** and **61** filter the power provided to microcontroller **52**. A jumper **62**, when closed, sets the circuitry **50** in the calibration mode. When jumper **62** is open, the circuitry **50** is set for the normal temperature measuring mode. A jumper **63**, when closed, establishes temperature measurement in the Fahrenheit mode. If jumper **63** is open, temperature measurement will be in the Celsius mode. A switch **64** provides a scan/memory function.

[**0031**] Some of the indicated terminals connect to other terminals in the schematic diagram of **FIG. 4**. For example, BAT CHK terminal **66** on the right side of the schematic in **FIG. 4** connects to the corresponding BAT CHK terminal, pin **75**, of microcontroller **52**. CS terminal **68** from pin **47** of microcontroller **52**, through resistor **69**, connects to the corresponding CS terminal, pin **1**, of EEPROM **54**. Similarly, SK terminal **70**, which is connected to pin **68** of microcontroller **52** through resistor **71**, is connected to the corresponding SK terminal, pin **2**, of EEPROM **54**. Upon turning power on, resistor **74** and capacitor **75** provide a slightly delayed reset signal to pin **69** of microcontroller **52** to initialize the microcontroller.

[**0032**] A plurality of resistors **80-87** interface microcontroller **52** with terminals **90-91** that connect to a thermopile **95** and with terminals **92-93** that connect to a temperature sensing thermistor **96**. Terminal **91** is connected to the positive terminal of thermopile **95**. The thermopile **95** typically measures the temperature of the patient by developing a signal that is proportional to the amount of incident infrared radiation from the ear canal. The thermistor **96** typically measures the ambient temperature. Certain of resistors **80-87** thus couple thermopile **95** to respective terminals of microcontroller **52**. Certain of resistors **80-87** similarly couple signals from thermistor **96**, which are representative of the measured temperature, back to microcontroller **52** for further analysis of the measured temperature. Switch **88** may be used to check any offset in the temperature measurements, especially during the calibration procedures. It is therefore not accessed by the user during normal operation of thermometer **20**.

[**0033**] Certain pins of microcontroller **52** are dedicated to provide information to display **28** and to also provide control signals to display **28**. Microcontroller pins **49-61** provide the SEG**13**-SEG**1** signals to display **28**, and pins **62**-provide **64** the COM**1**-COM**3** signals to display **28**. Microcontroller is thus able to supply information and control signals to display **28** to display the measured temperature and the various operating modes and other conditions, including "L" for a low out-of-range temperature, "H" for a high out-of-range temperature and "M" for a temperature previously stored in memory.

[**0034**] It will be understood that the embodiments of the present invention that have been described are illustrative of some of the applications of the principles of the present invention. Various changes and modifications may be made by those skilled in the art without departing from the true spirit and scope of the invention.

1. An ear thermometer for measuring the temperature of a living being by inserting a portion of the thermometer in the ear of the being comprising:

a housing;

a probe attached to the housing, said probe having a tapered tip adapted to be inserted into an ear canal of the being;

a display for displaying a temperature measured by said thermometer; and

a light source disposed on said housing to supply illumination in front of the tip of said probe to illuminate at least the area around the being's ear canal as the tip of the probe is being inserted therein.

2. The ear thermometer in accordance with claim 1 further comprising:

a switch in electrical communication with said light source; and

a source of electrical power,

said switch capable of being actuated to control the application of electrical power to said light source, thereby selectively controlling the light source in suppling illumination.

3. The ear thermometer in accordance with claim 1 further comprising:

a raised protrusion disposed on said housing,

said light source disposed in said raised protrusion and oriented to provide illumination in front of the tip of said probe.

4. The ear thermometer in accordance with claim 3 wherein said raised protrusion is disposed at a top end of the housing of the thermometer.

5. The ear thermometer in accordance with claim 1 wherein the illumination provided by said light source is in the form of divergent rays.

6. The ear thermometer in accordance with claim 1 wherein said light source comprises at least one incandescent lamp.

7. The ear thermometer in accordance with claim 1 wherein said light source comprises at least one light emitting diode.

8. The ear thermometer in accordance with claim 6 wherein said at least one light emitting diode is of the bright light emitting diode type.

9. The ear thermometer in accordance with claim 1 wherein said probe defines an axis and at least some of the illumination from said light source intersects with said axis in front of the tip of said probe.

10. The ear thermometer in accordance with claim 1 wherein the illumination provided by the light source illuminates the entire ear of the being.

11. The ear thermometer in accordance with claim 1 wherein said probe is pivotally mounted to said housing.

12. The ear thermometer in accordance with claim 1 wherein said probe is rotationally mounted to said housing.

13. The ear thermometer in accordance with claim 1 wherein said probe is mounted to said housing at an oblique angle thereto.

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专利名称(译)	带照明的耳温计		
公开(公告)号	US20050080354A1	公开(公告)日	2005-04-14
申请号	US10/683320	申请日	2003-10-10
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申请(专利权)人(译)	CROSSLEY DAVID W.		
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外部链接	Espacenet USPTO		

摘要(译)

耳温计具有光源以照射探头尖端前方的场，例如耳道周围的区域或整个耳朵，以帮助探头插入耳道。光源可以包括白炽灯或一个或多个明亮类型的LED，并且可以通过用户激活的开关来控制照明的应用以节省电池寿命。光源可以设置在温度计的壳体上的凸起的突起中，例如靠近壳体的顶部，以将发散的光线提供给感兴趣的场，例如耳朵。