US 20170020397A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0020397 A1**

Fraden (43) **Pub. Date: Jan. 26, 2017**

(54) **PROBE COVER WITH MATCHING FEATURE FOR A MEDICAL THERMOMETER**

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(21) Appl. No.: **15/069,412**

(22) Filed: **Mar. 14, 2016**

Related U.S. Application Data

(60) Continuation of application No. 13/747,918, filed on Jan. 23, 2013, now Pat. No. 9,285,276, which is a division of application No. 12/675,877, filed on Dec. 29, 2010, now Pat. No. 8,882,347, filed as application No. PCT/US09/69528 on Dec. 24, 2009.

(60) Provisional application No. 61/203,641, filed on Dec. 29, 2008.

Publication Classification

(51) **Int. Cl.**

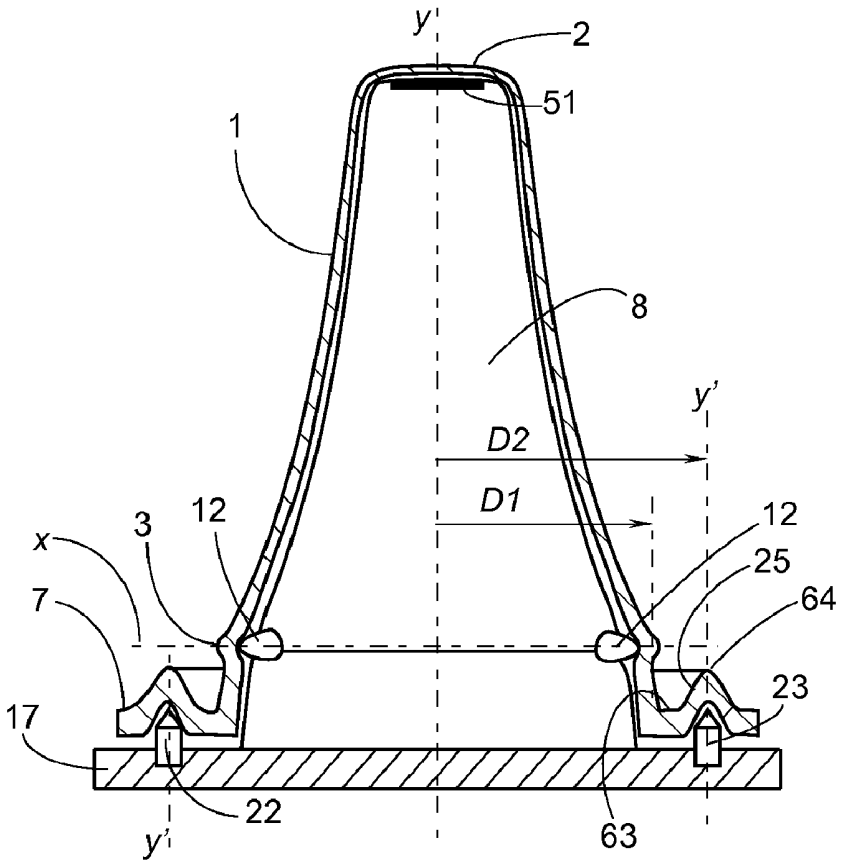
A61B 5/01	(2006.01)
A61B 5/00	(2006.01)
G01J 5/02	(2006.01)
G01K 1/08	(2006.01)
G01J 5/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A61B 5/01*** (2013.01); ***G01K 1/086*** (2013.01); ***G01J 5/0025*** (2013.01); ***G01J 5/021*** (2013.01); ***A61B 5/0086*** (2013.01); ***A61B 5/6817*** (2013.01); *A61B 2562/0233* (2013.01); *A61B 2562/0271* (2013.01); *A61B 2562/18* (2013.01)

(57) **ABSTRACT**

A probe cover for medical thermometer has a matching feature for preventing its use with an incompatible thermometer. A mechanical matching feature of the probe cover includes at least one of a fold, a step, or a series of holes or indentations that are respectively matched to a ridge, a valley or series of pins formed on the front end of a compatible thermometer. When applied to the compatible thermometer, the mechanical matching feature permits the probe cover to be fully seated on and retained by the probe, thereby placing the thermometer in condition for use. Alternatively, an opto-electronic matching feature of the probe cover includes a reflective layer for use with an opto-electronic detection circuit of a compatible thermometer. When applied to the compatible thermometer, the opto-electronic detection detects the reflective layer and places the compatible thermometer in an operational state for use.



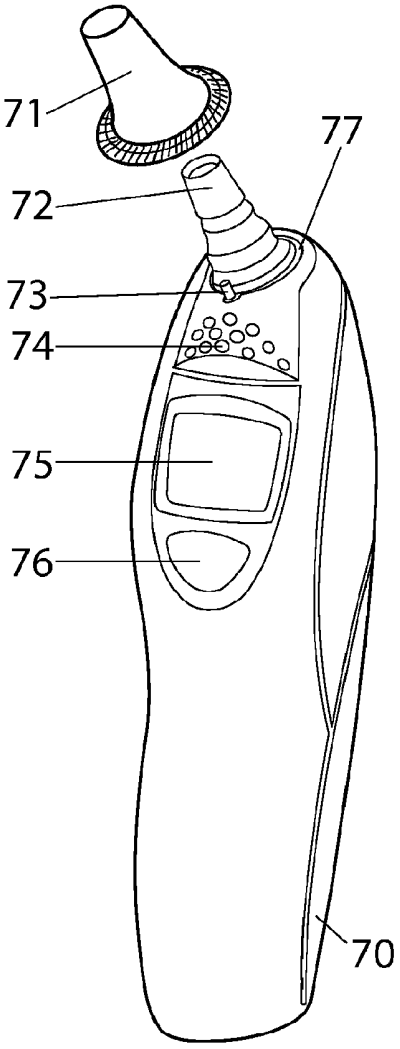


Fig. 1a
(Prior Art)

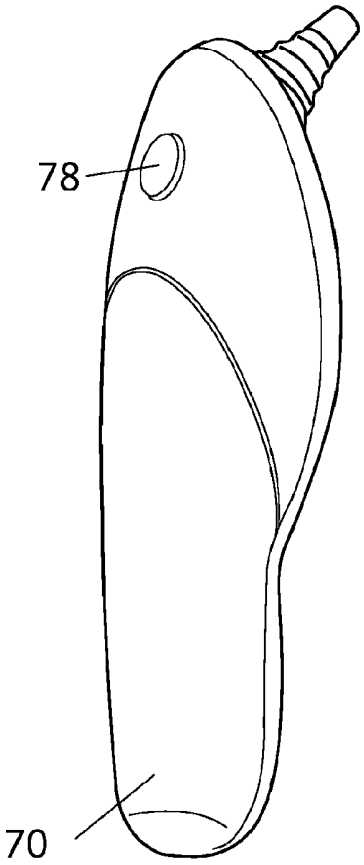


Fig. 1b
(Prior Art)

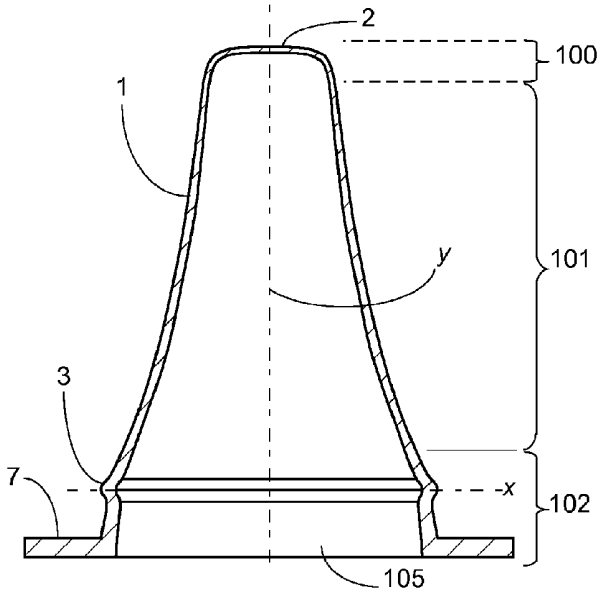


FIG. 2a
(PRIOR ART)

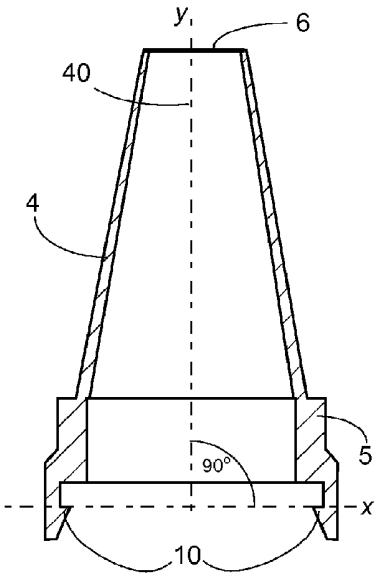


FIG. 2b
(PRIOR ART)

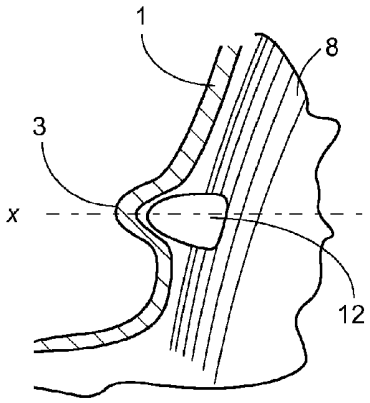


FIG. 2c
(PRIOR ART)

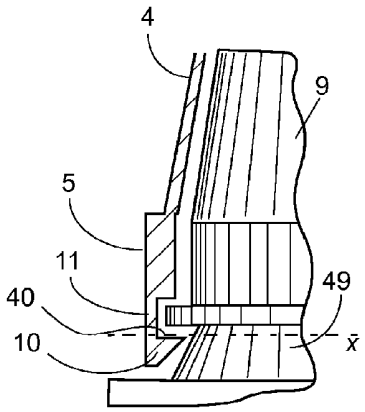


FIG. 2d
(PRIOR ART)

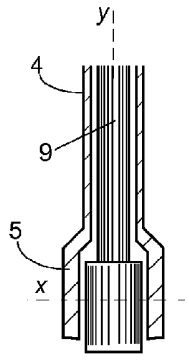


FIG. 2e
(PRIOR ART)

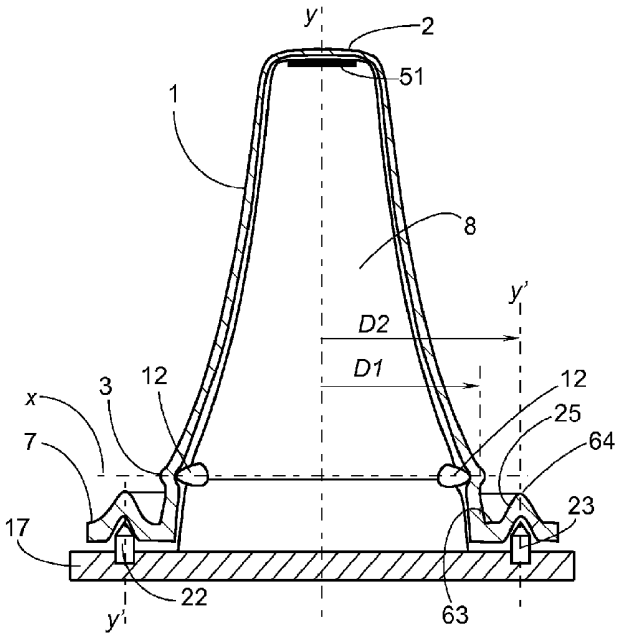


FIG. 3

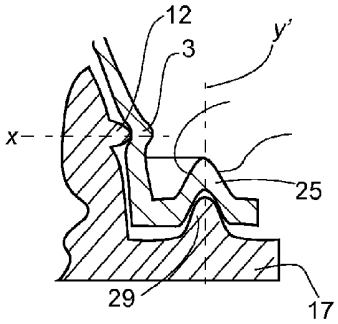


FIG. 4a

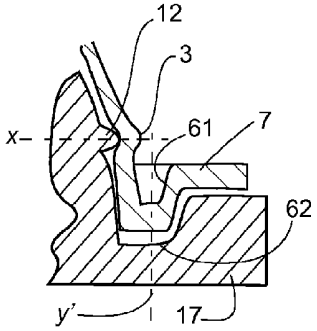


FIG. 4b

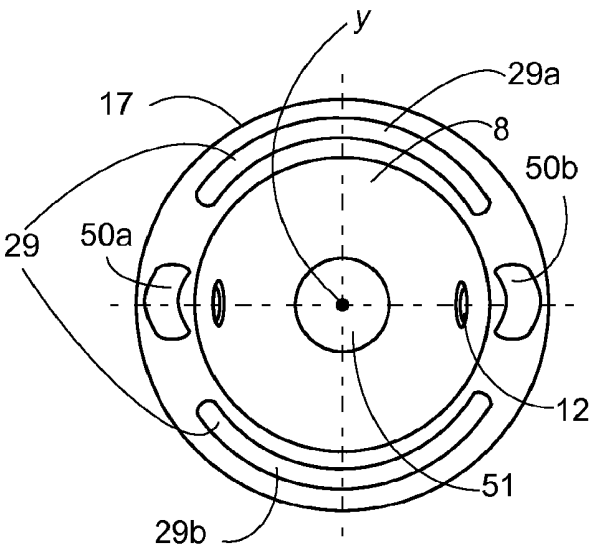


FIG. 5a

FIG. 5b

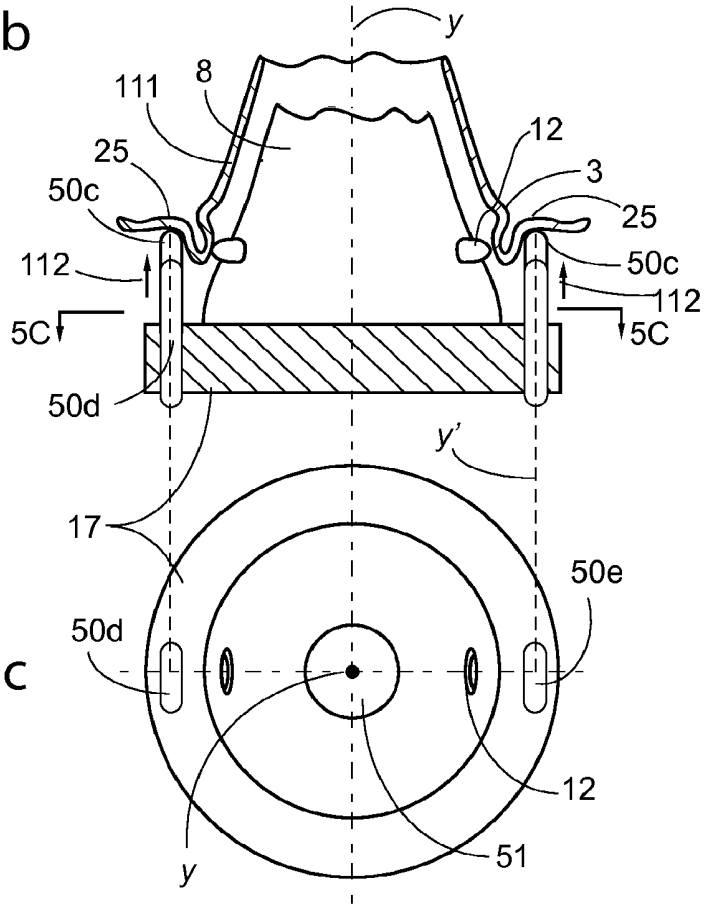


FIG. 5c

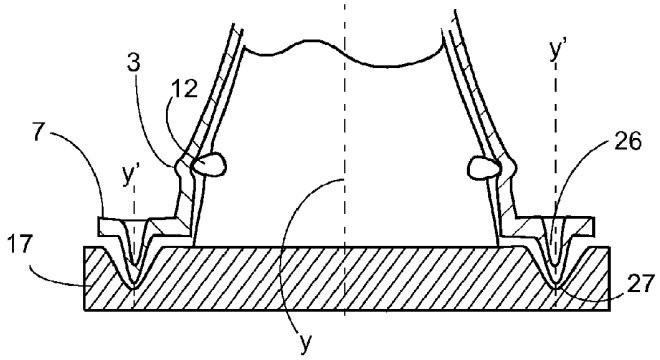


FIG. 6

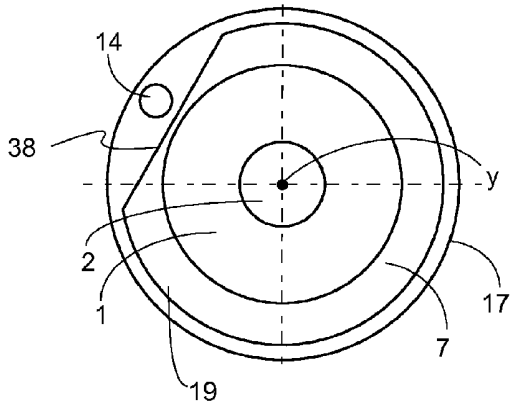


FIG. 7

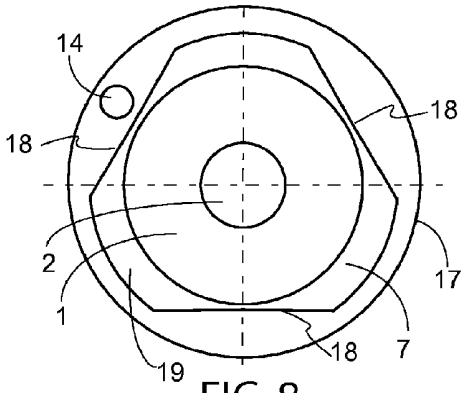


FIG. 8

FIG. 9

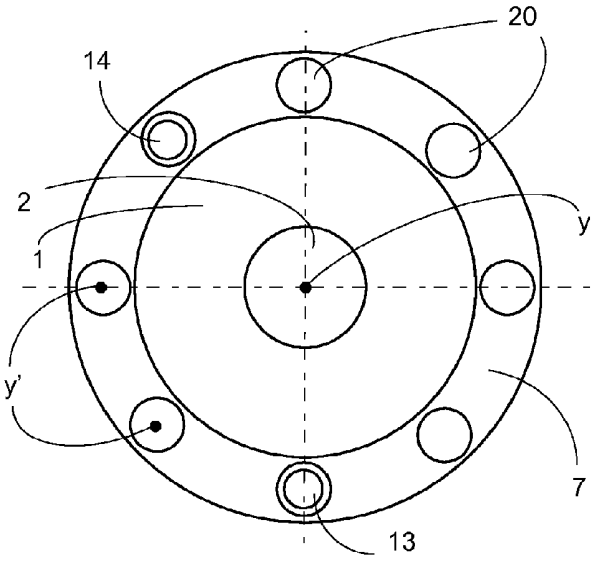


FIG. 10a

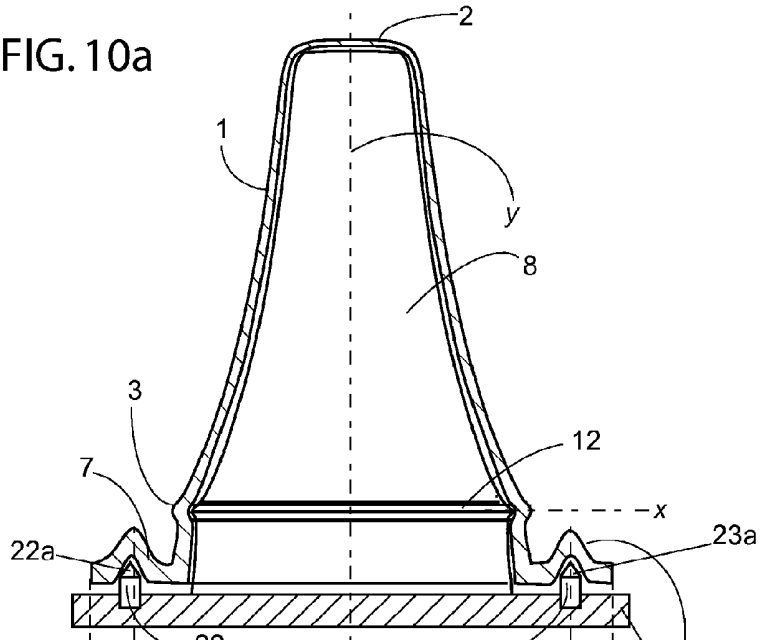


FIG. 10b

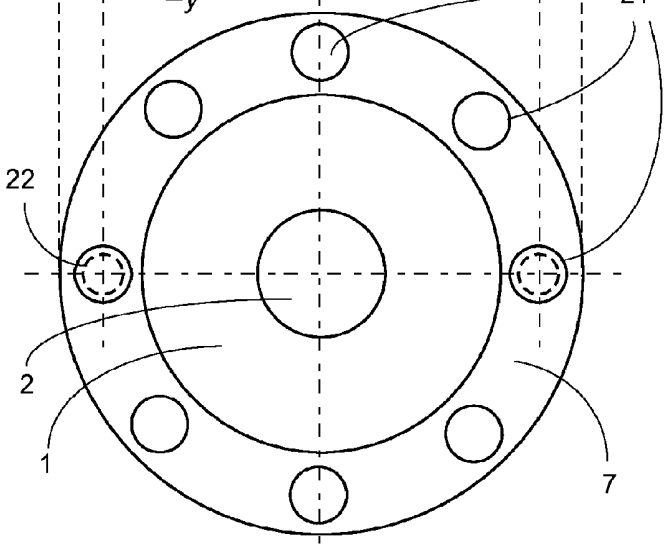
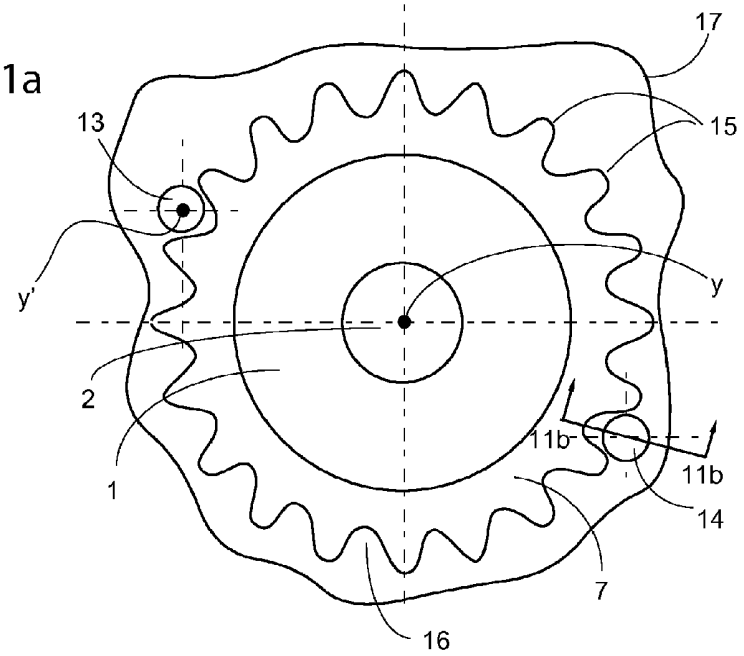


FIG. 11a



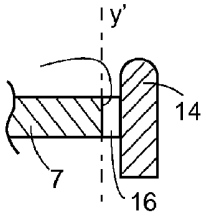


FIG. 11b

FIG. 12

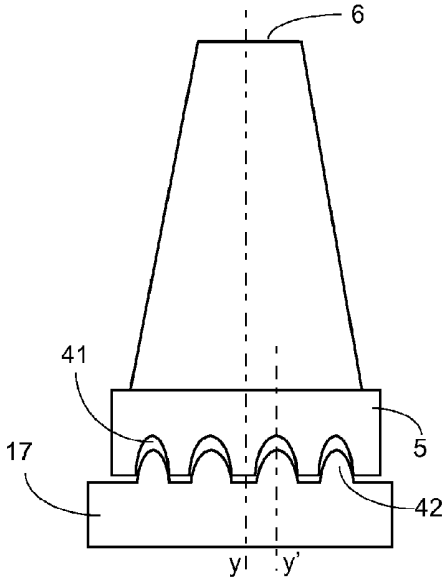
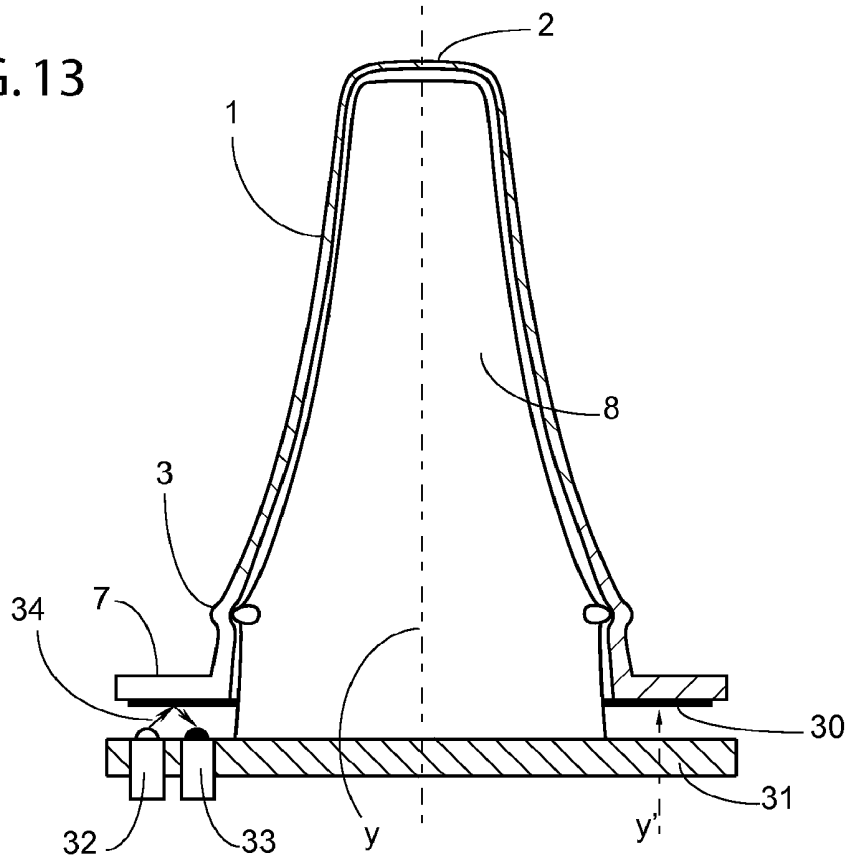


FIG. 13



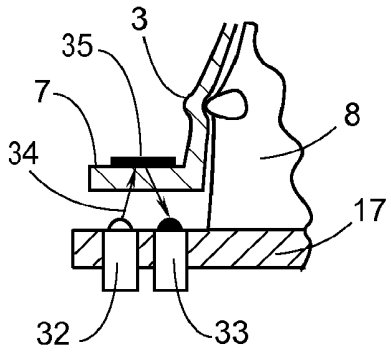


FIG. 14

PROBE COVER WITH MATCHING FEATURE FOR A MEDICAL THERMOMETER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application is a continuation application of U.S. patent application Ser. No. 13/747,918, filed on Jan. 23, 2013, which is a divisional of U.S. patent application Ser. No. 12/675,877, filed on Dec. 29, 2012, which was the National Stage of International Application No. PCT/U509/69528, filed on Dec. 24, 2009, which claims priority under 35 U.S.C. §119(e) to U.S. Provisional Application No. 61/203,641, filed on Dec. 29, 2008 and entitled "Matching Probe Cover for Infrared Thermometer," the contents of all of which are hereby fully incorporated by reference herein.

FIELD OF THE INVENTION

[0002] The present invention relates generally to thermometers, and more particularly, to medical thermometers that employ disposable or reusable probe covers.

BACKGROUND OF THE INVENTION

[0003] The temperature of a human or animal, can be measured either by means of thermal conduction or thermal radiation. In the former case, a temperature sensing probe may be positioned inside the patient's body cavity or on the skin surface to obtain an intimate contact for conductively receiving thermal energy indicative of a surface temperature of a patient-measured body site. In the latter case, a naturally-emanated electromagnetic radiation in the mid- and far-infrared spectral ranges may be detected by an appropriate non-contact sensor, whose output signal is indicative of the surface temperature of a patient-measured body site (for example, in proximity to the tympanic membrane). A combination of a sensor, electronic circuit and other components form an infrared (IR) thermometer, which is an opto-electronic instrument.

[0004] Many medical thermometers, either contact or non-contact, use sanitary probe covers which envelope the probe and prevent cross-contamination of patients and soiling of the probe. In a contact probe cover, thermal energy (heat) is transmitted by means of thermal conduction. Thus, requirements for the probe cover must be compatible with the thermally conductive properties of the probe cover material. Various conventional covers for such contact thermometers are described in many patents, for example, in U.S. Pat. No. 4,159,766 to Kluge, which is incorporated by reference herein in its entirety.

[0005] In order to measure a surface temperature of an object by means of IR radiation, the probe of the IR thermometer is aimed at the area of interest. For example, in order to measure the temperature of a tympanic membrane and the surrounding tissues, the probe is placed into the ear canal. Before the insertion, a probe cover is typically installed onto the probe to envelope its parts that otherwise might come in contact with the tissues of the ear canal.

[0006] A typical prior art infrared thermometer **70** is illustrated in FIGS. **1***a* and **1***b*. The thermometer **70** includes a front end **77**, from which an infrared probe **72** projects, for example, with an orientation suitable for placement of the probe **72** in the ear canal. A probe cover **71** is positioned to be placed over the probe **72** for eliminating any direct contact between the probe **72** and tissues of the ear canal. A power button **76** is provided for powering the circuitry of the thermometer **70**. A start button **78** is provided to engage the circuitry to perform a temperature measurement, and a display **75** is provided, for example, to indicate a current condition or status of the thermometer **70** and/or the results of a current temperature measurement. A probe cover detector **73** is positioned near a base of the probe **72** for detecting that the probe cover **71** has been placed over the probe **72**, and may for example interact with the circuitry to permit operation of the thermometer **70** only when installation of the probe cover **71** has been detected. After a temperature measurement has been made, a probe cover ejector **74** elevates the front end **77** of the thermometer **70** relative to the probe **72** in order to eject the probe cover **71** from the probe **72**.

[0007] The probe cover **71** is not only required to provide a sanitary protection against contamination of the probe by ear wax and other soiling biological compounds, but it must possess other properties for accurate temperature measurement by means of detecting an associated IR signal. Such properties, for example, include a good optical transparency of the probe cover in the spectral range of interest, low directional distortion of optical rays, tight manufacturing tolerances, stability of the optical properties during installation onto the probe, long term stability, and the like. Suitable probe covers for IR thermometers are exemplified by U.S. Pat. No. 5,088,834 issued to Howe et al. and U.S. Pat. No. 5,163,418 issued to Fraden et al., each of which is incorporated by reference herein in its entirety. Most prior art probe covers are formed to surround a longitudinal axis of a thermometer probe.

[0008] As a rule, a prior art probe cover intended for a medical thermometer includes three portions being disposed along the probe longitudinal axis y (see, e.g., FIG. **2***a*):

[0009] 1) a proximal or "base" portion **102** provided for physical retention of the cover by the thermometer probe or front end of a thermometer housing. The proximal portion **102** may contain an offset **3** for interaction with the retention devices of the probe. This offset **3** is disposed along a transverse axis x that is substantially normal to longitudinal axis y. A brim **7** may or may not be part of the proximal portion **102**. The proximal portion **102** has an opening **105** through which the probe is inserted during a probe cover installation. Instead of or in addition to the offset **3**, the proximal portion **102** may have a snug fit over the probe, thus using friction as a retention force (see, e.g., FIG. **2***e*),

[0010] 2) a middle or "body" portion **101** provided for enveloping the sides of the probe. The middle portion **101** includes a rigid or pliant wall **1**. The middle portion **101** may be prefabricated, or it may be formed during the probe cover installation by stretching wall **1** to match the probe length, and

[0011] 3) a distal or "tip" portion **100** provided for enveloping the optical end of the probe of an IR thermometer or the sensing part of a contact thermometer. This portion **100** contains a membrane **2** which is substantially transparent for IR radiation (for an IR thermometer), or is thermally conductive (for a contact thermometer). The membrane **2** may include a polymer film (for an IR thermometer, in thickness ranges from as little as 0.0005 in. to as much as 0.005 in.). The IR radiation passes through the membrane **2** before entering the probe where it is detected by the IR sensor. In

effect, the membrane **2** of the probe cover works as an optical filter, and often is alternatively called a "lens filter."

[0012] Typical materials for fabricating the probe covers are polyethylene, polypropylene, and copolymers of polyethylene and polypropylene. FIG. **2***a* shows a prior art unitary probe cover (as taught for example by U.S. Pat. No. 5,088,834) which is fabricated as a single piece. FIG. **2***b* shows a two-piece probe cover (as taught by U.S. Pat. Nos. 4,662,360, 5,293,862 and 5,179,936, each issued to O'Hara et al. and incorporated by reference herein in their entirety) where a membrane **6** is welded onto a frustoconical body **4**. In the probe cover of FIG. **2***b*, a bottom ring **5** is provided for affixing the probe cover to the probe as part of a proximal portion. Probe covers generally have shapes that follow a body of rotation around a longitudinal axis y.

[0013] Probe covers may be attached to the probe or the IR thermometer housing by various mechanisms. FIG. **2***c* once again shows the offset **3**, which is an extension of wall **1** of the probe cover in the proximal portion **102**. The offset **3** engages a nipple **12** that is part of a probe **8** of the IR thermometer when the probe cover is installed onto the probe **8**. The nipple **12** is disposed along a transverse axis x.

[0014] Another known way of attaching a probe cover to a probe is shown in FIG. **2***d*. FIG. **2***d* illustrates a hook **10** (also illustrated in FIG. **2***b*) which is supported by a neck **11**. The neck **11** is an extension of a ring **5**. When the probe cover is installed onto the probe **9**, hook **10** engages a retention skirt **49** of a probe cover **9**. The retention portion **40** of hook **10** is disposed along the transverse axis x. Alternatively, FIG. **2***e* shows a probe cover **4** installed on a probe **9**, which includes a retention ring **5** that enables the probe cover **4** to be retained by a frictional force applied to the probe cover **4** along the transverse axis x.

[0015] In the prior art probe covers illustrated in FIGS. **2***a*-**2***e*, a probe cover body is formed along the longitudinal axis y, having retention elements formed along the transverse axis x.

[0016] Known prior probe covers, while having various shapes and methods of retention, often may be interchanged between different types of thermometers. This is undesirable, and may for example cause a mismatch between the type of a membrane **2** (material, thickness and shape) and the thermometer calibration and, as a result, cause unacceptably high errors in temperature measurement. It is important to use only a correct (matching) probe cover with a particular thermometer. However, common matching techniques such as affixing an identification code on a probe cover are typically insufficient for preventing use of a wrong probe cover. Thus, a more direct method for preventing usage of a foreign probe cover on a thermometer is desirable.

SUMMARY OF THE INVENTION

[0017] The present invention is directed to a probe cover that encourages proper use with a thermometer probe by forming matching elements on a proximal portion of the probe cover to be matched with corresponding elements on a front end of the thermometer in proximity to the probe. The matching elements have complementary features to the corresponding elements on the thermometer probe (for example, complementary or interlocking shapes) that form a "key-lock" pair when the probe cover is installed onto the probe. A mismatching of non-corresponding elements makes it impossible either to securely position the probe cover on the probe and/or operate the thermometer. The method of matching can be used for any type of a medical thermometer having a probe cover (including, for example, IR and contact thermometers).

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The foregoing and other features of the present invention will be more readily apparent from the following detailed description and drawings of illustrative embodiments of the invention in which:

[0019] Figs. la and lb show a front perspective view and a rear perspective view of a prior art infrared thermometer, respectively;

[0020] FIGS. **2***a* and **2***b* shows a unitary prior art probe cover and a two-piece prior art cover, respectively;

[0021] FIGS. **2***c* and **2***d* show partial views of prior art probe covers having offset and hook retention mechanisms, respectively;

[0022] FIG. **2***e* shows a prior art probe cover including a friction ring for retention;

[0023] FIG. **3** provides a side cross-sectional view of a unitary probe cover according to an embodiment of the present invention;

[0024] FIG. **4***a* is a partial view of a probe cover according to another embodiment of the present invention;

[0025] FIG. **4***b* is a partial view of a probe cover according to a further embodiment of the present invention;

[0026] FIG. **5***a* shows a front elevational view of a probe cover according to another embodiment of the present invention;

[0027] FIGS. **5***b* and **5***c* respectively show a side cross-sectional view of a probe and probe cover according to a further embodiment of the present invention and a front elevational view of the probe;

[0028] FIG. **6** shows a partial cross-sectional view of a probe cover according to another embodiment of the present invention;

[0029] FIG. **7** shows a front elevational view of a probe cover according to another embodiment of the present invention;

[0030] FIG. **8** shows a front elevational view of a probe cover according to a further embodiment of the present invention;

[0031] FIG. **9** shows a front elevational view of a probe cover according to another embodiment of the present invention;

[0032] FIGS. **10***a* and **10***b* respectively show a side cross-sectional view and a front elevational view of a probe cover according to a further embodiment of the present invention;

[0033] FIG. **11***a* shows a front elevational view of a probe cover according to another embodiment of the present invention;

[0034] FIG. **11***b* shows a cross-sectional view through a portion of a brim of the probe cover of FIG. **11***a;*

[0035] FIG. **12** shows a side view of a probe cover according to another embodiment of the present invention;

[0036] FIG. **13** shows a side cross-sectional view of a probe cover according to another embodiment of the present invention; and

[0037] FIG. **14** shows a partial cross-sectional view of a probe cover according to a further embodiment of the present invention.

[0038] Like reference numerals are used in the drawing figures to connote like components of the probe cover.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0039] A probe cover for an infrared (IR) thermometer is a sanitary envelope which forms a barrier between the instrument and the patient. For the purpose of illustrating principles of the present invention, several probe covers are described and shown for application to an infrared thermometer used in measuring temperatures in an ear canal of a human or animal. The present invention is however equally applicable to probe covers used in a variety of other contexts, for example, including medical contact thermometers that take conductive temperature measurements from a body cavity or surface of a human and veterinary thermometers used for determining the temperature of an animal.

[0040] In the presently-described examples, a distal portion of the probe cover is designed to cover a window of a probe housing through which IR energy is received in order to measure temperature. The material for the probe cover's distal portion (that is, for its "optical portion") is preferably selected from the group of polymers which have significant transparency in the spectral range between 3 and 15 μm. Examples of suitable polymers include polyethylene, polypropylene, and copolymers of polyethylene and polypropylene. As a rule, the thickness of the optical portion of the cover is preferably on the order of 20 micrometers. This thickness provides acceptable IR transmission characteristics, as well as an acceptable mechanical strength. As shown for example in FIG. **3**, a body **1**, **2** of the probe cover is substantially symmetrical around a longitudinal axis y.

[0041] A probe cover, when installed onto the probe, may be retained by one of many methods known in the art, some of which are described above. A preferred embodiment of a probe cover according to the present invention includes middle and distal portions which are not substantially different from those of above-described prior art. It should be noted that the present invention is principally directed to providing additional features in a proximal portion of a probe cover for precisely matching the probe cover to a corresponding thermometer.

[0042] The probe cover of FIG. **3** is a unitary IR probe cover having a membrane **2** adjacent to an IR window **51** of the IR thermometer's probe **8**. Side wall **1** of the probe cover envelopes sides of the probe **8**. A circular offset **3** of the probe cover snaps over nipples **12** of the probe **8**, thus assuring retention of the probe cover when installed onto the probe **8**. Preferably, two or more nipples **12** are opposingly provided on the sides of the probe **8**. As shown in FIG. **3**, nipples **12** and offset **3** are disposed along a transverse axis x that is normal to the longitudinal axis y.

[0043] In the proximal or base portion of the probe cover of FIG. **3**, a brim **7** is provided and disposed in a direction substantially parallel to the transverse axis x. The brim **7** includes a pre-formed fold **25** that extends upwardly in a direction parallel to the longitudinal axis y. The fold **25** may be continuously formed around the longitudinal axis y, or may be broken into two or more segments. A front end **17** of the IR thermometer contains at least one pin **23** that enters the fold **25** as the probe cover is installed and seated on the probe. Preferably, two or more pins (**23** and **22**) are provided on the IR thermometer front end **17** for entering the fold **25**. If the pins **22** and **23** and the fold **25** are not matched (for example, if the probe cover is not intended to be used with the IR thermometer), the mismatch (between the shapes and positions of fold **25** and pins **23** and **22**) prevents the probe cover from sitting deeply enough on the probe **8** to be seated. As a result, the offset **3** is not able to engage with the nipples **12**, and the probe cover is not effectively retained for use on the probe **8**.

[0044] Alternatively to the pins **22** and **23**, a matching ridge **29** may be formed as part of the IR thermometer front end **17** (see, e.g., FIG. **4***a*). For a secure seating of the probe cover on the probe **8** that causes the nipples **12** to be engaged with the probe cover offset **3**, ridge **29** must have a complimentary shape to fold **25**. The fold **25** and the corresponding pins **22** and **23**, or the ridge **29** are substantially disposed along a matching axis y' that is substantially parallel to the longitudinal axis y and normal to the transverse axis x. Having a ridge **29** that is too wide or is centered at a wrong distance D2 from the longitudinal axis y for a particular probe cover, will prevent such probe cover from being retained on the probe.

[0045] A fold **25** is just one suitable example of a mechanical mating feature according to the present invention. Another example is a dip **61** (see, e.g., FIG. **4***b*) provided on the brim **7**, with a complementary valley **62** provided on the thermometer front end **17**. The dip **61** is essentially a half fold substantially formed along matching axis y' that is parallel to the longitudinal axis y and perpendicular to the transverse axis x. In the half fold arrangement, the brim **7** extends laterally outwardly from the matching axis y' rather than forming the second half of the fold as illustrated in the fold **25** of FIG. **4***a*.

[0046] Alternatively, a combination of a dip and a fold (or several of them) may be also employed in the probe cover and matched with the corresponding complementary features on the thermometer.

[0047] In each of the above-described embodiments of the present invention, the mating features such as a fold **25** and dip **61** shown in FIGS. **3**, **4***a* and **4***b* (formed along the matching axis y') and their corresponding mating features **22**, **23** and **29** formed on the probe are positioned further from the longitudinal axis y than the retention features such as offset **3** and nipple **12** (see, e.g., respectively corresponding distances D2 and D1).

[0048] The mating features on the IR thermometer may further be aligned with a probe cover ejector. For example, after a temperature measurement is complete, the probe cover can be removed (ejected) from the probe by disengaging nipples **12** from offset **3** (see, e.g., FIG. **5***b*). A disengagement can be accomplished by a simple manual pulling off of the probe cover. Alternatively, the disengagement may be assisted by an ejector that is part of the thermometer.

[0049] FIG. **5***a* depicts a front elevational view of the front end **17** of the thermometer as viewed along longitudinal axis y. No probe cover is installed. FIG. **5***a* illustrates a ridge **29** broken into two segments **29***a* and **29***b*. In between these segments, two ejectors **50***a* and **50***b* are positioned. The ejectors are normally hidden below the surface of the front end **17**, and have shapes and/or locations that are not matching the shape (for example, being wider than) and/or location of the ridge **29**.

[0050] Ejection of a probe cover is facilitated, for example, by moving ejectors **50***a* and **50***b* upwardly in along axis y'. Because the ejectors **50***a*, **50***b* do not match the shapes of the segments **29***a*, **29***b*, the ejectors **50***a*, **50***b* when operated will not fully enter the fold **25** of the probe cover, and will act therefore to push the probe cover upwardly in

a direction parallel to the axis y. The IR thermometer may include one or more ejectors. Each ejector is preferably positioned adjacent to one of the nipples **12** of the IR thermometer.

[0051] Alternatively, the ejectors may be configured to serve a dual purpose: providing a matching feature for retaining the probe cover, as well as an ejecting feature. For example, as illustrated in FIG. **5***b*, when ejectors **50***d* and **50***e* are partially retracted (that is, when only portions **50***c* extend above an upper surface of the front end **17**), the ejectors **50***d* and **50***e* may serve as ridges for mating with the probe cover fold **25** as illustrated in FIG. **3**. When partially retracted, the portions **50***c* provide just enough height to match with the fold **25**, and allowing the probe cover **111** to slide sufficiently downward for engaging the offset **3** and nipples **12**. However, when fully extended in a direction **112** as shown in FIG. **5***b*, the ejectors **50***d*, **50***e* will push the probe cover **111** outwardly and disengage offset **3** from nipple **12**. Preferably at least two ejectors **50***d*, **50***e* are positioned near two respective nipples, making two nipple-ejector pairs. Each pair is preferably disposed in opposition along the sides of the probe **8**. Each ejector is disposed along the axis y' that is parallel to the longitudinal axis y. FIG. **5***c* illustrates a front elevational view of the probe **8** which further shows the positioning of the ejectors **50***d*, **50***e*.

[0052] FIG. **6** illustrates probe cover according to the present invention which includes an outward fold **26** on the brim **7** for mating with valley **27** formed in the front end **17** of the thermometer. The fold **26** on the brim **7** extends downwardly along the axis y' that is parallel to the longitudinal axis y.

[0053] Numerous other shapes and mechanical mating arrangements can be formed on the proximal portion of the probe cover and the corresponding front end **17** or probe **8** of a thermometer. For example, as shown in FIGS. **7** and **8**, a circular brim **19** may be trimmed or relieved with a cut **38** forming a chord or linear segment between two points on the perimeter of the circular brim **19**, to facilitate matching or clearance in relation to a pin **14** projecting from the thermometer front end **17**. Any number of additional cuts may be added as needed for a particular design. For example, FIG. **8** show a probe cover having three cuts **18** made equidistantly around the brim **19**. The cuts **38** and **18** are made to match the positions of one or more pins **14**, or other complementary features disposed on the thermometer front end **17**

[0054] Another embodiment of the present invention is shown in FIG. **9**. In this embodiment, one or more holes **20** are formed in the brim **7** of the probe cover along matching axes y' that are parallel with the longitudinal axis y. In an embodiment having at least two holes **20**, mating pins **13** and **14** are positioned on the front end **17** to match the sizes and locations of holes **20**. For example, the lateral distance of the pins **13** and **14** from the longitudinal axis y and the angular relationship between the pins **13** and **14** with reference to the longitudinal axis y is matched by the positioning of the holes **20** in the brim **7** of the probe cover when the probe cover is seated on the probe

[0055] As an alternative to the holes **20**, conical or similarly-shaped extensions **21** can be formed on brim **7** as depicted in FIGS. **10***a* and **10***b*. For a unitary probe cover, they may be preferably formed by use of a thermoforming technology. In this case, mating pins **22**, **23** formed on the front end **17** include conical or similarly-shaped features **22***a*, **23***a* for effectively mating with the conical or similarly-shaped extensions **21**.

[0056] Another embodiment of the present invention having yet another mechanical mating feature is shown in FIG. **11***a*. In FIG. **11***a*, the brim **7** has petals **15** formed by indentations (voids) **16** spaced around a circumference of the brim **7**. One or more mating pins (for example, the pins **13** and **14**) on the thermometer front end **17** allows for the probe cover installation along longitudinal axis y. In this embodiment of the invention, the pins **13** and **14** are positioned to simultaneously enter the voids **16** between the petals to form a "key-lock" arrangement. The locking arrangement is shown in more detail in FIG. **11***b*.

[0057] In another embodiment of the present invention illustrated in FIG. **12**, a two-piece probe cover **55** has a matching feature formed as semi-oval cut-outs **41** in the bottom ring **5** that match corresponding semi-oval fingers **42** of the front end **17** when the probe cover is installed and seated. Any number of other complementary shapes may alternatively be used for the cut-outs and corresponding fingers. The cut-outs **41** are provided along the axes y' that are parallel to the longitudinal axis y.

[0058] The above described matching features all are of a mechanical nature. In another embodiment of the present invention, a non-mechanical matching feature between the probe and probe covers is provided using opto-electronic devices. As shown for example in FIG. **13**, a brim **7** of the probe cover is provided with a reflective layer **30** formed on an underside surface of the brim **7** facing a thermometer body **31**. The layer **30** may include, for example, an aluminum foil that is welded, glued, sputtered or otherwise deposited on the underside surface brim **7**. Alternatively, the reflective layer **30** may be a painted layer of selected color.

[0059] As illustrated in FIG. **13**, the thermometer body **31** carries a light emitter **32** and light detector **33** that together form an opto-coupler. When a probe cover with the reflective layer **30** is installed, the detector **33** is configured to receive a light beam **34** that is transmitted by the light emitter **32** and reflected by the layer **30**. Detector **33** will respond with a changing electrical signal, thus signaling a detection circuit in the IR thermometer that a suitable probe cover has been properly installed. If the detector **33** detects no reflection, or detects a reflection having a wrong intensity or mismatched spectral characteristics (color), the detection circuit preferably determines that a suitable probe cover has not been installed, and will prevent a temperature measurement from being initiated in the IR thermometer.

[0060] If the reflective layer **30** has been painted with a particular color, the color of the emitter **32** should be substantially the same to allow for proper reflection of the emitted light. For example, if emitter **32** generates green light and the reflector **30** is also green, then there will be reflection of the emitted light which will then be detected by detector **33**. However, if emitter **32** generates green light and the selected color of the reflector **30** is red, there will be a negligible reflection of green light toward detector **33** and the device will indicate a mismatch, i.e., a proper probe cover has not been used. A spectral response of detector **33** should be matched with the spectral response of the emitter **32**.

[0061] Alternatively, as shown in FIG. **14**, the reflective layer **35** may be deposited on a side of brim **7** opposite to the underside. In this embodiment of the invention, the light

beam **34** will travel through brim **7** on the way to detector **33**. This will not change the operation of the opto-coupler **32**, **33** and detection circuit, provided that the brim **7** of the probe cover is suitably transparent.

[0062] While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art as described herein that various changes in form and details may be made to the discloses embodiments without departing from the spirit and scope of the invention. For example, in relation to the embodiments having mechanical matching features, the embodiment of FIG. **10** could be modified to provide pin features in the brim of the probe cover while providing conical or similarly-shaped extensions in the surface of the front end of the thermometer. In addition, in relation to the embodiments having non-mechanical matching features, the reflector and optical circuits could respectively be replaced with an electrical component (for example, a film resistor) and circuits for measuring a selected characteristic of the electrical component (for example, a selected resistance).

[0063] Accordingly, the invention is to be limited only by the scope of the claims and their equivalents.

What is claimed is:

1. A probe cover for covering a probe of a thermometer, the probe comprising a proximal end in proximity to the housing of the thermometer and distal end, the probe cover comprising:
- a tip portion configured for covering the distal end of the probe;
- a base portion configured for retaining the probe cover at the proximal end of the probe; and
- a body portion disposed between the tip portion and the base portion, wherein:
- the tip portion, the body portion and the base portion are sequentially disposed in a direction along a longitudinal axis of the probe cover, and
- the base portion includes one or more matching features each configured to engage a corresponding feature of a thermometer housing for seating the probe cover on the probe.

2. The probe cover of claim **1**, wherein:
- the base portion includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one fold within the brim.

3. The probe cover of claim **1**, wherein:
- the base portion includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one dip within the brim.

4. The probe cover of claim **1**, wherein:
- the base portion includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one cut between two points on the brim.

5. The probe cover of claim **1**, wherein:
- the base portion includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one extension on the brim and parallel to the longitudinal axis.

6. The probe cover of claim **1**, wherein:
- the base portion includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one petal on the brim.

7. The probe cover of claim **1**, wherein:
- the base portion includes a bottom ring, and
- the one or more matching features comprise one or more recesses extending inwardly away from a bottom surface of the bottom ring in a direction parallel to the longitudinal axis.

8. A thermometer, comprising:
- a housing;
- a probe extending from the housing along a longitudinal axis, the probe being configured for receiving thermal energy indicative of a temperature; and
- a probe cover for covering the probe, the probe cover comprising:
  - a tip portion configured for covering a distal end of the probe;
  - a base portion configured for retaining the probe cover at a proximal end of the probe; and
  - a body portion disposed between the tip portion and the base portion, wherein:
  - the tip portion, the body portion and the base portion are sequentially disposed in a direction along the longitudinal axis,
  - the base portion includes one or more matching features configured to mate with a corresponding feature of the thermometer housing for seating the probe cover on the probe.

9. The thermometer of claim **8**, wherein:
- the base portion of the probe cover includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one fold within the brim.

10. The thermometer of claim **8**, wherein:
- the base portion of the probe cover includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one dip within the brim.

11. The thermometer of claim **8**, wherein:
- the base portion of the probe cover includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one cut between two points on the brim.

12. The thermometer of claim **8**, wherein:
- the base portion of the probe cover includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one extension on the brim and parallel to the longitudinal axis.

13. The thermometer of claim **8**, wherein:
- the base portion of the probe cover includes a brim extending laterally away from the longitudinal axis; and
- the one or more matching features comprise at least one petal on the brim.

14. The thermometer of claim **8**, wherein:
- the base portion of the probe cover includes a bottom ring; and

the one or more matching features comprise at least one recess extending inwardly away from a bottom surface of the bottom ring in a direction parallel to the longitudinal axis.

15. The thermometer of claim **8**, wherein:

the housing includes a front end; and

the corresponding features comprise at least one projection on the front end of the housing and extending parallel to the longitudinal axis.

16. The thermometer of claim **8**, wherein:

the housing includes a front end; and

the corresponding features comprise at least one ridge on the front end of the housing.

17. The thermometer of claim **8**, wherein:

the thermometer includes a front end; and

the corresponding features comprise at least one valley within the front end of the housing.

16. The thermometer of claim **8**, wherein the thermometer includes at least one ejector configured to mate with at least one matching feature of the probe cover.

17. A probe cover for covering a probe that extends from a housing of a thermometer, the probe cover comprising:

a tip portion configured for covering a distal end of the probe;

a base portion configured for retaining the cover at a proximal end of the probe; and

a body portion disposed between the tip portion and the base portion, wherein:

the tip portion, the body portion and the base portion are sequentially disposed in a direction along a longitudinal axis of the probe cover, and

the base portion including a reflective layer.

18. The probe cover of claim **18**, wherein the reflective layer comprises a metal foil.

19. A thermometer, comprising:

a housing;

a probe extending from the housing along a longitudinal axis, the probe being configured for receiving thermal energy indicative of a temperature; and

a probe cover for covering the probe,

the probe cover comprising:

a tip portion configured for covering a distal end of the probe;

a base portion configured for retaining the probe cover at a proximal end of the probe; and

a body portion disposed between the tip portion and the base portion, wherein:

the tip portion, the body portion and the base portion are sequentially disposed in a direction along the longitudinal axis,

the base portion further includes at least one protrusion extending laterally away from the longitudinal axis for engaging a locating element of the probe to locate the cover at a seating position along the longitudinal direction,

the brim further including a reflective layer, and

wherein:

the thermometer further comprises a light emitter and a light detector, and

the light emitter is operative to emit light energy toward the reflective layer and the light detector is operable to detect light energy reflected by the reflective layer.

20. The thermometer of claim **19**, wherein:

the thermometer further comprises a detection circuit for determining whether the detected light energy meets a predetermined criteria.

* * * * *

专利名称(译)	探头盖具有医疗温度计的匹配功能		
公开(公告)号	US20170020397A1	公开(公告)日	2017-01-26
申请号	US15/069412	申请日	2016-03-14
[标]申请(专利权)人(译)	特洛伊之海伦有限公司		
申请(专利权)人(译)	小龙女有限公司之		
当前申请(专利权)人(译)	小龙女有限公司之		
[标]发明人	FRADEN JACOB		
发明人	FRADEN, JACOB		
IPC分类号	A61B5/01 A61B5/00 G01J5/02 G01K1/08 G01J5/00		
CPC分类号	A61B5/01 G01K1/086 G01J5/0025 G01J5/021 A61B2562/18 A61B5/6817 A61B2562/0233 A61B2562/0271 A61B5/0086 G01J5/02 G01K1/08		
优先权	PCT/US2009/069528 2009-12-24 WO 61/203641 2008-12-29 US		
其他公开文献	US9854978		
外部链接	Espacenet USPTO		

摘要(译)

用于医用温度计的探头盖具有匹配的特征，以防止其与不兼容的温度计一起使用。探针盖的机械匹配特征包括折叠，台阶或一系列孔或凹口中的至少一个，所述孔或凹口分别与形成在兼容温度计的前端上的脊，谷或一系列销相匹配。当应用于兼容温度计时，机械匹配功能允许探头盖完全固定在探头上并由探头保持，从而使温度计处于使用状态。或者，探头盖的光电匹配特征包括用于兼容温度计的光电检测电路的反射层。当应用于兼容的温度计时，光电检测器检测反射层并将兼容的温度计置于操作状态以供使用。