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Yu

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(54) **DEFLECTABLE PROBE AND THERMOMETER**

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(51) **Int. Cl.**[7] **G01K 1/00**; G01K 1/14; A61B 5/00

(52) **U.S. Cl.** **374/208**; 374/163; 600/474; 600/549

(58) **Field of Search** 374/163, 208, 374/170, 151; 600/474, 549

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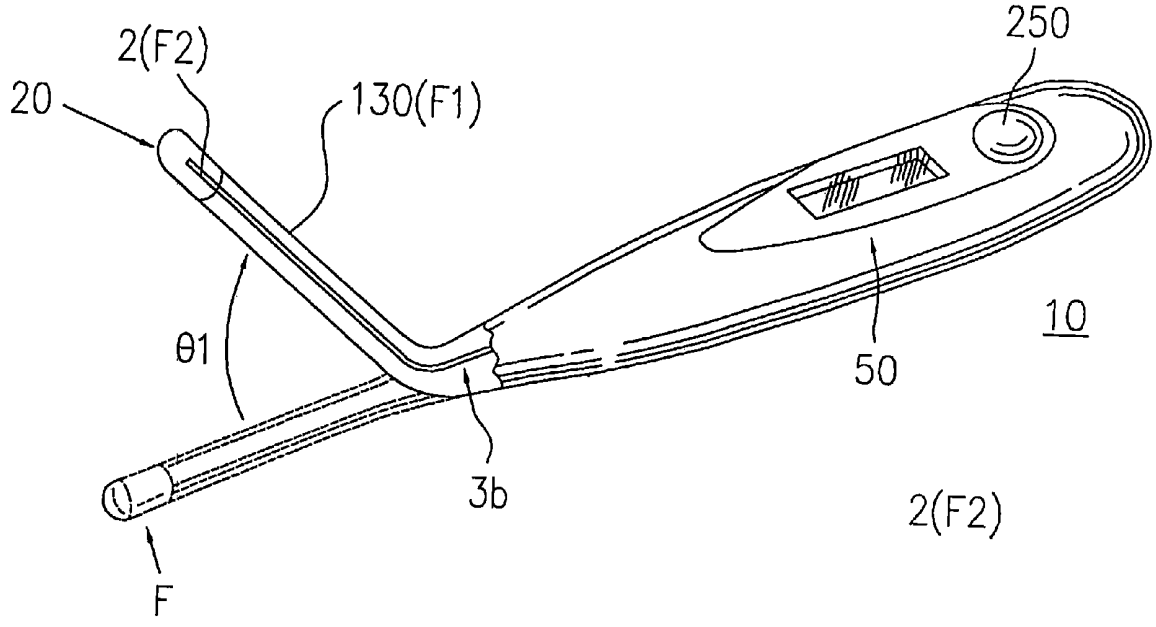
(57) **ABSTRACT**

A deflectable probe for use in a thermometer. The deflectable probe is constituted by a bendable probe body and a hollow tip member secured thereto. Furthermore, a deflectable member includes a main portion disposed in the bendable probe body. When the bendable probe body is subjected to a force, deformation of the main portion occurs. In particular, the deformation cannot be undone by a return force from the bendable probe body when the applied force is removed, so that the bendable probe body is sustained in a bent form.

16 Claims, 7 Drawing Sheets



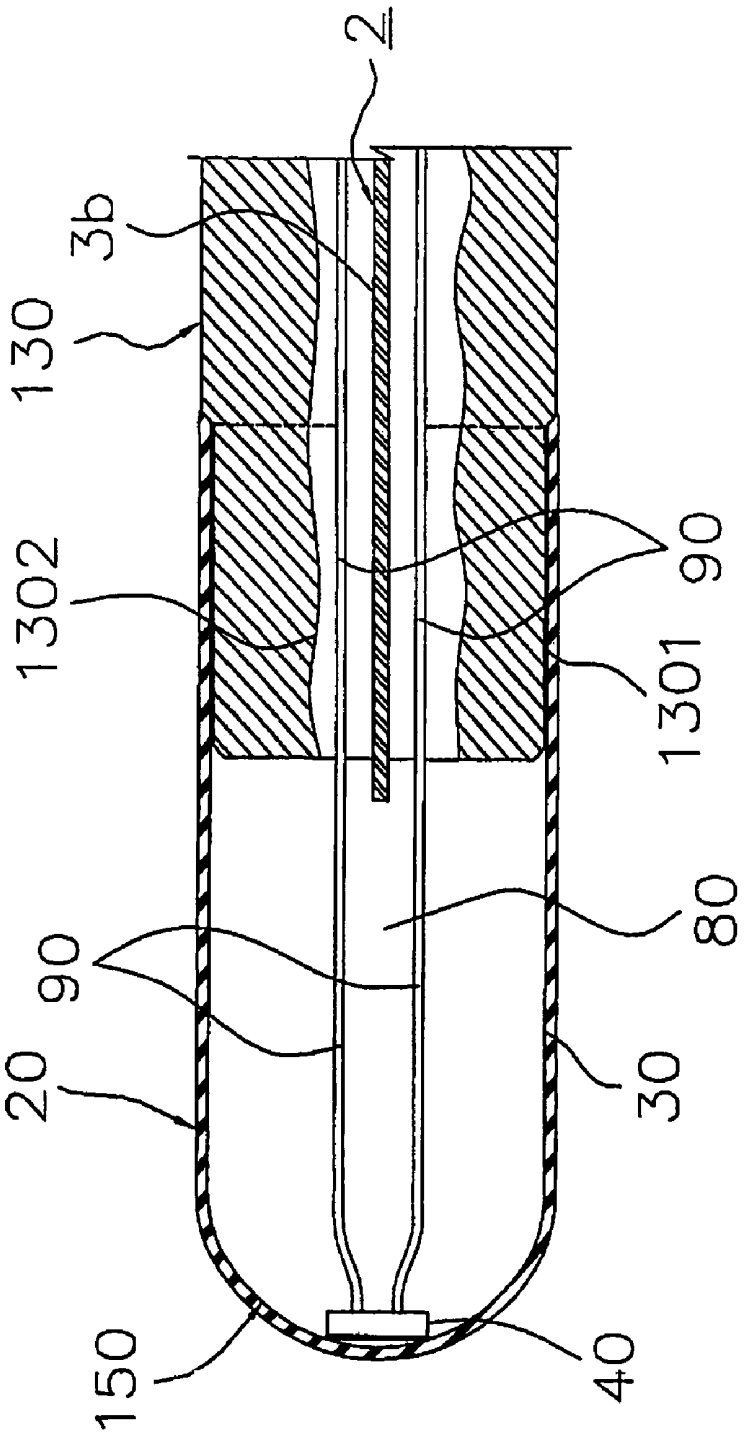


FIG. 1A

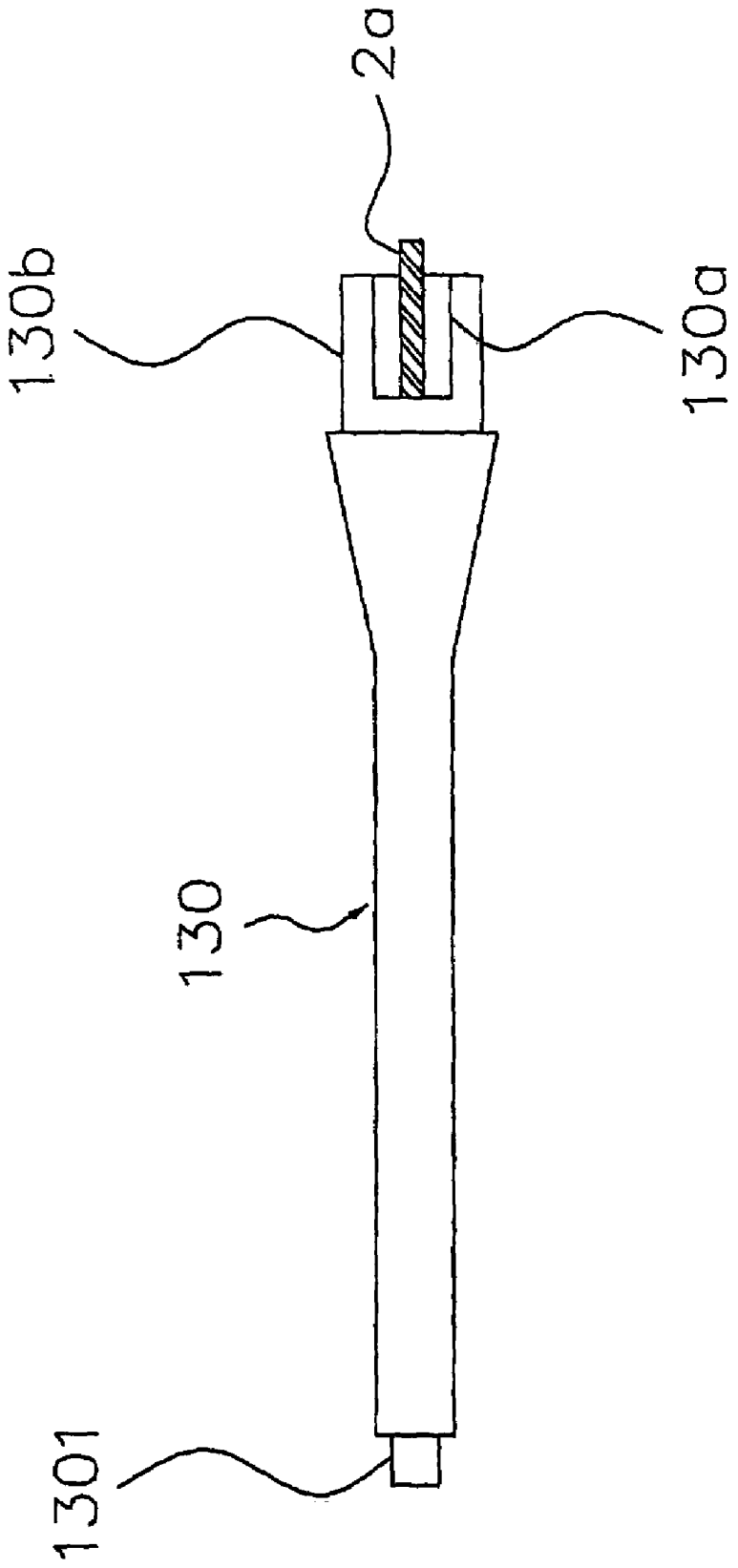


FIG. 1B

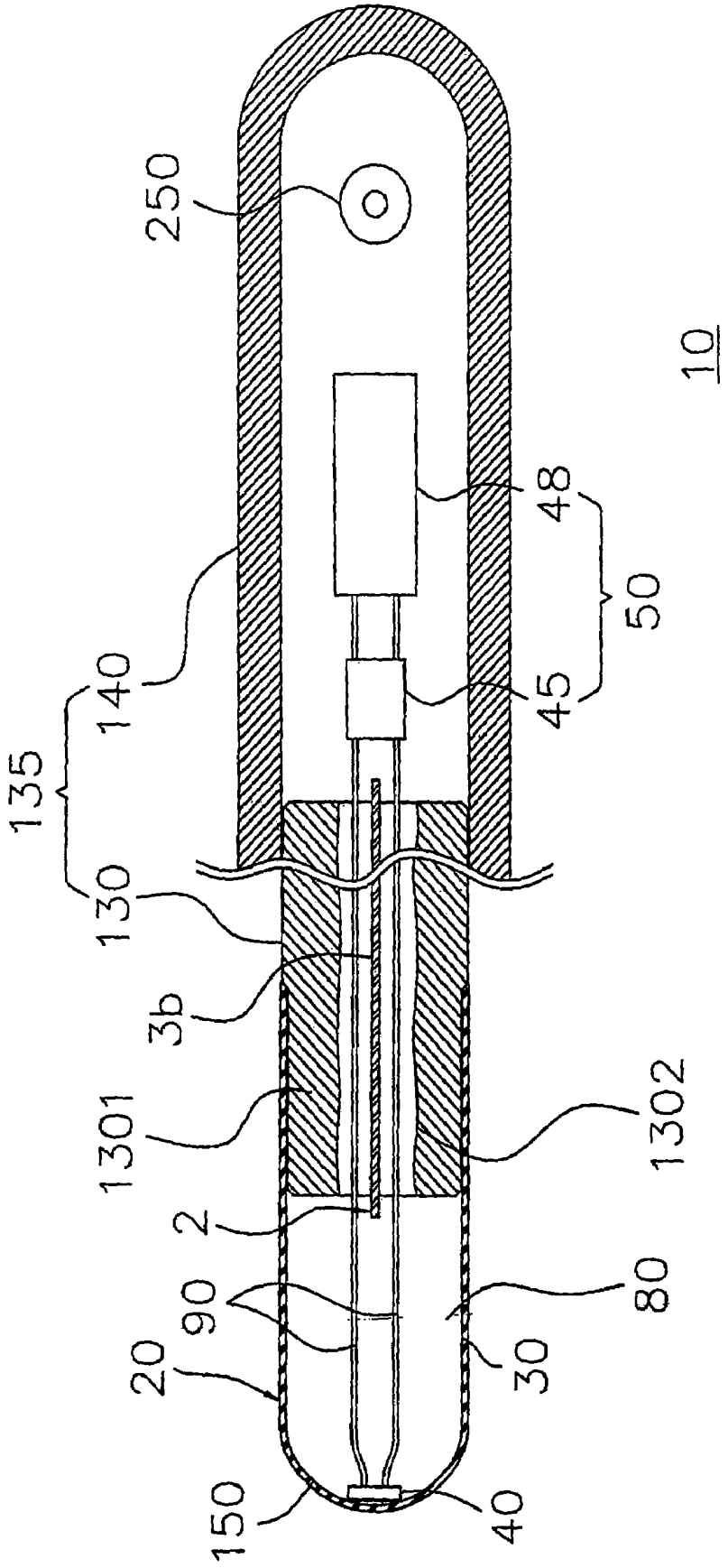


FIG. 2

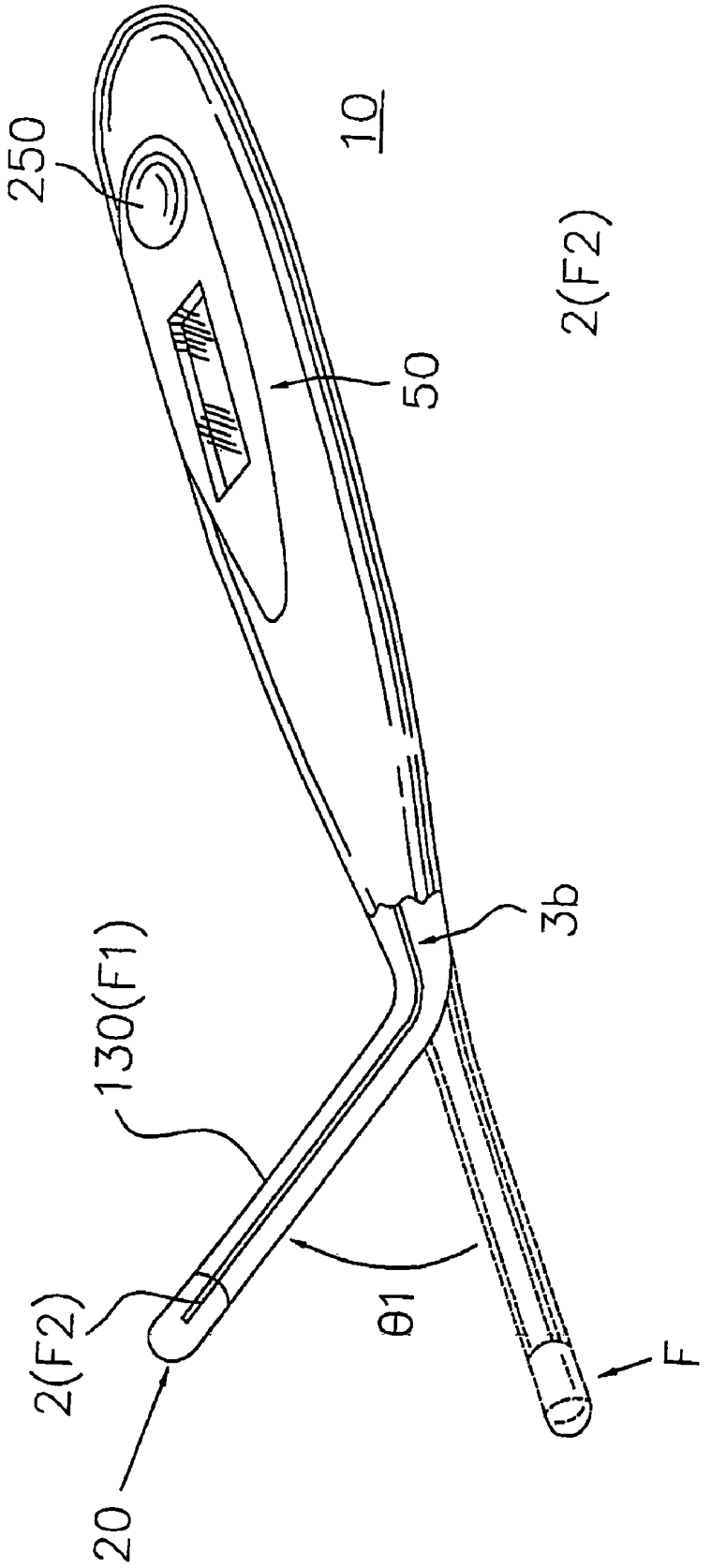


FIG. 3

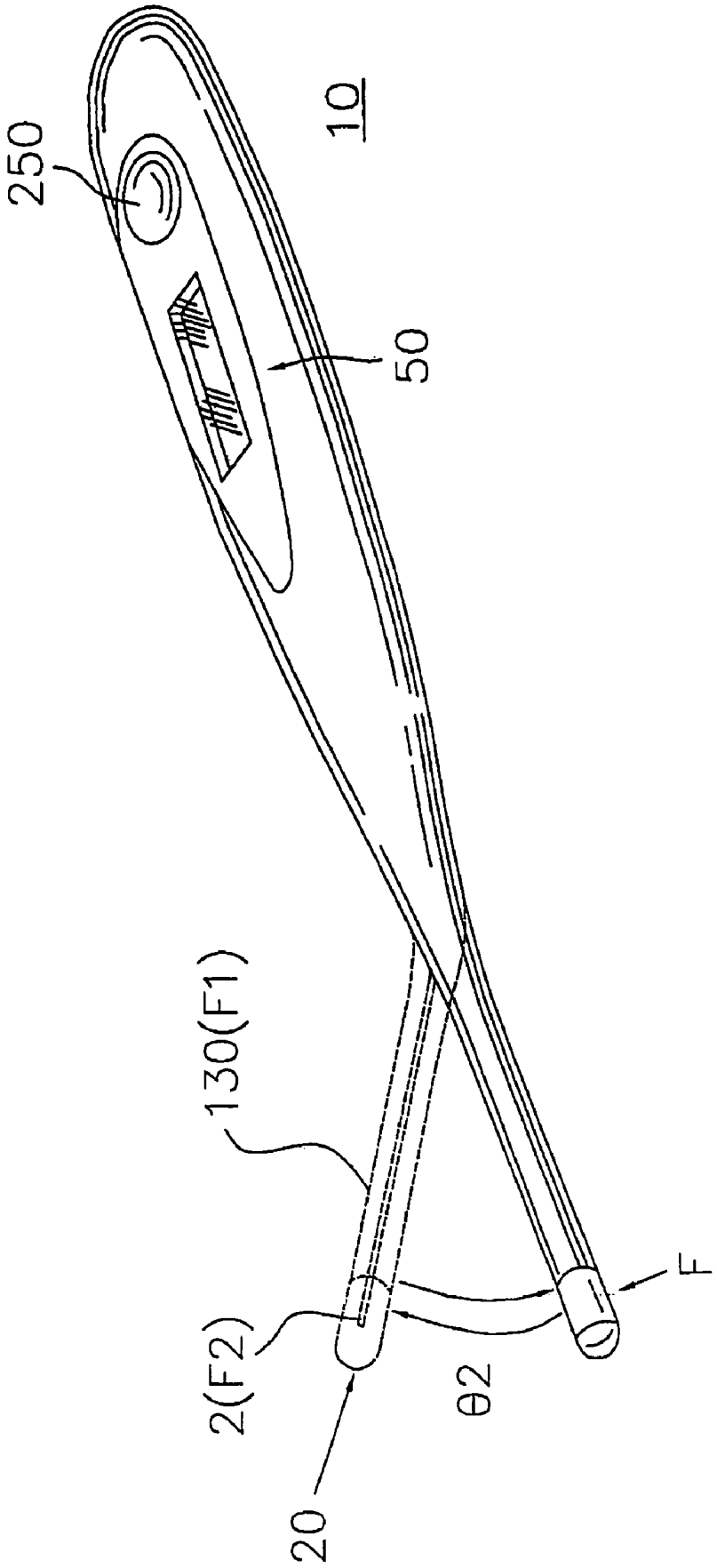


FIG. 4

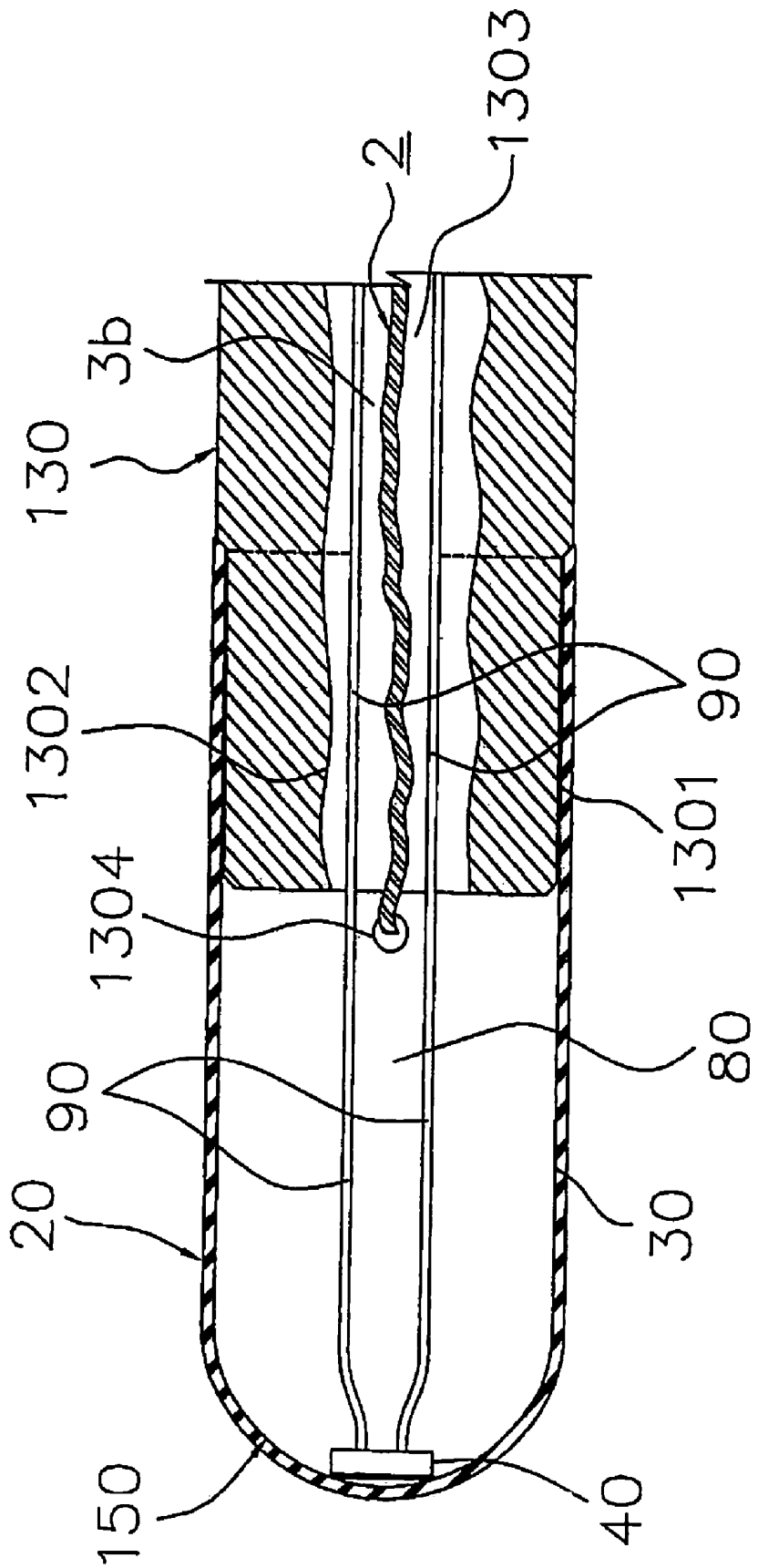


FIG. 5

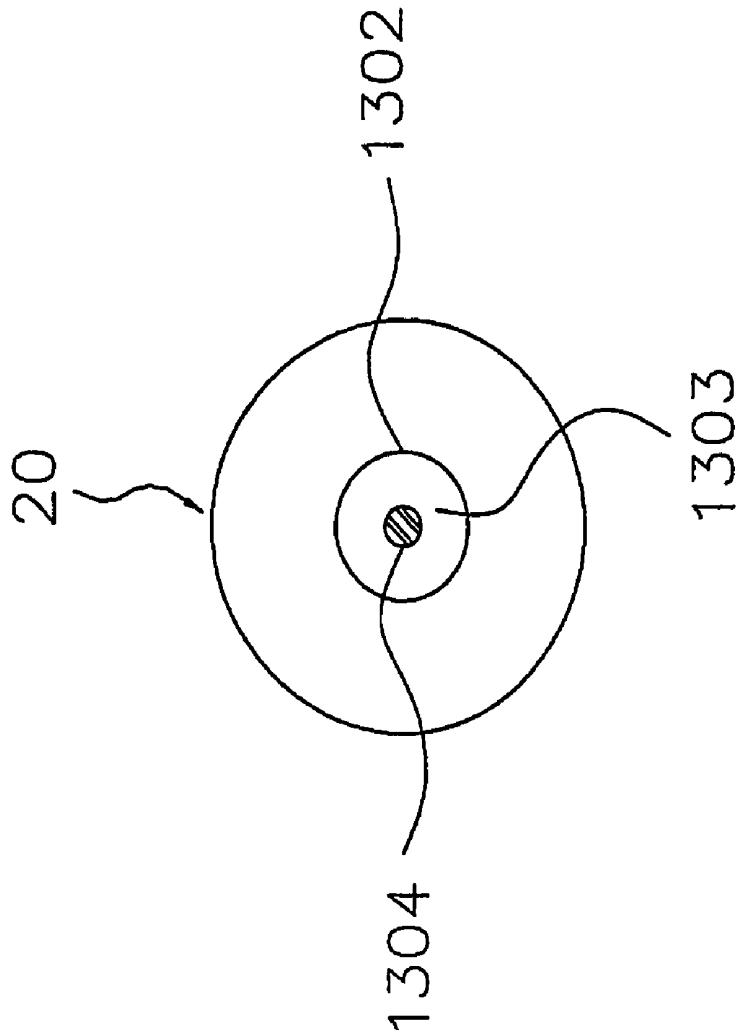


FIG. 6

DEFLECTABLE PROBE AND THERMOMETER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Ser. No. 60/498,780, filed on Aug. 29, 2003 and entitled "Deflectable Probe and Thermometer," which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the field of thermometers, and more particularly to the field of medical thermometers employing a thermal probe for measurement of a patient's temperature, although it is equally applicable to other temperature measurement fields.

2. Description of the Related Art

Electronic thermometers generally offer a great number of advantages over conventional glass and mercury thermometers for use in the health care field. Among the advantages of electronic thermometers are the elimination of sterilization procedures for glass thermometers, made possible by the use of disposable covers; elimination of the possibility of broken glass if a thermometer is dropped; a digital temperature display to eliminate temperature reading errors; and with proper circuit design and calibration, higher accuracy and resolution is possible with accurate measurement and display of tenths of a degree Fahrenheit being easily attainable.

However, most probes used in existing electronic thermometers are rigid thereby presenting a danger of injury to the patient, especially in the case of small children where the thermometer is generally used rectally. U.S. Pat. No. 3,946,613 discloses an electronic thermometer with a flexible probe which is safe and not a danger to patients, particularly children. Because the prior-art probes are not deflectable, they nonetheless tend to recover their original shapes and remain straight with the thermometer body. The lack of the capability of being deflected is very annoying when a body cavity being measured cannot accommodate the longitudinal dimension of the flexible probe. Another disadvantage is that the flexible probe's shape cannot be well adapted to the body cavity being measured for bed-bound patients or children.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a thermometer with a deflectable probe to overcome the limitations of the prior art. The use of a deflectable member allows the inventive probe to be easily adapted to a patient's body cavity being measured. Furthermore, a main portion of the deflectable member is constructed by a deflectable metal wire which is preferably made of copper having a diameter of about 0.5 to 2.0 mm. In this manner, the inventive probe can be easily deflected and sustained in a bent form, thereby enhancing the probe life.

According to one aspect of the invention, a deflectable thermometer probe comprises a bendable probe body, a hollow tip member and a deflectable member. The hollow tip member having a thermal contact surface is secured to the bendable probe body. The deflectable member includes a main portion disposed in a hollow pipe of the bendable probe body.

According to another aspect of the invention, the hollow pipe provides a space for deformation of the main portion of the deflectable member. In one embodiment, the hollow pipe has at least a portion with a diameter greater than that of the main portion of the deflectable member. Preferably, a protecting head is formed at a front end of the deflectable member. Furthermore, a groove is defined in the bendable probe body's end portion and a corresponding hook formed at a back end of the deflectable member is embedded in the groove.

When the bendable probe body is subjected to a force, deformation of the main portion occurs. In particular, the deformation cannot be undone by a return force from the bendable probe body when the applied force is removed, so that the bendable probe body is sustained in a bent form.

DESCRIPTION OF THE DRAWINGS

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

FIG. **1A** is an enlarged cross-sectional view of a deflectable probe according to an embodiment of the invention;

FIG. **1B** is a cross-sectional view of a bendable probe body of FIG. **1A**;

FIG. **2** is a fragmentary cross-sectional view of a thermometer according to the invention;

FIG. **3** is perspective view of the thermometer according to the invention, where the bendable probe body is subjected to a sufficient force;

FIG. **4** is perspective view of the thermometer according to the invention, where the bendable probe body is subjected to an insufficient force.

FIG. **5** is an enlarged cross-sectional view of a deflectable probe according to an embodiment of the invention; and

FIG. **6** is a side cross-sectional view of a bendable probe body of FIG. **5**.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1A**, a deflectable probe **100** is composed of a bendable probe body **130** and a hollow tip member **20** secured to the probe body **130**. The bendable probe body **130** is typically made of a plastic or rubber material. The hollow tip member **20** includes a thermal contact surface **30** surrounding a hollow cavity **80**. In one embodiment, the hollow tip member **20** is preferably made of metal with high thermal conductivity, such as stainless steel.

A thermal sensor **40** is placed at the end **150** of the hollow tip member **20** and mounted on the inside of the thermal contact surface **30**. The thermal sensor **40** is capable of sensing the temperature of the thermal contact surface **30** to yield a temperature signal. There are a set of lead wires **90** coupled to the thermal sensor **40** for transmission of the temperature signal.

A deflectable member designated numeral **2** in FIG. **1A** includes a main portion **3***b* disposed in the bendable probe body **130**. When the bendable probe body **130** is subjected to a force, deformation of the main portion **3***b* occurs. When the applied force is removed, the deformation cannot be undone by a return force from the bendable probe body **130**. Thus, the bendable probe body **130** is sustained in a bent form after release of the force.

Further, the bendable probe body **130** includes a hollow pipe **1302** to hold the deflectable metal wire **2**. The lead wires **90** are also designed to run through the hollow pipe **1302**.

Note that the main portion **3***b* of the deflectable member **2** is constructed by a deflectable metal wire **2** which is made of deflectable metal like copper. Turning to FIG. **1**B, a groove **130***a* is preferably defined in the sidewall of the bendable probe body's end portion **130***b* while a corresponding hook **2***a* is formed at an end of the deflectable metal wire **2**. The hook **2***a* can embed itself in the groove **130***a* to firmly fix the deflectable metal wire **2**.

Referring again to FIG. **1**A, a recess **1301** is defined in the outer surface of the bendable probe body's front end portion. The back end portion of the hollow tip member **20** has its inner surface adapted to receive the recess **1301** of the bendable probe body **130** for formation of a lap joint.

Referring to FIG. **2**, an embodiment of a thermometer having a deflectable probe is illustrated. The thermometer **10** is made up of a body member **135** and a hollow tip member **20**. In FIG. **2**, the hollow tip member **20** is shown in an enlarged view for detailed description. The body member **135** includes a bendable probe body **130** and a display portion **140**. The hollow tip member **20** is secured to the bendable probe body **130** of the body member **135**; it contains a thermal contact surface **30** surrounding a hollow cavity **80**. In one embodiment, the hollow tip member **20** is preferably made of metal with good thermal conductivity, such as stainless steel.

A thermal sensor **40** is placed at the end **150** of the hollow tip member **20** and mounted on the inside of the thermal contact surface **30**. The thermal sensor **40** senses the temperature of the thermal contact surface **30** and produces a temperature signal. There are a set of lead wires **90** coupled to the thermal sensor **40** for transmission of the temperature signal.

A display means **50** is mounted on the display portion **140**. The display means **50** comprises a display **48** and circuitry **45** coupled to the display **48**. The circuitry **45** is connected to the lead wires **90** to receive the temperature signal; it drives the display **48** to show a corresponding temperature reading. The thermometer **10** also includes a switch **250** to turn on and off the display means **50**.

The features of the embodiment will now be described in conjunction with FIGS. **2** through **4**. A deflectable member **2** includes a main portion **3***b* disposed in the bendable probe body **130**. When the bendable probe body **130** is subjected to a force F, deformation of the main portion **3***b* occurs. As shown in FIG. **3**, the main portion **3***b* is deformed by a deflection angle of θ**01**. When the applied force F is removed, the deformation cannot be undone by a return force F**1** from the bendable probe body **130**. As a result, the bendable probe body **130** is sustained in a bent form after release of the force F.

Note that the main portion **3***b* of the deflectable member **2** is constructed by a deflectable metal wire **2** which is made of deflectable metal like copper. The latter embodiment is similar to that of FIG. **1**B where a groove is preferably defined in the sidewall of the bendable probe body's end portion while a corresponding hook is formed at an end of the deflectable metal wire **2**. The hook can embed itself in the groove to firmly fix the deflectable metal wire **2** in the bendable probe body. Further, the bendable probe body **130** includes a hollow pipe **1302** to hold the deflectable metal wire **2**. The lead wires **90** are also designed to run through the hollow pipe **1302**.

Referring again to FIG. **2**, a recess **1301** is defined in the outer surface of the bendable probe body's front end. The back end portion of the hollow tip member **20** has its inner surface adapted to receive the recess **1301** of the bendable probe body **130** for formation of a lap joint.

According to the embodiment, the hollow tip member **20** is preferably made of thin metal with good thermal conductivity, such as silver, platinum, or stainless steel. The hollow tip member **20** is made in the form of a tubular shape and closed at a domed, hemispherical or hemiellipsoid shaped end. The hollow tip member **20** also includes a thermal contact surface **30** surrounding a hollow cavity **80**. The contact surface **30** is brought in contact with flesh of a patient so that heat can be transferred from the patient's flesh to the hollow tip member **20**. In one embodiment, the thermal sensor **40** is thermistor. The lead wires **90** and the thermistor **40** are both adhered on the inside of the thermal contact surface **30** with heat conductive glue. The glue is an insulating material with good thermal conductivity, e.g., epoxy resin. Moreover, the lead wires **90** are made up of a pair of electrical lead wires; they are used to connect the thermal sensor **40** to the circuitry **45**.

However, the lead wires **90** might be easily to be cut off when the deflectable metal wire **2** is pushed into the hollow cavity **80**. To overcome the aforementioned issue, the hollow pipe provides a space **1303** for the deformation of the main portion of the deflectable member to prevent the deflectable member **2** being pushed into the hollow cavity **80**. To enhance the effect, the hook **2***a* can embed itself in the groove **130***a* to firmly fix the deflectable metal wire **2** in the bendable probe body **130** as FIG. **1**B.

Referring to FIG. **5** and FIG. **6**, preferably, the hollow pipe **1302** has at least a portion with a diameter greater than that of the main portion **3***b* of the deflectable member **2**. Further, a protecting head **1304** is formed at a front end of the deflectable member **2**. The protecting head **1304** is disposed in the hollow tip member **20** to avoid the deflectable member **2** cutting off the lead wires **90**.

From FIG. **3**, it can be seen that deformation of the main portion **3***b* occurs when the bendable probe body **130** is subjected to a force F. Consequently, the main portion **3***b* is deformed by a deflection angle of θ**1**. Because a deflection force F**2** is greater than a return force F**1** from the bendable probe body **130**, the deflection angle of θ**1** cannot be undone by the return force F**1** when the applied force F is removed. As a result, the bendable probe body **130** is sustained in a bent form after release of the force F.

In contrast, the main portion **3***b* is deflected by a smaller angle of θ**2** if the applied force F is insufficient. In this case, the deflection force F**2** is less than the return force F**1** from the bendable probe body **130**, so the deflection angle of θ**2** can be undone by the return force F**1** when the applied force F is removed. Therefore, the bendable probe body **130** goes back to its original shape after release of the force F.

In view of the above, the use of a deflectable member allows the thermometer probe of the invention to be well adapted to a patient's body cavity being measured. Additionally, the deflectable member is preferably made of a metal wire having a diameter of about 0.5 to 2.0 mm. Hence, the thermometer probe of the invention can be easily deflected and sustained in a bent form, thereby enhancing the probe life.

While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications and similar arrangements (as

would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A deflectable thermometer probe comprising:

a bendable probe body;

a tip member secured to the bendable probe body and having a thermal contact surface;

a thermal sensor mounted on the inside of the thermal contact surface of the tip member, for sensing the temperature of the thermal contact surface and producing a temperature signal;

a set of lead wires coupled to the thermal sensor for transmission of the temperature signal; and

a deflectable member having a main portion disposed in the bendable probe body, wherein deformation of the main portion occurs when the bendable probe body is subjected to a force, and the deformation cannot be undone by a return force from the bendable probe body when the applied force is removed, thereby the bendable probe body is sustained in a bent form;

wherein a protecting head is formed at a front end of the deflectable member to avoid the deflectable member cutting off the lead wires.

2. The probe as recited in claim **1** wherein the main portion of the deflectable member is constructed by a deflectable metal wire.

3. The thermometer as recited in claim **2** wherein the deflectable metal wire is made of copper.

4. The probe as recited in claim **1** wherein the bendable probe body includes a hollow pipe and the main portion of the deflectable member is disposed in the hollow pipe.

5. The probe as recited in claim **4** wherein the hollow pipe has at least a portion with a diameter greater than that of the main portion of the deflectable member.

6. The probe as recited in claim **4** wherein the hollow pipe provides a space for the deformation of the main portion of the deflectable member.

7. The probe as recited in claim **4** wherein the lead wires run through the hollow pipe in the bendable probe body.

8. The probe as recited in claim **1** wherein the tip member is hollow.

9. A deflectable thermometer probe comprising:

a bendable probe body;

a tip member secured to the bendable probe body and having a thermal contact surface;

a thermal sensor mounted on the inside of the thermal contact surface of the tip member, for sensing the temperature of the thermal contact surface and producing a temperature signal;

a set of lead wires coupled to the thermal sensor for transmission of the temperature signal; and

a deflectable member having a main portion disposed in the bendable probe body, wherein deformation of the main portion occurs when the bendable probe body is subjected to a force, and the deformation cannot be undone by a return force from the bendable probe body when the applied force is removed, thereby the bendable probe body is sustained in a bent form;

wherein a groove is defined in the bendable probe body's end portion and a corresponding hook formed at a back end of the deflectable member is embedded in the groove.

10. The probe as recited in claim **9** wherein the main portion of the deflectable member is constructed by a deflectable metal wire.

11. The thermometer as recited in claim **10** wherein the deflectable metal wire is made of copper.

12. The probe as recited in claim **9** wherein the bendable probe body includes a hollow pipe and the main portion of the deflectable member is disposed in the hollow pipe.

13. The probe as recited in claim **12** wherein the hollow pipe has at least a portion with a diameter greater than that of the main portion of the deflectable member.

14. The probe as recited in claim **12** wherein the hollow pipe provides a space for the deformation of the main portion of the deflectable member.

15. The probe as recited in claim **12** wherein the lead wires run through the hollow pipe in the bendable probe body.

16. The probe as recited in claim **9** wherein the tip member is hollow.

* * * * *

专利名称(译)	可偏转的探头和温度计		
公开(公告)号	US6979122	公开(公告)日	2005-12-27
申请号	US10/788806	申请日	2004-02-27
[标]申请(专利权)人(译)	虞初新益		
申请(专利权)人(译)	虞初新益		
当前申请(专利权)人(译)	MESURE TECHNOLOGY CO.，LTD.		
[标]发明人	YU CHU YIH		
发明人	YU, CHU YIH		
IPC分类号	A61B5/01 G01K13/00 G01K1/00 G01K1/14 A61B5/00		
CPC分类号	G01K13/002		
优先权	60/498780 2003-08-29 US		
其他公开文献	US20050047478A1		
外部链接	Espacenet USPTO		

摘要(译)

用于温度计的可偏转探头。可偏转探针由可弯曲的探针主体和固定到其上的中空尖端构件构成。此外，可偏转构件包括设置在可弯曲探头主体中的主要部分。当可弯曲探针体受到力时，发生主要部分的变形。特别地，当施加的力被移除时，来自可弯曲探针主体的返回力不能解除变形，使得可弯曲探针主体以弯曲形式维持。