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**Kuhn**

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(54) **CLINICAL THERMOMETER**

6,030,342 A \* 2/2000 Amano et al. .... 600/301

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**FOREIGN PATENT DOCUMENTS**

(73) Assignee: **Geratherm Medical AG**, Geschwenda (DE)

DE	298 04 222 U 1	10/1998
EP	0 424 102 A1	4/1991
GB	2 286 684	8/1995
WO	WO 90/09570	8/1990

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

\* cited by examiner

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(21) Appl. No.: **09/654,351**

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(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Sep. 3, 1999 (DE) ..... 199 42 089

The invention relates to a clinical thermometer of a small design portable also by children, having a data memory **18** and an interface **21**, by which both continually monitoring measurements and discontinued cyclic measurements as a maximum thermometer may be comfortably performed at locations which are medically established for measuring body temperature. Depending on the selected setting of the storage rate, the temperature of the measurement location is continuously monitored or cyclic individual measurements are taken. For changing the mode of operation, no extra keys or switches are necessary which would be difficult to place on a small, compact housing **14**.

(51) **Int. Cl.<sup>7</sup>** ..... **G08B 23/00**

(52) **U.S. Cl.** ..... **340/573.1; 340/573.7**

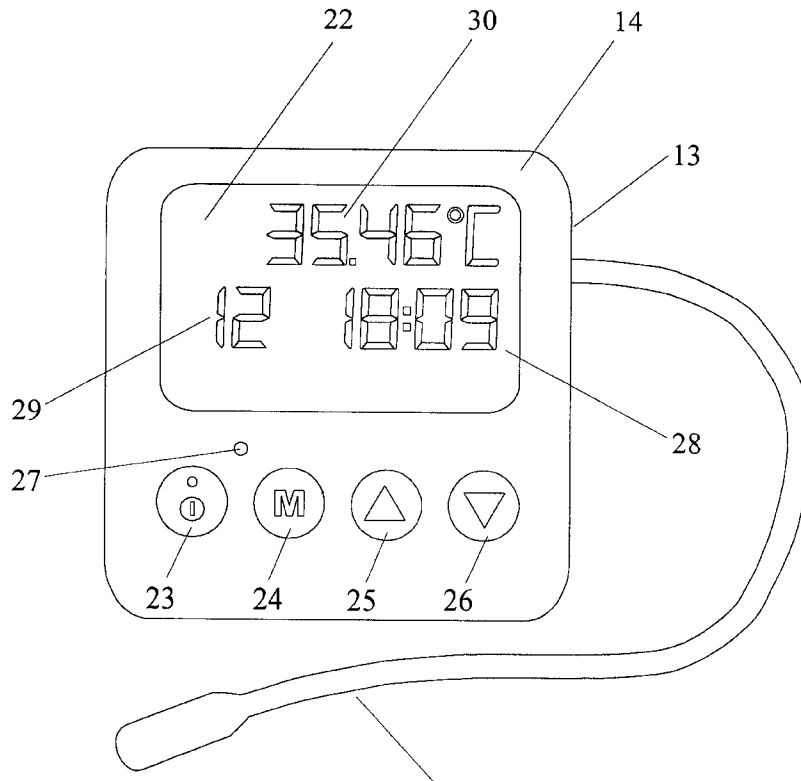
(58) **Field of Search** ..... **340/573.1, 573.7, 340/584; 600/301, 474, 484**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,636,093 A	1/1987	Nagasaka et al. ....	374/186
5,559,497 A	9/1996	Hong .....	340/573.1
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**13 Claims, 3 Drawing Sheets**



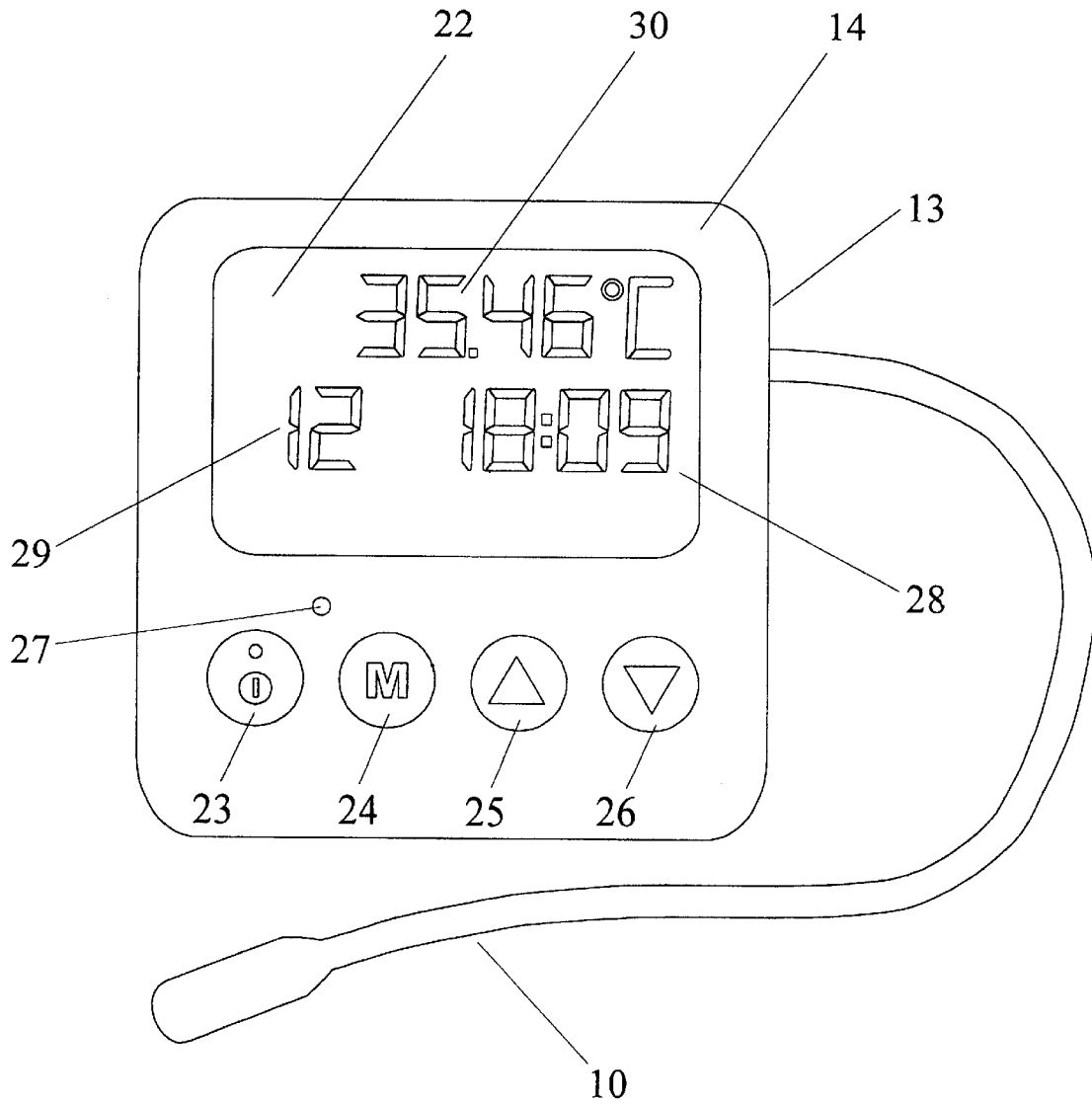


Fig. 1

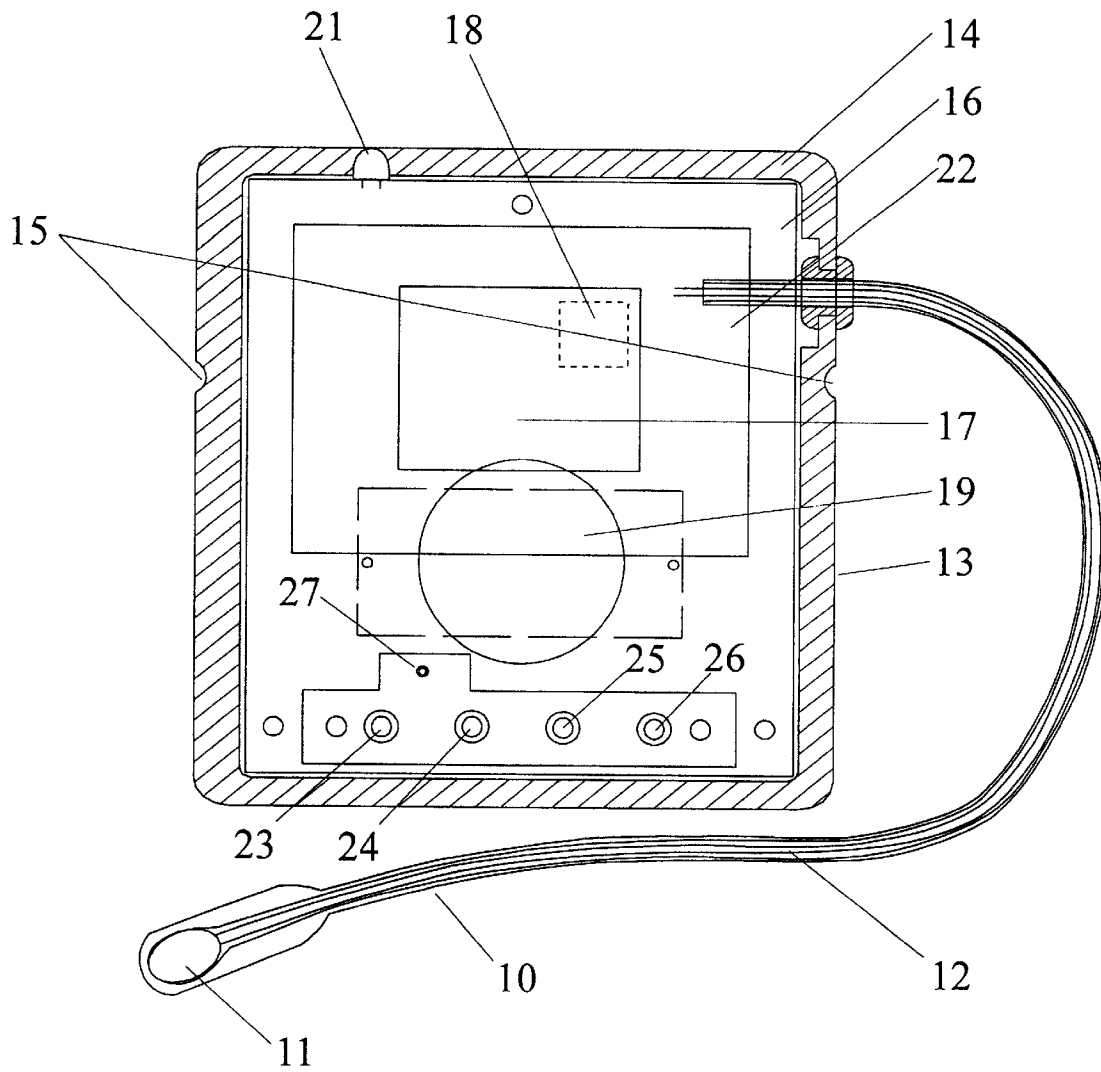


Fig. 2

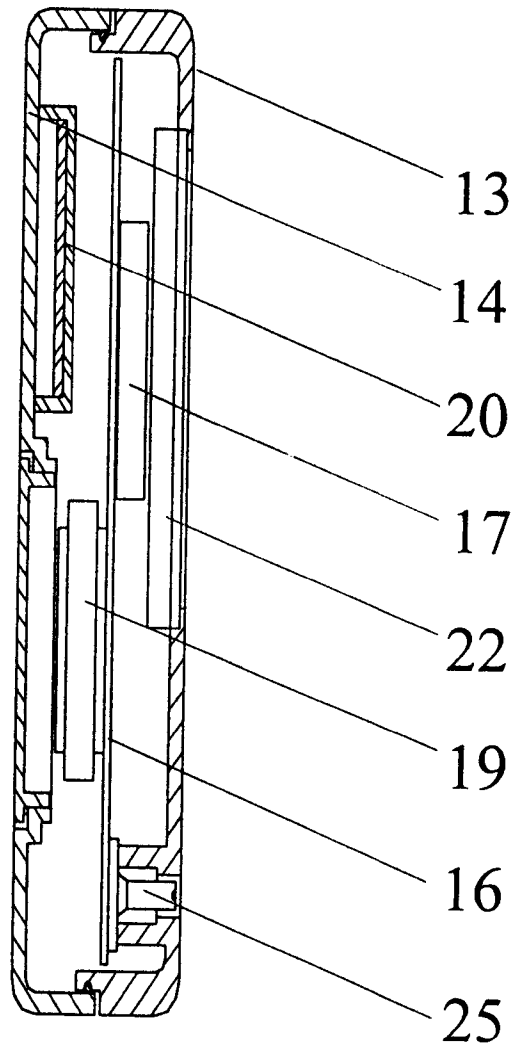


Fig. 3

**CLINICAL THERMOMETER****BACKGROUND OF THE INVENTION**

Small children and babies are prone to suffer from colds and various infectious diseases, e.g. the so-called children's diseases (measles, smallpox, German measles, scarlet fever and the like). These diseases put considerable stress on the parents, also because of the necessity to check the child's body temperature regularly in order to recognise drastic changes at once. To this end, the parents at night have to interrupt their own sleep and that of their child, which is unpleasant for all concerned. It would therefore be desirable to have a thermometer which performs such monitoring function automatically, takes the body temperature continually and initiates an alarm when critical changes occur.

It is often not easy for the parents to decide whether a given temperature increase is dangerous for the child. It would thus be most advantageous if the detected temperature curve could be readily transmitted, e.g. by e-mail, to the family doctor who will use his expertise to judge the measurements and take appropriate steps.

Fever can become dangerous if it causes convulsions which may entrain a loss of conscience. Such convulsions are caused by a sudden increase in temperature. A convulsion of this type can occur specifically with children between the age of six months to five years. About 3 to 4 per cent of the children of this age are affected. As the duration of the attack increases, it enhances the risk of later afibrile effects, i.e. epilepsy. Therefore, optimum therapy is of the essence in an acute attack. Unless antispasmodic measures are taken within few minutes, the attack represents a genuine emergency.

To reduce the risk of occurring, specifically re-occurring, convulsions during fever, it is recommended to apply fever-reducing measures from a body temperature of 38.5° C. on as early as possible. Also in this case, a continually measuring thermometer is required which generates an alarm when a limit temperature is exceeded, to enable quick action. Since many of the endangered children are active, such a thermometer must be unproblematic to carry by children.

With older, specifically helpless persons, insufficient food intake, chronic infections and the like may cause emaciation (cachexia), which in turn may lead to dangerous hypothermia. A body temperature below about 30° C. may result in a state of unconsciousness making it impossible for the person to help himself or herself. A continually measuring thermometer, which generates an alarm when the temperature falls below a limit value, allows endangered persons to obtain quick help in acute cases.

A relatively dependable medication-free method of natural contraception is the temperature method in which a woman can determine the fertile days of her menstrual period by watching the basal temperature. Another important parameter in diagnosing and curing disturbances of the menstrual period is the wake-up temperature. The recordal and evaluation of the basal temperature requires a thermometer which operates as a maximum thermometer. The temperature of the measurement location is detected until the rising gradient reaches or falls below a limit value. This type of thermometer will always give only the largest temperature value found in a given measuring period, i.e. the maximum. A cyclo-thermometer may be in the form of a maximum thermometer which stores the temperature maximum along with the time and a day number and upon request

A plurality of suggestions have been made for continuously monitoring the body temperature, particularly of small children; compare DE 298 04 222 U1, U.S. Pat. No. 5,559, 497, FR 26 94 977 A1, WO 90/09570, DD 254 643 A and GB 2 286 684 A. These thermometers, however, have no maximum function and are therefore unsuited for taking individual measurements.

Many documents propose to fix a thermometer to the wrist; compare U.S. Pat. No. 5,559,497, FR 26 94 977 A1 and GB 2 286 684 A. The wrist, however, is unsuited for taking continuously monitoring body temperature measurements, since the measurement results may very strongly depend on the surrounding temperature and on the location of measurement being covered (such as by clothing, a blanket, position of the wrist underneath the body). The calibration of the thermometer with respect to the body core temperature by means of a reference sensor, as provided in GB 2 286 684 A does not solve this problem since the calibration is valid for one given environmental situation only.

EP 0 424 102 A1 discloses a thermometer for women for daily determining the basal temperature. The thermometer operates as a maximum thermometer but is unsuited for taking continuously monitoring measurements.

U.S. Pat. No. 4,636,093 discloses a temperature measuring arrangement, by which temperature values detected at a number of locations by means of one or a plurality of radiation thermometers can be performed with a portable recording device and subsequently transmitted to a processing equipment. Each measurement is taken by manually operating the recording device and may represent the instant temperature or the maximum value that occurs within a short period.

**SUMMARY OF THE INVENTION**

It is an object of the invention to provide a clinical thermometer which permits taking both continually monitoring measurements and discontinuous cyclic measurements as a maximum thermometer.

This object is met by a clinical thermometer having a housing, a temperature sensor connected to said housing, a measuring circuit disposed in said housing and including a micro controller and a data memory for recording the temperature value measured by said temperature sensor, said data memory having a storage rate, a voltage supply for powering said measuring circuit, and a mode switch for switching the storage rate of said memory between a continuous operation mode, in which the temperature of a measurement location is continuously monitored, and a discontinuous operation mode, in which individual temperature measurements are recorded.

The setting of storage rate determines whether the thermometer continuously monitors the temperature of the measurement location or performs cyclic or individual measurements. For changing the mode of operation, no extra switch is required, which would be difficult to place on a small, compact housing.

The storage rate is adapted to be set to zero to switch-over to the discontinuous operation mode. For any storage rate different from zero, the thermometer operates as a continually measuring thermometer which regularly stores the actual temperature in a data memory at regular intervals in accordance with the selected storage rate. In the discontinuous operation mode, the thermometer preferably operates as a maximum thermometer.

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