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G1A
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G01N

(54) Blood sample monitoring device

(57) The device 10 is intended to measure the glucose level in a blood sample, by measuring the change in colour of a sensitised strip 11 on which a sample has been applied, the device 10 having a housing 12, and an input station 13 for receiving the sensitised strip 11 with a sample portion 14 on which a sample is applied. A light source (17, Fig 2, not shown) is arranged in the housing 12 to direct an optical beam towards the sample portion 14, and an electro-optic receiver (18) in the housing 12 receives the beam reflected from the sample portion 14 and generates an electrical signal representative of the proportion of the predetermined component in the blood sample. A driving device (19) receives the signal from the electro-optic receiver, and operates a bar graph type display device 22. The monitoring device will be particularly suitable for use by diabetics in order to give a clear visual indication of glucose level in a blood sample.

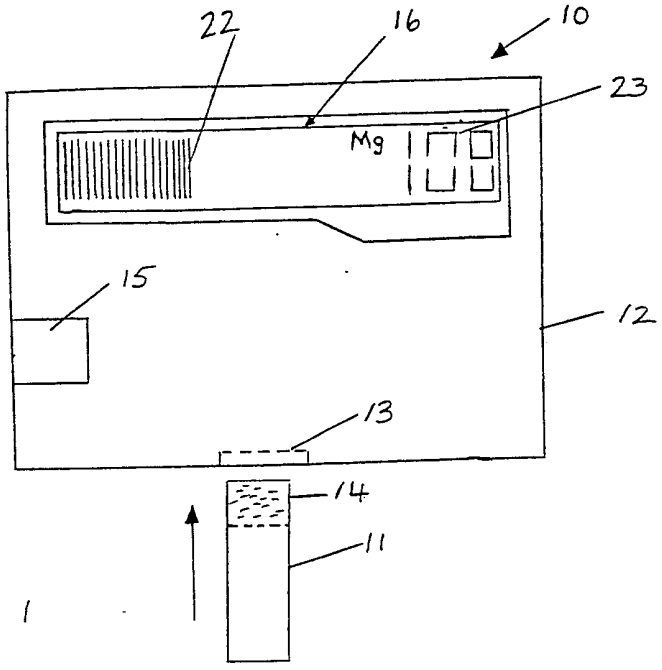

FIG 1

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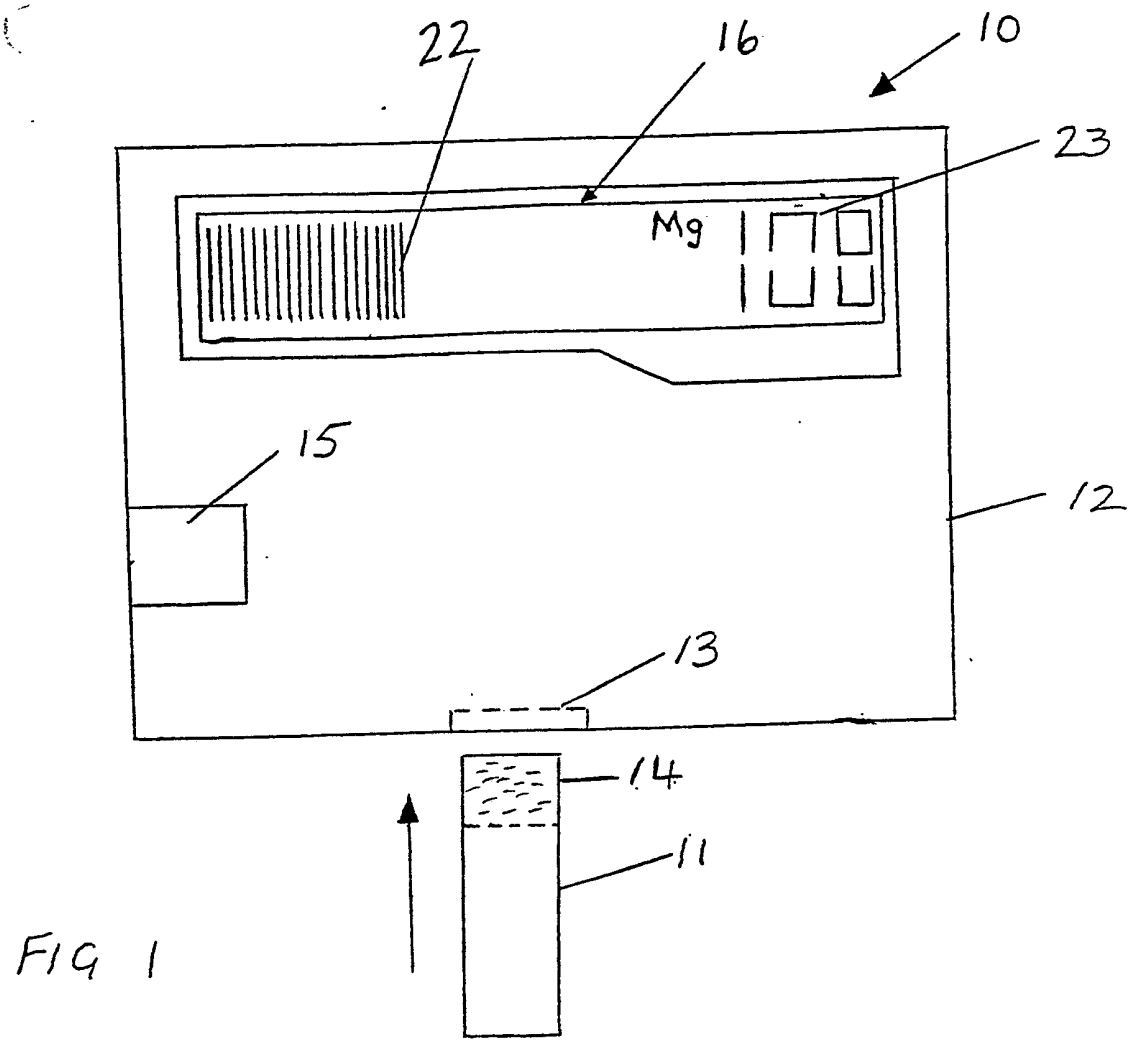

FIG 1

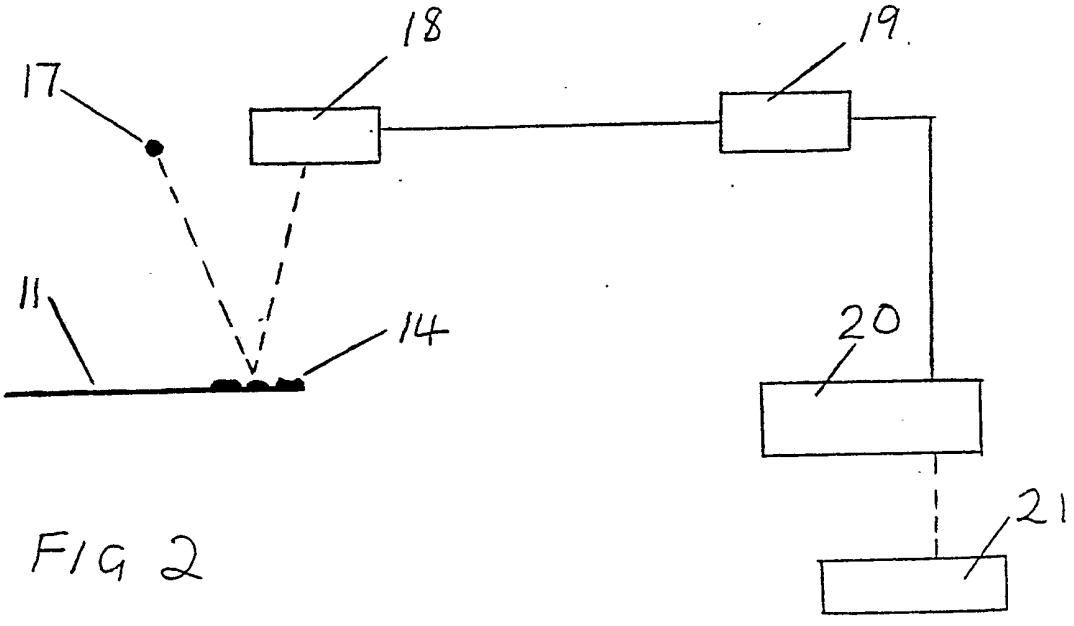

FIG 2

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MONITORING DEVICE

This invention relates to a monitoring device for monitoring a blood sample by measuring the change in colour of a sensitised strip to which the sample has been applied.

The invention has been developed primarily, though not exclusively, in relation to a monitoring device for measuring the glucose level present in a blood sample, which is a measurement that diabetics are required to carry out at regular intervals. However, it should be understood that a monitoring device according to the invention may be applicable in monitoring the presence of other constituents in a blood or other liquid sample by measuring the change in colour of a sensitised strip to which the sample has been applied.

According to the invention there is provided a monitoring device for monitoring a blood sample by measuring the change in colour of a sensitised strip to which the sample has been applied, the change in colour being derived from the proportion of a predetermined component in the blood sample, and in which the device comprises:

a housing;

an input station provided on the housing for receiving a sensitised strip having a sample portion on which a blood sample has been applied;

a light source arranged in the housing to direct an optical beam towards the sample portion of the strip, when the latter has been received by the input station;

an electro-optic receiver arranged in the housing to receive the beam reflected from said sample portion and to generate an electrical signal representative of the proportion of the predetermined component in the blood sample;

a driving device arranged in the housing to receive the signal from the electro-optic receiver; and,

a bar graph type display device mounted in the housing and arranged to be operated by said driving device to provide a visual indication of the proportion of the predetermined component in the blood sample.

A monitoring device according to the invention is particularly suitable for use by diabetics, in which the predetermined component to be measured in a blood sample is the glucose level. The bar graph display will provide an easily read (and understood) indication of a safe or a dangerous condition for any particular person, and it should be borne in mind that "safe" glucose levels can vary from person to person. Thus, diabetics are usually most concerned about deviations in glucose level from their own personal normal level (as advised by their physician), rather than by the absolute measurement, the interpretation of which could be misleading.

The bar graph display device conveniently may have up to 40 bars, and a series of colour bands may be arranged alongside the bar graph as a quick reference to enable the operator to see immediately any deviation from his normal position and therefore take any necessary action.

For some users, it may be advantageous to provide an additional indicating function, in which case a digital display is provided to give a numerical read-out of the actual proportion of the component e.g. glucose in a sample, usually indicated in mg/dL or mmol/L units.

One embodiment of monitoring device according to the invention will now be described in detail, by way of example only, with reference to the accompany drawing, in which:

Figure 1 is a schematic plan view of a monitoring device according to the invention for use in measuring the glucose level present in a blood sample; and

Figure 2 is a schematic illustration of the electro-optical components provided within the housing of the monitoring device for carrying out, and for displaying the

required measurements.

Referring first to Figure 1 of the drawing, there is shown a monitoring device which is designated generally by reference 10, and which is intended to measure the glucose level in a blood sample, by measuring the change in colour of a sensitised strip 11 on which a blood sample has been applied. The monitoring device 10 has a housing 12, and an input station 13 is provided in the wall of the housing 12 in order to receive the sensitised strip 11, the latter having a sample portion 14 on which the sample is applied.

An on/off switch 15 is provided on the housing 12, as well as a display device 16 which provides a visual indication of the proportion of a predetermined component in the blood sample, such as in the present case the glucose level.

Referring now to Figure 2, a light source 17 is arranged in the housing to direct an optical beam, preferably in the visual spectrum, towards the sample portion 14 of the strip 11, when the latter has been received by the input station 13. An electro-optic receiver 18 is arranged in the housing to receive the beam reflected from the sample portion 14 and to generate an electrical signal representative of the proportion of the predetermined component in the blood sample. A driving device 19 is also arranged in the housing 12 to receive the signal from the electro-optic receiver, and a bar graph type display device 20 is arranged to be operated by the driving device 19 to provide a visual indication of the proportion of the predetermined component in the blood sample. In addition, as shown in dashed lines, a digital display 21 may be provided to give a numerical read-out of the actual proportion of the predetermined component i.e. glucose in the sample, usually in mg/dL or mmol/L units.

Referring again to Figure 1, the display device 16 incorporates a moving bar graph type display device 22, and a digital display 23, which correspond with the schematic

illustration of components 20 and 21 in Figure 2 respectively. The bar graph type display device 22 may incorporate up to 40 bars, and a series of colour bands (not shown) is provided alongside the bar graph to provide a quick reference to enable the operator to see immediately any deviation from the normal position, and thereby take any necessary action. The digital read-out 23 may be provided in more expensive units for users which require ease of use, and the reassurance of absolute measurement.

A typical sequence of operation of the monitoring device 10 would be as follows:

1. Switch the monitor on, and an audible tone is generated to provide a function check.
2. Take a blood sample and place a drop on the end of the test strip 11.
3. Press the start button, and a warning symbol appears on the display for about 60 seconds. After this period, the symbol disappears and the audible tone is produced.
4. Wipe blood from the strip, and then press the start button again. A warning symbol will appear and an audible tone is produced. The strip should be inserted in the monitor for an immediate measurement of the blood glucose level.

The light source within the monitor is directed onto the sensitised portion of the test strip, and the light reflected from the strip is received by a light dependant device, the amount of light being dependant upon the change of colour of the strip once the blood sample has been applied. The reflected light is transferred into an electrical signal which is measured, using an analogue to digital convertor, the output of which is used to drive the display device, which may be the bar graph type display only, a digital display, or a combined display.

The bar graph display renders the unit easy to use, and the manufacture of the electronic components, using

"surface mount" technology, provides a more compact unit than those currently available.

Preferably, a display hold function is incorporated within the monitor, since test strips in common use for blood glucose level monitoring are liable to provide a chemical reaction which continues after the blood sample has been taken. Therefore, the display hold function is provided within the monitor, to minimise errors which may be caused by the continuing reaction on the test strip.

The operating sequence will be as previously described, but with the addition that when the strip is inserted into the monitor, the start button is again pressed momentarily. The arrangement is such that circuitry is then activated which ensures that the reading taken by the monitor is frozen for a period of, say, 1 minute, irrespective of any further changes of the strip during that time.

This preferred additional feature provides a more accurate reading, and enables the display to be read at leisure.

CLAIMS

1. A monitoring device for monitoring a blood sample by measuring the change in colour of a sensitised strip to which the sample has been applied, the change in colour being derived from the proportion of a predetermined component in the blood sample, and in which the device comprises:

a housing;

an input station provided on the housing for receiving a sensitised strip having a sample portion on which a blood sample has been applied;

a light source arranged in the housing to direct an optical beam towards the sample portion of the strip, when the latter has been received by the input station;

an electro-optic receiver arranged in the housing to receive the beam reflected from said sample portion and to generate an electrical signal representative of the proportion of the predetermined component in the blood sample;

a driving device arranged in the housing to receive the signal from the electro-optic receiver; and,

a bar graph type display device mounted in the housing and arranged to be operated by said driving device to provide a visual indication of the proportion of the predetermined component in the blood sample.

2. A monitoring device according to claim 1, in which the bar graph display device has up to 40 bars, and a series of colour bands is arranged alongside the bar graph as a reference to enable the operator to see any deviation from a datum position.

3. A monitoring device according to claim 1 or 2, in which a digital display is provided on the housing to give a numerical read-out of the actual proportion of the component.

4. A monitoring device according to any one of claims

1 to 3, including a display hold function incorporated within the monitor to minimise errors which may be caused by a continuing reaction of a blood sample with the sensitised strip.

5. A monitoring device according to claim 1 and substantially as hereinbefore described with reference to, and as shown in the accompanying drawings.

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