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(54) **Title**: METHOD FOR PROVIDING VISUALIZATION OF DATA AGE

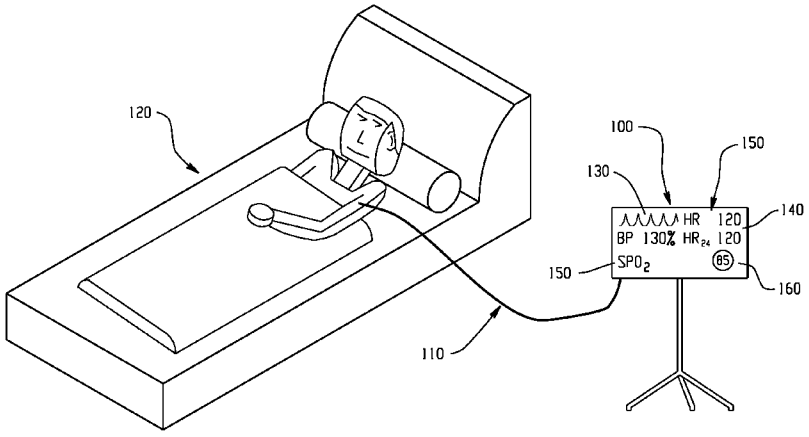

Fig. 1

(57) **Abstract**: Medical monitor readings (150) are displayed along with an indication of along with the age of the reading. The reading display is changed by altering the intensity of the reading value (210-240), color of the reading value (310-330), a subscript next to the reading (400), a shape of the background (600-700), or icon (FIGS. 6-11) to indicate the age of a presented reading.

METHOD FOR PROVIDING VISUALIZATION OF DATA AGE

DESCRIPTION

The present application relates to the art of data display. It finds particular application to the display of aperiodically acquired physiological data and will be described with particular reference thereto. However, it will also find application in other types of displays in which the age of the data is of interest.

Patients in a medical setting typically have several physiological parameters monitored. Some, like ECG, SpO2 and invasive are continuously measured. Others, like non-invasive blood pressure, spot check temperature, and laboratory values, are only measured intermittently. The values of these and other physiological parameters are temporally relevant as they may have triggered treatment change, and are typically displayed on a monitor with a date and time stamp indicating when they were obtained.

Because the age of the intermittently measured parameter data is significant to the clinician, it is commonly marked with a sample acquisition date and time stamp, particularly the time when the parameter was measured. One problem with the time stamp is that the monitor display is already cluttered with the numerical values of numerous measured physiological parameters. Another problem is that the clinician performs mental math to see how old the measurement really is. In some instances, the clinician will also make a determination of whether and how much the age of the measurement affects the clinical value of the measurement.

The present application provides an improved method and apparatus which overcomes the above-referenced problems and others.

In accordance with one aspect, a method is presented for displaying a reading or data value. A reading or data value is displayed and the display is altered as the data value ages with time such that the display is indicative of the data value and its age.

In accordance with one aspect, an apparatus is presented that displays a reading or data value. The apparatus includes a human readable display device and a processor programmed to control the display device to display the reading or data value and alter the displayed reading or data value or a label progressively with time such that the displayed value or the table thereof is indicative of its age.

An advantage resides in reducing clutter, particularly a number of alphanumeric characters and symbols, on the face of a display device.

An advantage resides in enabling a clinician to quickly determine the age of each reading on a display screen without requiring the clinician to performing the mental arithmetic of by subtracting the time a the reading was taken from the current time now in order to calculate the age of a reading, and repeating this math for each reading on the display.

A further advantage is that it provides intuitive assessment of the clinical value of a reading on a display.

Still further advantages of the present invention will be appreciated to those of ordinary skill in the art upon reading and understand the following detailed description.

The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating the preferred embodiments and are not to be construed as limiting the invention.

FIGURE 1 illustrates the parameter display adjacent to the patient bed;

FIGURE 2 illustrates fading in intensity to indicate parameter age;

FIGURE 3 illustrates a changing color to indicate parameter age;

FIGURE 4 illustrates subscript to indicate parameter age;

FIGURE 5 illustrates changing the size of the subscript to indicate parameter age;

FIGURE 6 illustrates progressive background change of a circle to indicate parameter age;

FIGURE 7 illustrates progressive background change to indicate parameter age;

FIGURE 8 illustrates the use of clock hands to indicate age of a parameter;

FIGURE 9 illustrates a timer adjacent to the parameter reading;

FIGURE 10 illustrates the use of an hour glass as a timer mechanism; and

FIGURE 11 illustrates the expired parameter reading being crossed out.

FIGURE 12 illustrates the value has expired by substituting three dashes for numbers.

FIGURE 13 illustrates a reading with a progress bar count down.

With reference to FIGURE 1, a medical monitor for patients uses measurement devices that measure various physiological parameters and a display device **100** that displays values of the measurement parameters, commonly called readings. Such readings are gathered by an electronic probe or monitor **110** and displayed on a medical monitoring display **100** which is often located near a patient bed **120**. The display presents some medical data as a graphical readout **130** and other readings and information in numbers **140**, or text **150**. Some readouts have a relevance which is time dependent. There is a need in the art of medical displays for a simple, intuitive means to measure and indicate how long ago the last data reading was taken. The present application presents a plurality of means by which the age of a data reading may be measured.

In one embodiment, the age of data displayed is conveyed by the color or intensity of the data **140**. In another embodiment, the age of data is conveyed by use of a subscript next to the actual data reading which would indicate the number of days, hours, minutes, or seconds the reading has been displayed or could present the amount of time until the next reading is due. In another embodiment, the age of a data display is conveyed graphically **160** through use of an icon or symbol such as, but not limited to a clock or a circle with removable wedges, an hour glass, or the like. The picture or symbol represents the length of time the data has been displayed, will remain on display, or the length of time remaining until the next data reading is to be obtained. Use of such means may also reduce screen clutter.

Typically, bedside patient monitors and nursing station central monitors display a plurality of physiological parameters for each patient. Some of these parameters are measured continuously and in real time, and others are measured aperiodically. The aperiodic measurements may be taken every hour, every few hours, every day, etc. In order to inform the medical care giver how old each displayed aperiodic parameter is, it was common to place a date stamp in conjunction with the parameter title and number. The date stamp might be a time, or time and day at which the measurement was made. These additional numbers on an already-busy display add to clutter, making the display harder to read. Typically, the more data displayed, the more difficult it becomes for a user to read the display and sort out relevant data from not relevant

data. Moreover, the care-giver has to do mental math to derive the age of the measurement from the time it was made.

The present application discloses a method and apparatus to display data and simultaneously inform the user how old, recent, and relevant the data is to the current clinical picture. Using a non-text based intuitive technique to convey the age of data without use of time and date stamps eliminates text from the display screen area and thereby reduces screen clutter. Relevance of data may be indicated based on a displayed parameter such as brightness, intensity, color intensity relative to the parameter label used in the real-time monitor, by use of a subscript or superscript located on either side of the value, or special icon as a background for the data parameter. As a new aperiodic parameter is measured, such as non-invasive blood pressure, it is displayed on the display of the monitor by an underlying parameter display algorithm. In some instances, the reading is displayed with a time stamp and the reading is automatically removed from the real time display after a preconfigured aging threshold. A threshold is a predetermined maximum time for which the data parameter should be displayed. An example would be that of a certain data value which should remain on the screen for one hour and then should be removed.

In the embodiment of FIGURE 2, a medical reading indicates the age of the displayed data by altering the intensity of the displayed numbers. In the present example, the most recent value is one that is less than 15 minutes old and the most recent value is the most intense, most brightly illuminated reading **210**. As the readings age, the intensity decreases such that the reading which is more than 15 minutes old but less than 30 minutes old the displayed reading number **220** is less intense than the previously mentioned reading. Similarly, a reading **230** that is more than 30 minutes old but less than 45 minutes old is less intense than the previously mentioned reading, while a reading **240** that is more than 45 minutes old but less than 60 minutes old is less intense than the previously mentioned reading so as to be almost invisible. Finally, when the reading is more than 60 minutes old, the displayed completely disappears and is replaced by a symbol indicative of no current reading, such as but not limited to a dashed line **250**. The times herein are given as an example and other lengths of time could be used. The device would function in substantially the same manner whether the readings were in seconds, minutes, hours, or days and the like.

In the embodiment of FIGURE 3, the aging of the readings is represented not by the fading of the intensity of the readout, but by a change in color of the readout. The change of color functions analogously to fading in intensity of the previously recited disclosure. Thus green **310** could represent less than 15 minutes, yellow **320** could represent more than 15 and less than 30 minutes, and red **330** could represent more than 30 but less than 45 minutes, with the reading is more than 60 minutes old, the displayed completely disappears and is replaced by a symbol indicative of no current reading, such as but not limited to a dashed line **340**. These colors are by way of example representative example, and any color could be assigned to any time frame. Any collection of colors, such as but not limited to pastels, earth tones, neon colors, primary colors and the like could be used to represent any time quantity such as, but not limited to, seconds, minutes, hours, or days. The color can change in discrete steps or can morph continuously. The color can be in discrete steps or continuous.

In one embodiment, the displayed reading value is initially presented at maximum contrast with the background. As the parameter ages, the color or intensity fades into the background color. For example, the color intensity decreases gradually to gray. Once the aging threshold is met, the data parameter is then removed.

The display of aperiodic measurements is aged in an intuitive way. In one embodiment, the content reading value fades as time elapses, such that the intensity of the data displayed dims. In another embodiment, the color assigned to the parameter in question fades to gray with time. This replaces a time or date stamp and reduces the clutter caused by including a date and time with the accompanying data.

With reference to FIGURE 4, in another embodiment the reading 140 includes a subscript **400**. In one embodiment, the subscripts denote the nominal useful life of the aperiodic measurement over which it is aged. This reading value can fade or change color as disclosed above. . Here, the presence of a 1 in subscript indicates that the reading has a useful life of 1 hour **410**. A subscript of 8 indicates that the reading has a useful life of 8 hours **420**. A subscript of 12 indicates that the reading has a useful life of 12 hours **430**. A subscript of 24 indicates that the reading has a useful life of 24 hours **430**. Finally, when the reading is more than 24 hours old, the displayed completely disappears and is replaced by a symbol indicative of no current reading, such as but not limited to a dashed line **450**. These times are given by way of example and other lengths of time could

be used in the device. The device would function in substantially the same way whether the readings were in seconds, minutes, hours, or days and the like. In another embodiment, the subscripts serve to indicate the aging or remaining useful life.

With reference to FIGURE 5, the subscript indicates the age of the displayed reading value presented. The aging of the readings could also be represented by the size or shape of the subscript wherein the subscript is largest for a new reading **510** and shrinks to a smaller size **520**, **530**, **540** as the reading got older, or becomes more italic or less bold as the age progresses. Finally, when the reading is more than 24 hours old, the displayed completely disappears and is replaced by a symbol indicative of no current reading, such as but not limited to a dashed line **550**.

With reference to FIGURE 6, another embodiment for displaying the age of the data parameter is presented. The display may include, but is not limited to, a circle **600** in which a data value **602** is disposed. The age of a display reading is conveyed through use of this graphical symbol. In one embodiment, a reading that is new or only a few minutes old is displayed in a full circle background **610**. After a short time, such as but not limited to 7–10 minutes a small wedge is removed from missing from circle **620**. As time progresses such as or about 15 minutes later, the wedge has grown to a quarter of the circle **630**. Similarly, as the reading ages further to 22-25 minutes, the wedge continues to increase in size **640**. Like a clock hands, at the 30 minute mark half of the background is missing **650**. When the age exceeds 30 minutes, more of the circle is removed and the background is expanded **660**. At the 45 minute age point three quarters of the background is missing **670**. Finally, when the age is over 45 minutes, only a small of the circle would remain **680**. The reading value and the circle would disappear completely after 60 minutes **690**. The wedge icon thus emulates the movement of a clock hand.

With reference to FIGURE 7, another embodiment for displaying the age of the data parameter is presented. The display may include, but is not limited to, a box **700** in which a data value **702** of a second color is disposed. The age of a display reading is conveyed through use of this graphical symbol. In one embodiment, a reading that is new or only a few minutes old is displayed in a full background **710**. After a short time, such as but not limited to 7–10 minutes a small wedge is removed **720**. As time progresses such as or about 15 minutes later, the wedge has grown to a quarter **730**. Similarly, as the reading ages further to 22 to 25 minutes, the wedge continues to increase

in size **740**. Like a clock hands, at the 30 minute mark half of the background is missing **750**. When the age exceeds 30 minutes, more is removed and the background is expanded **760**. At the 45 minute age point three quarters of the background is missing **770**. Finally, when the age is over 45 minutes, only a small wedge remains **780**. The reading value and the box disappear completely after 60 minutes **790**. The wedge icon thus emulates the movement of a clock hand.

With reference to FIGURE 8, an additional embodiment of the present application are disclosed which also uses a clock icons **800**. As another embodiment of a clock **810**, a clock hand **820** is used behind the reading value **830**. Further, another suggested interface **840** may use a two handed clock to keep track of minutes **850** and hours **860** located behind the reading label or measurement value **870**.

With reference to FIGURE 9, an additional embodiment to display the age of the reading **900**. One embodiment **910** displays the age **920** adjacent the reading label or measurement value **930**. Further, another suggested embodiment **940** displays the age using both hours and minutes using a two handed clock **950** adjacent to the reading label or measurement value **960**.

With reference to FIGURE 10, an additional embodiment **1000** presented displays another time-intuitive display **1010**, such as but not limited to an hour glass **120**, indicates the age of the reading data. Here the hour glass **1020** is located adjacent to the reading display **1030**. The hourglass **1040** comprises an upper section **1050** and a lower section **1060**. When the data reading value is new, the upper portion **1050** is darkened and the lower section **1060** is clear. As the reading ages **1070**, the upper section reduces in volume and the lower section increases in volume by substantially the same amount of volume lost by the upper section. When the reading is about to expire, **1080**, the volume of the upper section **1080** is empty and the volume of the lower section **1090** is substantially equal the original volume of the original upper section **1050**. The display device functions in substantially the same way whether the readings were in seconds, minutes, hours, or days and the like. The hourglass can be displayed behind the reading.

With reference to FIGURE 11, another embodiment of the present application **1100** incorporates display of an icon to denote that the aperiodic measurement has expired. Icons include, but are not limited to, a slash-through, a

"not" symbol **1110** comprised of a box or a circle **1110** with a slash **1130** superimposed over the reading value display **1120**, or an "X" **1140** over the reading value **1150**. Furthermore the time display of the measurement may also be dropped. Other icons which retain the label to denote that such a measurement should be there rather than merely eliminating the label or the reading value are also contemplated. Both the reading value displayed and the icon symbol over the reading value can be the same color or different colors, where the reading value may be darker or lighter than the icon symbol.

Furthermore, the indicators presented herein including the fading change in intensity, the change in color, use of a subscript, or the changing background. Another changing graphical symbol may be combined in any manner to signify the age of a data parameter reading.

With reference to FIGURE 12, an expired value may be indicated by the replacement of the numerical value or the alphanumeric characters with dashed line. A value is presented prior to expiration **1210** that conveys the reading to a user. When that reading is no longer valid, the numerical component of the reading may be replaced by dashed lines **1220**. Another embodiment might also replace the alphanumeric characters that describe the reading **1230**, such as 'HR', in addition to also replacing the reading value such that the entire space formerly occupied by the reading is entirely replaced by dashes once the value has been deemed to have expired.

With reference to FIGURE 13, an in progress countdown bar may also be employed to convey the time duration of the reading. Here a new alpha numerical medical reading **1310** would be accompanied by a graphical bar located above, below, or to the side of a medical reading value **1320.** This bar may be fully darkened to indicate that the medical value is new and may transition to undarken the darkened potion as time passes and the medical value ages. A time legend **1330** may also be located substantially near the graphical bar.

As time passes and the medical value ages, **1340**, the bar may transition from a fully darkened graphical display **1320** to a partially darkened graphical display **1350**. The length of time that has passed or is remaining on the life of the medical value may be determined through use of an accompanying legend **1360**. The degree to which the display is darkened will ideally correspond to the amount of time that has passed since the medical value was initially generated.

At the end of the useful life of the medical value **1370**, the bar may be entirely undarkened such that there remains no shaded or darkened portion within the remaining outline of the previously darkened or shaded bar **1380**. This unshaded or undarkened bar may also be accompanied by a legend **1390**.

In an alternative embodiment, the graphical bar may begin life completely undarkened or unshaded, which would indicate that the accompanying medical value is new. In this embodiment, the graphical bar would gradually darken or fill up as time passes and the medical value ages such that a partially shaded or darkened bar would indicate an aging medical value. At the end of the useful life of the medical value, the graphical bar may be fully darkened so as to indicate that time is up for the life of the medical value and this value has expired.

In a further embodiment, the shading or darkening may be replaced by a change in the graphical bar's color, color shade, color intensity, shading pattern or shape. The color changing or darkening may proceed from right to left, from left to right, from center outward toward the edge, from the edge inward toward the center, from top to bottom, from bottom to top, from inside to outside, from outside to inside, diagonally from the upper right hand corner to lower left hand corner, diagonally from the upper right hand corner to the lower left hand corner, diagonally from the lower right hand corner to the upper left hand corner, diagonally from the lower right hand corner to the upper left hand corner, and the like.

The method, system and apparatus described herein may also incorporate a computer operable means including but not limited to a computer data input means, a computer display terminal for presenting data, a computer memory that may contain a database, and a network connection that may enable the method, system and apparatus to interact on a computer network system including but not limited to the Internet.

The invention has been described with reference to the preferred embodiments. Modifications and alterations may occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be constructed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

CLAIMS

Having thus described the preferred embodiments, the invention is now claimed to be:

1. A method of displaying a reading of data value, the method comprising:

displaying a reading or data value (150);

altering the reading or data value display with time, such that the display is indicative of the data value and it age.

2. The method according to claim 1, wherein altering the reading or data value display includes changing a luminous intensity (210-240) of the displayed value or a label thereof.

3. The method according to claim 1, wherein altering the reading or data value display includes changing a color (310-330) of the displayed value or a label thereof.

4. The method according to any one of claims 1-3, wherein the reading or data value display includes:

displaying the reading or data value or a label thereof; and

changing at least one of size, shape, or color of the background with time (610-690; 710-790).

5. The method according to claim 4, wherein the background emulates a clock (600, 700, 800) as it changes with time.

6. The method according to claim 5, wherein the background emulates a clock by displaying one of:

a circle or box divided into wedges (600. 700) that change color progressively analogous to a hand of a clock; or

a circle with a clock hand (820) that advances with time.

7. The method according to any one of claims 1-3, wherein the reading or data value display includes displaying one of a clock (900) or hourglass icon (1010) adjacent the displayed value or label thereof.

8. The method according to any one of claims 1-7 further including:

displaying a subscript or superscript (400) adjacent the value or a label thereof to indicate an age threshold.

9. The method according to any one of claims 1-8 further including: after the age threshold is reached, terminating displaying the reading or data value (250, 340, 450, 550).

10. The method according to any one of claims 1-9, wherein the reading or data value is a non-continuously measured physiological parameter of patients which is displayed on a medical monitor (100).

11. A display apparatus (100) which is controlled to perform the method according to any one of claims 1-10.

12. A computer readable medium programmed with software which when implemented by a processor controls a monitor (100) to perform the method of any one of claims 1-10.

13. An apparatus for displaying a reading or data value, the apparatus comprising:

a human readable display device (100);

a processor programmed to control the display device to:

display the reading or data value (140);

alter the displayed reading or data value or a label (150), thereof progressively with time such that the displayed value or the table thereof is indicative of its age.

14. The apparatus according to claim 13, wherein the reading or data value represents a physiological parameter of a patient and further including:

at least one of physiological parameter sensor (110) for sensing a physiological parameter of the patient.

15. A display for presenting information in a human readable format comprising:

a computer operable video display terminal (100) for presenting alphanumeric characters;

at least one alphanumeric symbol quantifying a measurement obtained from an electronic device (140, 150); and

at least one graphical element conveying the age of the quantified measurement (FIGS. 2-11).

16. The display according to claim 15, wherein the age of a measurement is conveyed through change in color (310-340) of the at least one alphanumeric symbol.

17. The display according to claim 15, wherein the age of a measurement is conveyed through change in intensity (210-240) of the at least one alphanumeric symbol.

18. The display according to claim 15, wherein the age of a measurement is conveyed by use of symbols adjacent to and smaller than (400, 820, 920, 1020) the at least one alphanumeric symbol.

19. The display according to claim 15, wherein the age of a measurement is conveyed by manipulation of an icon image (FIGS. 6-11) displayed with the at least one alphanumeric symbol.

20. The display according to any one of claims 15-19, wherein the measurement is a medical reading.

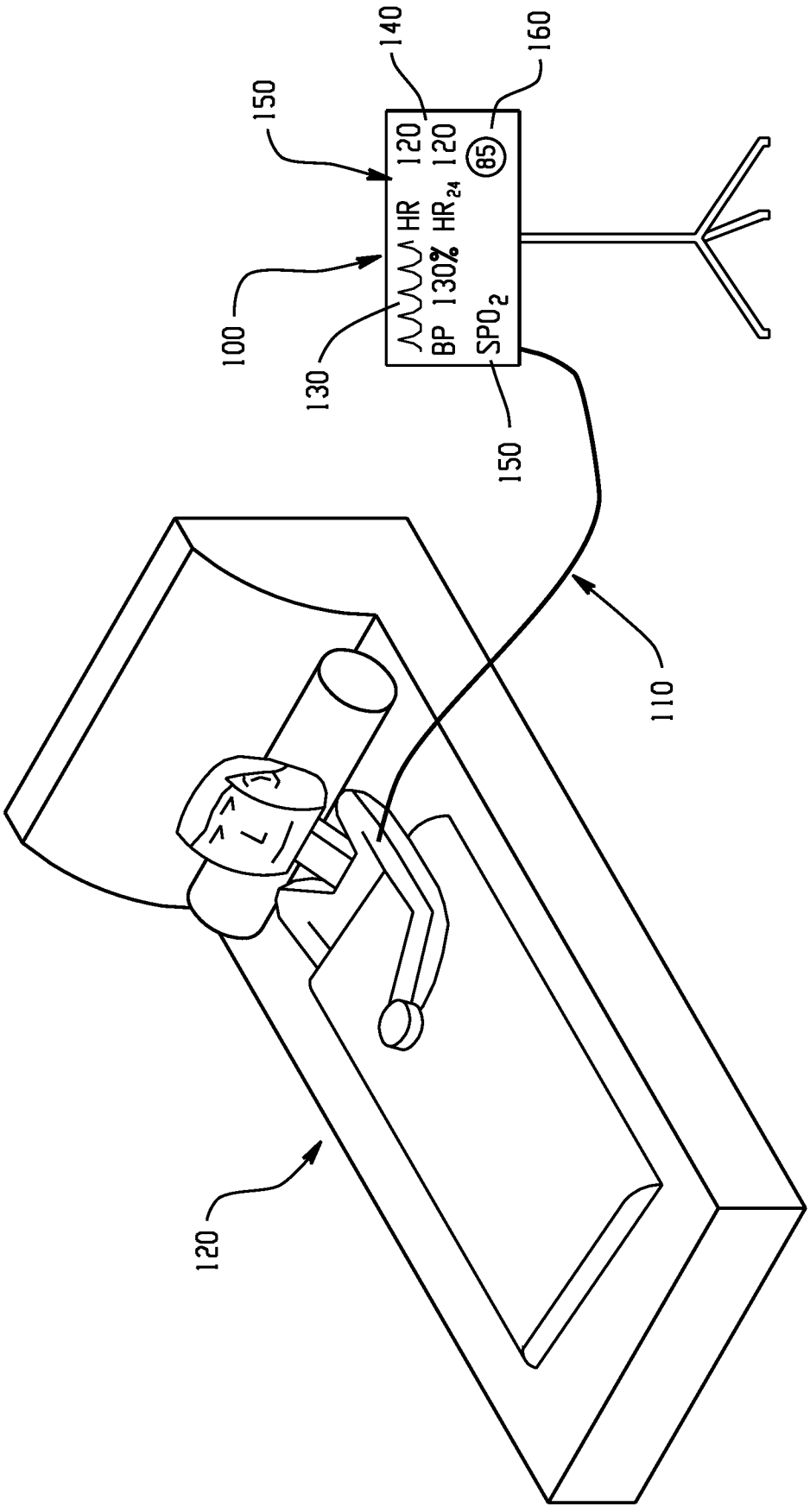

Fig. 1

Fig. 2

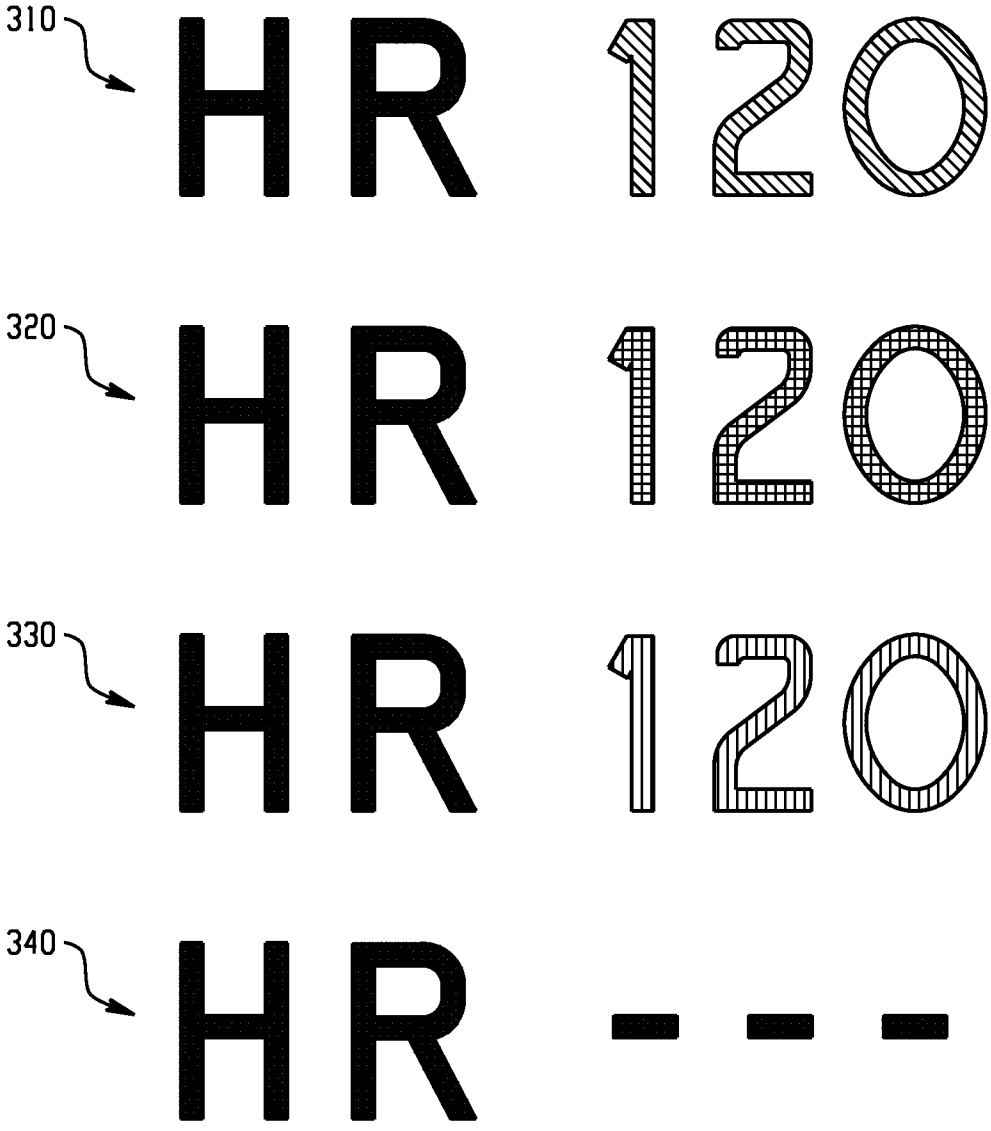

Fig. 3

Fig. 4

Fig. 5

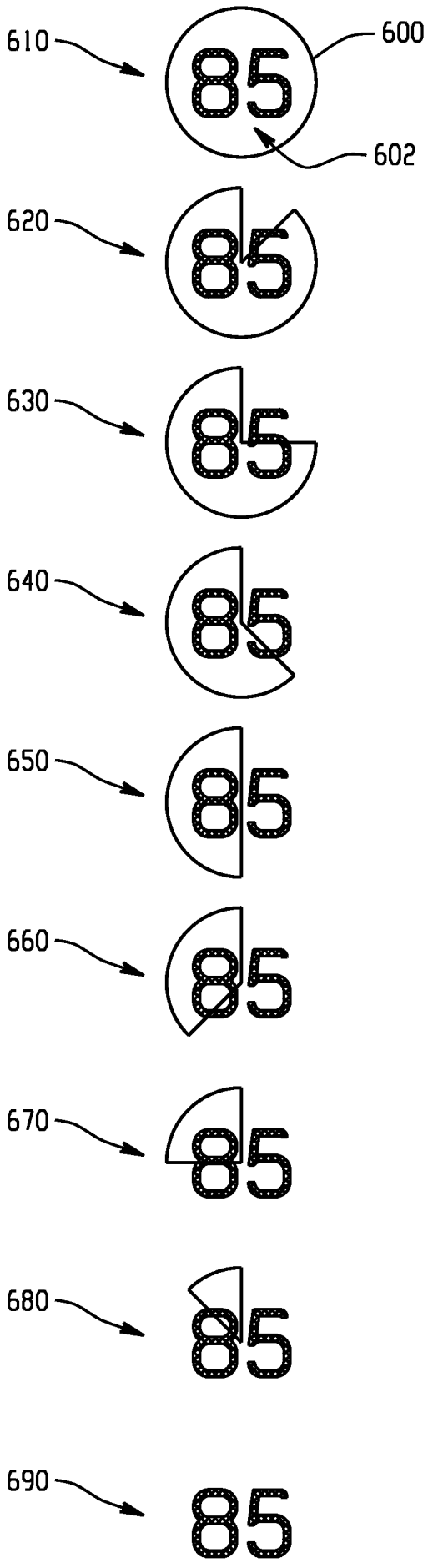

Fig. 6

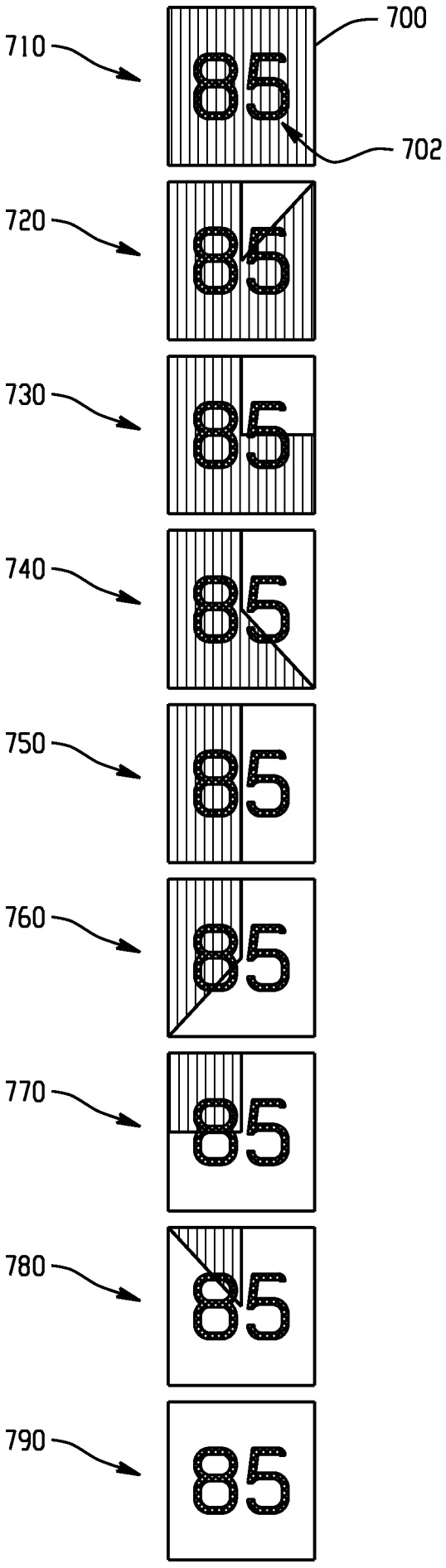

Fig. 7

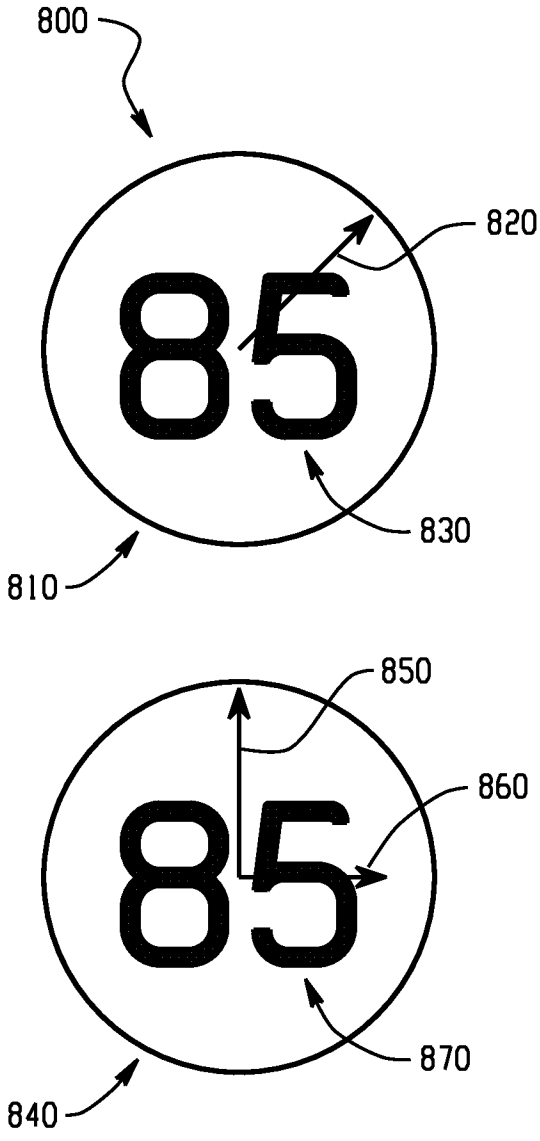

Fig. 8

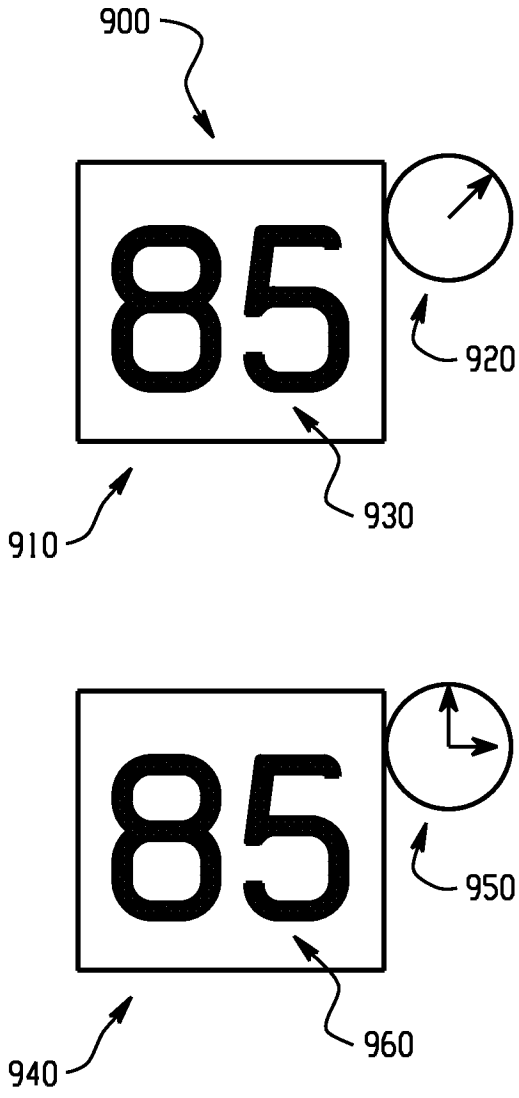

Fig. 9

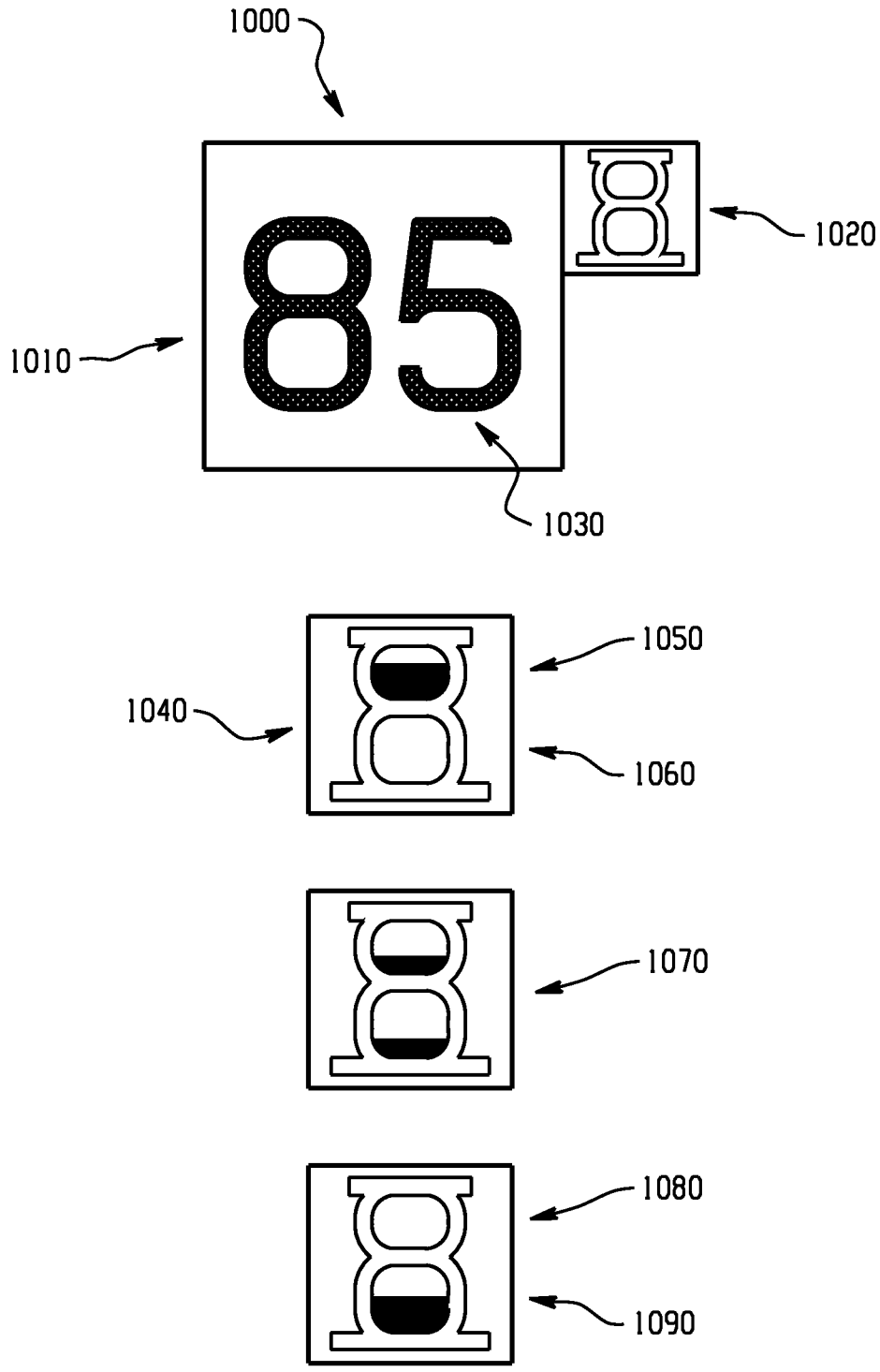

Fig. 10

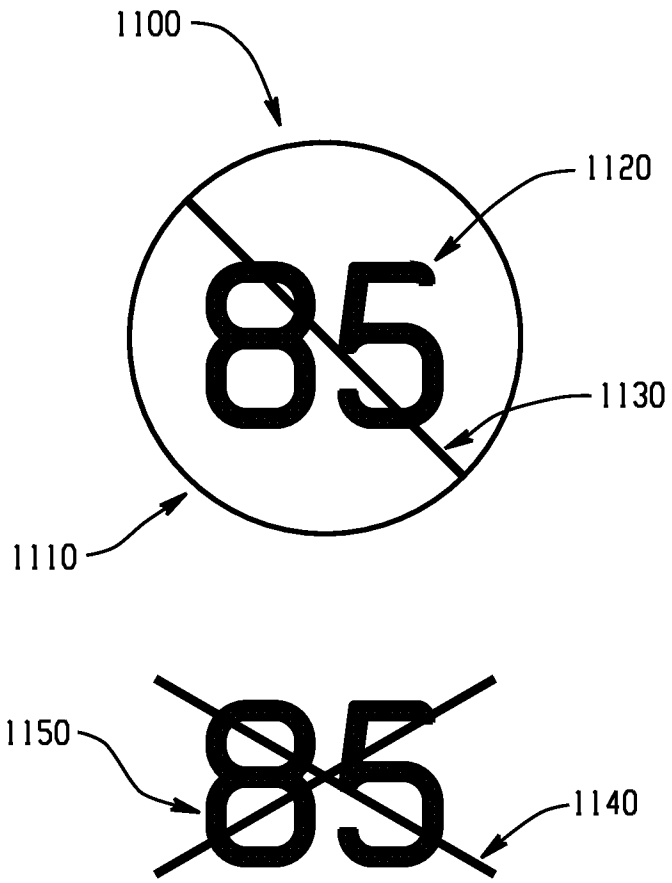

Fig. 11

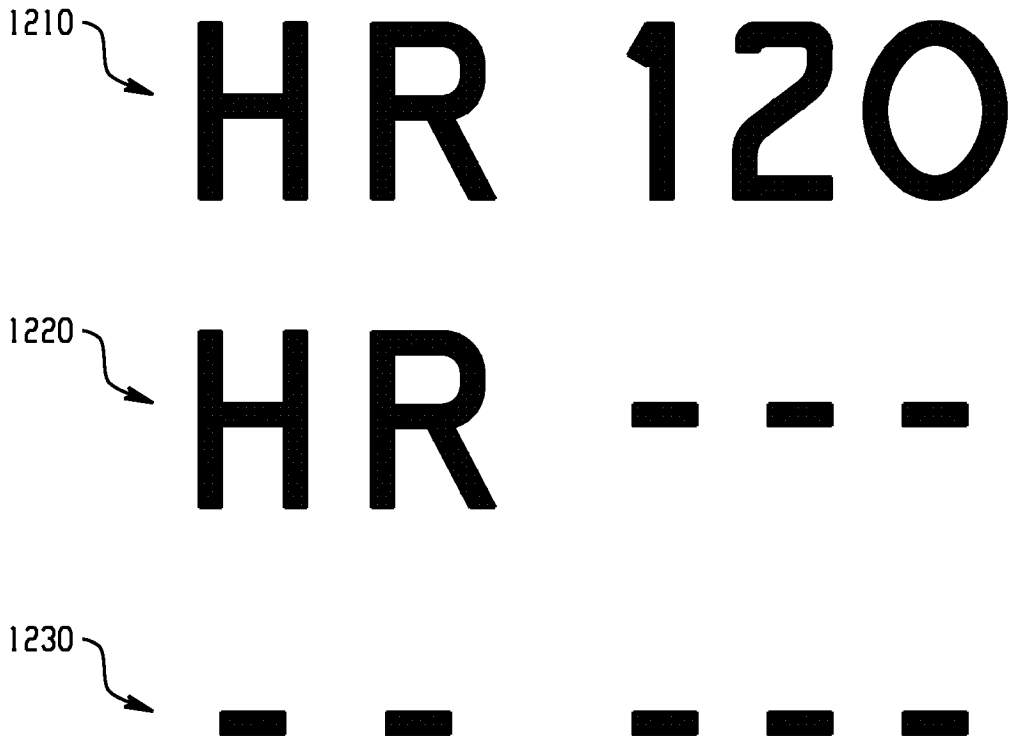

Fig. 12

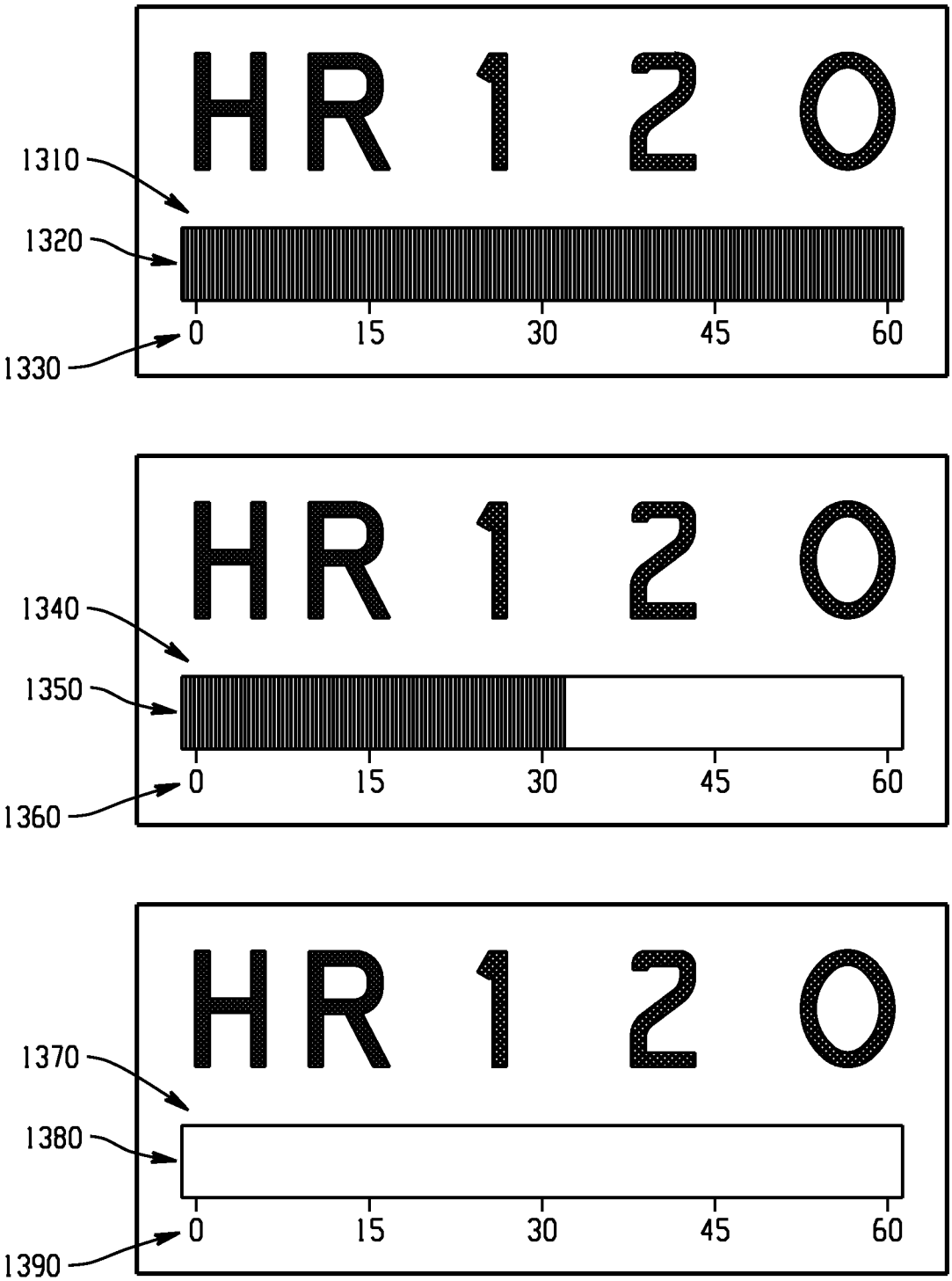
HR 120
1310
1320
0
15
30
45
60
1330
HR 120
1340
1350
0
15
30
45
60
1360
HR 120
1370
1380
0
15
30
45
60
1390

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/053549

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B5/00 A61B5/021 G06F19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/045538 A (MASIMO CORP [US]; AL-ALI AMMAR [US]) 17 April 2008 (2008-04-17) paragraph [0004] paragraph [0004] - paragraph [0009] paragraph [0043] figure 3A	1-5,7, 9-17,20
X	US 6 322 516 B1 (MASUDA HIROSHI [JP] ET AL) 27 November 2001 (2001-11-27) column 7, paragraph 1 column 13, paragraph 1 figure 5	1,4,8, 10-15, 18,20

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 December 2009	16/12/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Gärtner, Andreas

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/053549

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/025341 A (UNIV QUEENSLAND [AU]; WATSON MARCUS [AU]) 8 March 2007 (2007-03-08) page 5, paragraph 5 figure 1	1,10,11
X	GB 1 027 320 A (HELMUT KRONSCHWITZ) 27 April 1966 (1966-04-27) the whole document	1,2,4,9, 11
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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