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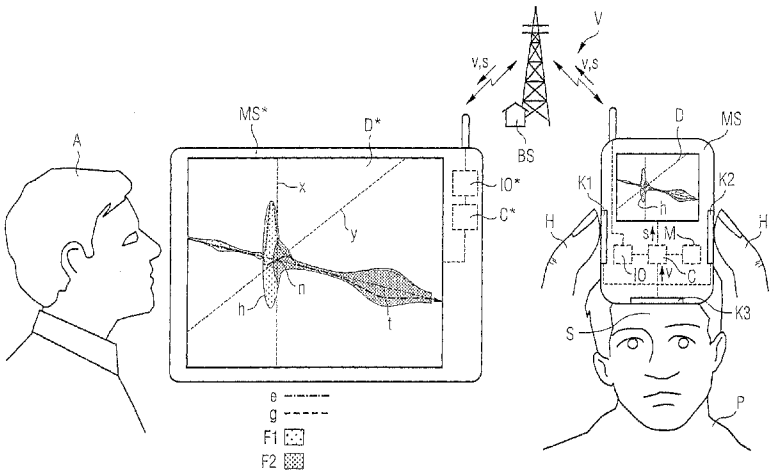
(54) **Title:** METHOD AND ECG ARRANGEMENT FOR DISPLAYING AN ECG



(57) **Abstract:** The invention relates to a method for displaying an ECG, in which ECG data (v) measured on a body is processed by means of a control device (C; C*) and graphically displayed by means of a display device (D; D*) as an ECG signal varying with respect to time along a time axis (t), wherein the ECG data (v) is converted into a three-dimensional ECG signal (s) varying with respect to time and displayed three-dimensionally about the time axis. A conversion takes place by means of an ECG arrangement for displaying an ECG with a measuring device (MS) with contacts (Kl, K2, K3) for measuring ECG data (v) on a body, with a control device (C; C*) for processing the measured ECG data (v) into an ECG signal varying with respect to time along a time axis and with a display device (D; D*) for graphically displaying the ECG signal along a time axis, wherein the control device is configured or can be activated to convert the measured ECG data into a three-dimensional ECG signal (s) varying with respect to time and for the three-dimensional display of the three-dimensional ECG signal about the time axis.

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Method and ECG arrangement for displaying an ECG

Cardiac currents or cardiac voltages are investigated by means of electrocardiography (ECG), which was discovered by Einthoven and Goldberger. When the heart muscle is excited, an electrical voltage is produced, which can be measured on the body by a voltage measuring apparatus. The cardiac rhythm can be analysed by means of ECG data obtained in this manner to diagnose heart attacks. The ECG data is typically collected by the doctor in the practice, in hospital or else with portable 24h ECG apparatuses and evaluated by the doctor using a two-dimensional display of an ECG signal varying with respect to time. In this case, portable ECG apparatuses, which transmit the measured ECG data without a display on the apparatus itself via a mobile radio interface to a doctor, are also known. ECG data received in this manner is then displayed as one or more two-dimensional ECG signals on a suitable apparatus at the doctor's.

Voltages generated by the heart can be measured as ECG data by tapping a respective voltage difference between two contact points of the body which are spaced apart from one another. For example, ECG data can be measured in a simple manner by a voltage

measurement on the two arms or hands of the body. ECG data measured in this manner is two-dimensionally displayed as an ECG signal varying with respect to time along a time axis. For display, as the recording device where there is a paper writer, a sheet of paper is generally used as the recording medium. Where there is a video screen apparatus as the recording device, the two-dimensional video screen is used as the recording medium to display the ECG signal.

The contact points are usually selected in such a way that the heart is located between contacts applied to the contact points. Depending on the orientation of the contacts, in other words, for example, whether these are arranged in the lateral direction on the arms or in the longitudinal direction on the head and legs, various regions of the heart or generated voltage values thereof can accordingly be measured. Depending on the orientation of the contacts as electrodes, correspondingly larger or smaller deflections are to be recorded in the two-dimensional ECG signal displays associated with these. Two or more datasets from ECG data are therefore generally measured using various contact points on the body and displayed separately from one another as two or more ECG signals on a corresponding display medium in two-dimensional form along the time axis. A doctor

evaluating ECG signals of this type mentally combines the information from the various ECG signals to make a diagnosis which is as precise as possible regarding the state of the heart and its individual portions, as a comprehensive display is not available in a unified form.

The increasing need to be informed about his cardiovascular system, leads to the desire for a method, which, on the one hand, does not restrict the diagnostic approach of the doctor and simultaneously shows the patient or optionally a healthy user a visual display, with which he can intuitively detect the current state of his heart.

With the foregoing in mind, an object of the invention may be considered to consist in improving a method and an ECG arrangement for displaying an ECG such that a clearer observation of the ECG data is allowed, which optionally or preferably, also makes a state analysis possible for a non-medical user.

This object may be achieved by a method or an ECG arrangement for displaying an ECG of the independent claims. The dependent claims relate to particular or advantageous, configurations.

A method may be, in this case, advantageous, in which the conversion of the ECG data into the three-dimensional ECG signal is implemented as an ellipsoidal or circular ECG signal, which is displayed with corresponding ellipsoidal or circular structures. The ECG data is optionally, or preferably, converted into the three-dimensional ECG signal, in this case, as an ECG signal rotating ellipsoidally or circularly about the time axis, which is displayed with corresponding ellipsoidal or circular structures. This even allows a single ECG signal according to Einthoven to be displayed in a visually pleasing manner and so as to be easier to interpret than in a two-dimensional display.

It is optional, or preferred, if the ECG data is measured and provided by a time sequence of data as a first two-dimensional time ECG signal according to Einthoven from a first and second contact on hands or arms of the body.

A particular method, which may be, advantageous is one in which the ECG data is measured and provided by a time sequence of data as a first two-dimensional time ECG signal according to Einthoven from a first and second contact, on the one hand, on hands or arms of the body and, on the other hand, by a further time

sequence of data as a second two-dimensional time ECG signal according to Goldberger by means of a third contact in another region of the body. Thus, two single two-dimensional ECG signals can be displayed according to Einthoven and Goldberger in a visually pleasing manner and so as to be easier to interpret than in two separate two-dimensional displays of the two ECG signals. Instead of having to observe two separate curves and evaluate them together in one's head, a combined three-dimensional display can be observed. This allows the observation of envelopes around the time axis, wherein the individual portions of the envelopes, depending on the state of the cardiac function, have very specific forms which can be differentiated surprisingly well. Even medical laymen are put into a position of being able to recognise certain critical malfunctions on the basis of specific shapes and can thus consult a doctor in good time.

The three-dimensional ECG signal is optionally, or preferably formed, in a first dimension to the side of the time axis, by the first two-dimensional ECG signal and, in a second dimension to the side of the time axis, by the second two-dimensional ECG signal by the vectorial superimposition thereof. The first and second dimensions do not need to, although optionally

or, preferably may, however, absolutely necessarily define a Cartesian coordinate area together with the time axis.

The time axis for displaying the three-dimensional ECG signal is optionally, or preferably, not placed spatially parallel to the display plane of a display medium of the display device. A three-dimensional spatial effect can thus be achieved in a simple manner despite use of a two-dimensional mapping medium, in particular a flat video screen or a printout.

A method for displaying an ECG maybe, and possibly advantageously, combined therewith or else independently, with an optionally only two-dimensional flat display, wherein ECG data measured on a body is processed by means of a control device and graphically displayed by means of a display device as an ECG signal varying with respect to time along a time axis and wherein various measurable characteristic signal courses of the ECG signal displayed flat or three-dimensionally are displayed by various colours, various brightness values or various grey stages of portions of the ECG signal which follow one another with respect to time. For example, zero crossings n of one or the two two-dimensional ECG signals can thus be displayed very strikingly as components of the

three-dimensional signal or of the envelopes. Visual displays of two derivatives with a colour change at zero crossing n of one of the two components of the ECG signal are accordingly possible, in particular. However, simple visual displays of only one derivation can also be implemented, corresponding visual displays of a derivation with a colour change at a zero crossing n being optional or preferred.

A particular ECG arrangement which may be advantageous, is one in which the contacts are arranged as contact faces for hands or another body region outside of the measuring device. Contacts for cables and cables which have to be carried are therefore not required.

The measuring device is optionally, or preferably, configured as a subscriber device of a radio communication system. ECG data can thus be transmitted if necessary, directly or after interim storage in a memory of the subscriber device, to a doctor. The subscriber device can be configured in a technically simple manner as a conventional mobile radio apparatus, which is equipped with additional contacts to configure the touch contacts or optionally also for the connection of cables.

An already available control device in the subscriber device, in particular in a mobile radio apparatus, merely has to be equipped with corresponding software for carrying out the preferred method if the three-dimensional ECG signal is to be displayed on the display device of the mobile radio apparatus. If a separate display device is to be used or only a transmission to the doctor is to take place, who then uses the method on his display mechanism, software in the consumer device allowing the data to be tapped from the contacts and the transmission thereof via an interface, preferably a radio interface, is sufficient.

A first and a second one of the contacts are optionally, or preferably, configured and connected to measure the ECG data by a time sequence of data as a first two-dimensional time ECG signal according to Einthoven on hands or arms of the body.

Particularly, or preferably, a first and a second of the contacts are configured and connected to measure the ECG data by a time sequence of data as a first two-dimensional time ECG signal according to Einthoven on hands or arms of the body, and a third of the contacts is configured and connected to measure the ECG data by a further time sequence of data as a

second two-dimensional time ECG signal according to Goldberger in another region of the body.

The first and the second contact are optionally, or preferably arranged on two opposing sides of the measuring device and the third contact is, which may be advantageous, arranged on a further side of the measuring device. This allows gripping and contacting with the two hands, on the one hand, and a further contacting of the forehead or the chest region with the third contact, on the other hand. In particular, an arrangement of this type allows a view on a display device of the measuring device even for the user, who can thus simultaneously observe his current body values.

The display device may be configured as a component of a display device separate from the measuring device. The measuring device can thus be carried by a person to monitor his cardiac function and the preferred method for three-dimensional display of the ECG signal can be carried out on the display device of the display mechanism of a doctor spatially distant from the measuring device.

The control device of the measuring device or the control device of a display mechanism, which is

separate from the measuring device, with the display device, is preferably configured or controlled to carry out one of the optional, or preferred, methods.

A method for displaying an ECG is taken as the starting point, in which ECG data measured on a body is processed by means of a control device and graphically displayed by means of a display device as an ECG signal varying with respect to time along a time axis. Instead of graphically displaying ECG data measured on a body as one or two ECG signals varying with respect to time along a time axis in a two-dimensional form, the ECG data is, in the present case, converted into a three-dimensional ECG signal varying with respect to time and displayed three-dimensionally about the time axis.

In terms of the mechanism, a single-part or multi-part ECG arrangement for displaying an ECG with a measuring device with contacts for measuring ECG data on a body, with a control device for processing the measured ECG data into an ECG signal varying with respect to time along a time axis and with a display device for the graphic display of the ECG signal along a time axis, is provided. The control device is configured here or can be activated to convert the measured ECG data into a three-dimensional ECG signal varying with respect to

time and for the three-dimensional display of the three-dimensional ECG signal about the time axis.

Instead of a plain two-dimensional ECG signal, two independent two-dimensional ECG signals, which are measured in particular with arrangements according to Einthoven and Goldberger, are therefore converted into a three-dimensional ECG signal. However, the specific information of the two independent two-dimensional ECG signals does not become lost in the process. This may be advantageous, as the doctor typically often detects heart attacks or other lesions of the heart muscle specifically from the detached observation of one electrical vector. An optional, or preferred, method combines two different electric vectors for visual display, in such a way that an aesthetically and diagnostically valuable medium is obtained for communication between the doctor and patient or user. With the aid of the three-dimensional display, specific forms and in particular coloured structures of the resulting ECG signal are produced, which also allow a medical layperson to again recognise critical and harmless forms and structures. A visual display of measured ECG data is thus implemented in the form of an ECG signal varying with respect to time, which allows both a doctor and a patient or a user a new type of observation and analysis.

The three-dimensional display is, in particular, also taken to mean displays, which offer a pseudo-three-dimensional display by display by means of a two-dimensional display medium. This is made possible, in particular, in that, in the display, the time axis to display the ECG signal is not placed spatially parallel to the display plane of the display medium.

The corresponding measuring apparatus in the mobile device provides the first and the second contact as touch contacts for the right and left hand. Thus, the derivation according to Einthoven I as an axis from the left to the right arm is detected. The third contact is thus located at the end of the apparatus in such a way that when holding the apparatus with two hands at the first or the second contact, the third contact either detects a skin portion on a leg or else chest, neck or even head. Thus, with a simple arrangement of the contacts on the apparatus, a plurality of different ECG derivations is possible. If the user should only carry out the one derivation of the hands, the visual display can already be carried out and displayed, possibly advantageously, as a pure rotation about an axis to nevertheless achieve pleasing aesthetic results.

The displays may show various measurable and visually displayable situations by corresponding colour changes or various grey stages on, for example, a non-colour display. In the case of two derivatives, visual displays of a combination according to Einthoven I and AVF or a combination according to Einthoven I and various chest wall derivations are possible. Visual displays of two derivations with a colour change in the zero crossing n of one of the two components of the ECG signal are possible, which may be advantageous in particular. However, simple visual displays of only one derivation can also be converted, visual displays of a derivation with a colour change at a zero crossing n being preferred. A static observation of graphic 3D objects produced by the display or a dynamic animated observation of 3D objects of this type are however, also, possibly advantageously, allowed.

An embodiment of the invention will be described in more detail below, by way of non-limiting example only, with the aid of the drawings, in which:

Fig. 1 schematically shows a mobile radio apparatus as an ECG measuring device and at the same time an ECG display device and a display mechanism remote therefrom, for example at a doctor's, a vectorally

combined display form of two ECG signals being sketched on the display devices;

Fig. 2 shows a person with tapping points for generating two different types of ECG signals and a vectorally combined display form of the ECG signals and

Fig. 3A - 3D show various display forms of ECG signals of this type.

Fig. 2 shows a person P, on which ECG data is being tapped or measured. In this case, ECG data is measured as a derivation according to Einthoven AE by tapping voltage values on the two arms or hands H. Further ECG data is obtained as a derivation according to Goldberger AG by two taps on the arms or hands H and a further tap on a leg or foot of the person P.

According to the method, the ECG data obtained in this manner of two measuring series of this type can not be displayed as respectively autonomous, and mutually independent two-dimensional ECG signals g, e along a time axis t, but displayed together along the time axis t as a combined three-dimensional ECG signal s. Accordingly, a plane spanned perpendicularly to the time axis t is divided into two coordinates x, y.

Each of the coordinates x, y forms a dimension with a lateral extension to the time axis t. The ECG data, which are determined as a derivation according to Einthoven AE, are plotted in the plane of the second coordinate y along the time axis t as a two-dimensional ECG signal e. The ECG data, which correspond to the derivation according to Goldberger AG, are plotted in the second coordinate x along the time axis t as the second two-dimensional ECG signal g. According to the method, a vectorial display is formed from or with respect to the two-dimensional ECG signals e, g plotted in this manner and configures the three-dimensional ECG signal s. The three-dimensional ECG signal s may be, or preferably is, determined in a computing or control device for subsequent display on a display device.

An illustrative form of display of a three-dimensional ECG signal s of this type along the time axis t or about the time axis t is sketched with the aid of Fig. 1 and 3B. In all the figures the ECG signal g is displayed as a derivation according to Goldberger AG by means of a dashed line and the ECG signal is displayed as a derivation according to Einthoven by means of a dash-dot line and the three-dimensional ECG signal s is displayed by means of a solid line if the respective figures show the corresponding signals. In

general, the same reference numerals in the various figures refer to identical or identically acting components, signals or functions, so the descriptions with respect to other figures should also be taken into account in each case.

Fig. 3A shows the display of the three ECG signals g, e, s according to the display from Fig. 2. Fig. 3B shows the effective display formed therefrom on a display device, as is offered to the observer in a particular or preferred, manner. The three-dimensional ECG signal s forms an envelope h about the time axis t in the manner of a rotating display about the time axis t. Optionally, or preferably, for every time point, an ellipse or circle is formed and displayed accordingly in the control device from the two signal components of the ECG signals g, e according to Goldberger and Einthoven. A sheath-shaped structure with bubble-shaped structures is thus produced along the time axis t. In this case, an ellipse with a high long axis and a short lateral axis is, for example, a high derivation value of the instantaneous ECG data of the second ECG signal g according to Goldberger, the corresponding data value of the first ECG signal e according to Einthoven having a clearly smaller deflection. An aspect, which may be advantageous, in this mode of display is that

two separate ECG signals g, e no longer have to be observed independently of one another by a doctor and mentally evaluated together as a display form is allowed, which allows a unified and easily comprehensible statement with the aid of ellipsoidal structures or ellipsoidal shapes.

As a further possibly advantageous, method feature, various portions of the envelopes h which follow one another with respect to time are shown by different colours F1, F2 or grey stages. This is schematically illustrated by dotting with different densities. The zero crossing n of, for example, the first ECG signal e of the derivation according to Einthoven is selected as the criterion for a colour change between two such colours F1, F2. In principle, as an alternative or in addition, zero crossings n of the second ECG signal g of the derivation according to Goldberger can also be used as the criterion for a colour change of the display.

Apart from the shape or structure of the envelopes, a second criterion is thus available owing to a corresponding colour selection so as to be able to clearly map the in particular three-dimensional ECG signal s.

In order to allow a three-dimensional display on a two-dimensional display medium, the time axis t is optionally, or, preferably, not placed parallel, but obliquely, to the plane which is spanned by the face of the display medium as can be seen from Figs. 1, 2, 3A and 3B. Two side views are shown parallel to the time axis t with the aid of Fig. 3C and 3D merely to illustrate the two two-dimensional ECG signal components and their effects on the colour change and the individual structures of the envelopes h. In this case, Fig. 3C shows a side view of a plane parallel to the plane spanned by the second component x and the time axis t, while Fig. 3D shows a plan view of a plane, which is spanned parallel to the first component y and to the time axis t.

Fig. 1 shows illustrative components of an ECG arrangement for carrying out such a method for processing and displaying ECG data v. A first component, which can also be operated completely independently is a consumer device of a radio communication system in the form, for example, of a mobile radio apparatus of a conventional mobile radio standard, for example, GSM or UMTS. However, consumer devices of other types of communication systems of this type can be used, for example according to WLAN (Wireless Local Area Network), if ECG data v or a data

sequence of the three-dimensional ECG signal s is to be transmitted via an interface, in particular radio interface, to a remote display mechanism MS*. A radio interface V of this type is constructed, for example, to form a base station BS of a mobile radio system, so the data to be transmitted in a manner known *per se* can be transmitted to the remote display device MS*. However, in principle, an ECG arrangement in the form of a combined measuring device MS and display mechanism with a display device D can also be configured and used without providing a radio interface device IO to construct a radio interface V.

The measuring device MS has contacts K1, K2, K3, which are used to contact correspondingly suitable body points of a person P to be examined. A particular arrangement here is one in which a first or second one of the contacts K1, K2 is arranged on the side of the measuring device MS and are contacted in each case with a finger of the right or left hand H. A derivation according to Einthoven can thus already be determined. Provision also of the third contact K3, which is used in particular for additional contact of a further body part, may be advantageous. For example, as a further body part, a forehead S of the person P is sketched, so that a derivation according to Goldberger can also be determined. The third

contact K3 may particularly advantageously also be placed on the chest or a leg of the person P, so the person P can simultaneously observe the display device D on which the three-dimensional ECG signal or the envelope h spanned by the three-dimensional ECG signal is displayed.

A control device C, from which an analogue/digital converter is optionally connected upstream, is used to process the data v provided by the contacts K1, K2, K3 in the form of voltage values. The processing of the data according to the method illustrated with the aid of Fig. 2 and 3A - 3D is carried out in the control device C to provide the three-dimensional ECG signal s. The data of the three-dimensional ECG signal s is displayed directly by the control device C or optionally by means of an interposed graphics processing control device on the display device D as the envelope h along the time axis t. The observer can therefore substantially more intuitively detect the state of his heart in a clear form and optionally consult a doctor A upon the occurrence of certain forms of the envelopes h and/or certain positions of colour changes deviating from desired forms or positions.

In order to allow the doctor to observe the ECG data this and/or the already processed and provided three-dimensional ECG signal s can be stored in a memory device M of the measuring device MS for later retrieval or a later transmission. The doctor A can then retrieve and observe the desired display of various instants on the display device D.

In the case of an ECG arrangement distributed over various sites, the ECG data v measured in the measuring device MS are transmitted, for example, via the radio interface V and a corresponding radio interface device IO* into the display mechanism MS* of the doctor A. This display device MS* accordingly has a display device D* for displaying the three-dimensional ECG signal or the envelope h thereof. Optionally, or preferably, but not necessarily, the signal components of the three-dimensional and two-dimensional ECG signals of the envelopes h can additionally be displayed, superimposed.

The measured ECG data v can be processed into the three-dimensional ECG signal in this case in a control device C* of the display mechanism MS* located at the doctor's A. However, various variations are also possible, for example instead of transmitting only the pure ECG data v, transmitting the two-dimensional ECG

signals g, e or the already displayable three-dimensional ECG signal s from the measuring device MS into the display mechanism MS*.

Apart from the particular configuration of the three-dimensional ECG signal s using the ECG data v of the two ECG signals g, e according to Goldberger or Einthoven, a three-dimensional display is also possible if only a single two-dimensional ECG signal is present. In this case, the envelope h is configured in a simple manner by concentric circles about the time axis t.

Apart from a reduction to ECG data v for a single two-dimensional ECG signal, the use of a plurality of further ECG data for still further previously only two-dimensionally displayed ECG signals is possible to generate and display a three-dimensional ECG signal of this type or a corresponding envelope h. The more ECG data of various contact points on the body of the person P is used to form the three-dimensional ECG signal s, the more versatile is the configuration of the shapes and/or colours when displaying the envelopes h along the time axis t. Correspondingly, the informative power increases with an increasing amount of ECG data from various contact points. Expediently, a measuring device MS for recording more

than two derivations correspondingly has a relatively large number of contacts.

Insofar as embodiments of the invention described above are implementable, at least in part, using a software-controlled programmable processing device such as a general purpose processor or special-purposes processor, digital signal processor, microprocessor, or other processing device, data processing apparatus or computer system it will be appreciated that a computer program for configuring a programmable device, apparatus or system to implement the foregoing described methods, apparatus and system is envisaged as an aspect of the present invention. The computer program may be embodied as any suitable type of code, such as source code, object code, compiled code, interpreted code, executable code, static code, dynamic code, and the like. The instructions may be implemented using any suitable high-level, low-level, object-oriented, visual, compiled and/or interpreted programming language, suchs as C, C++, Java, BASIC, Perl, Matlab, Pascal, Visual BASIC, JAVA, ActiveX, assembly language, machine code, and so forth. A skilled person would readily understand that term "computer" in its most general sense encompasses programmable devices such as

referred to above, and data processing apparatus and computer systems.

Suitably, the computer program is stored on a carrier medium in machine readable form, for example the carrier medium may comprise memory, removable or non-removable media, erasable or non-erasable media, writeable or re-writeable media, digital or analog media, hard disk, floppy disk, Compact Disk Read Only Memory (CD-ROM), Company Disk Recordable (CD-R), Compact Disk Rewriteable (CD-RW), optical disk, magnetic media, magneto-optical media, removable memory cards or disks, various types of Digital Versatile Disk (DVD) subscriber identify module, tape, cassette solid-state memory. The computer program may be supplied from a remote source embodied in the communications medium such as an electronic signal, radio frequency carrier wave or optical carrier waves. Such carrier media are also envisaged as aspects of the present invention.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

As used herein any reference to "one embodiment" or "an embodiment" means that a particular element, feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

As used herein, the terms "comprises," "comprising," "includes," "including," "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a process, method, article, or apparatus that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. Further, unless expressly stated to the contrary, "or" refers to an inclusive or and not to an exclusive or. For example, a condition A or B is satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

In addition, use of the "a" or "an" are employed to describe elements and components of the invention. This is done merely for convenience and to give a

general sense of the invention. This description should be read to include one or at least one and the singular also includes the plural unless it is obvious that it is meant otherwise.

The scope of the present disclosure includes any novel feature or combination of features disclosed therein either explicitly or implicitly or any generalisation thereof irrespective of whether or not it relates to the claimed invention or mitigate against any or all of the problems addressed by the present invention. The applicant hereby gives notice that new claims may be formulated to such features during prosecution of this application or of any such further application derived therefrom. In particular, with reference to the appended claims, features from dependent claims may be combined with those of the independent claims and features from respective independent claims may be combined in any appropriate manner and not merely in specific combinations enumerated in the claims.

Claims

1. Method for displaying an ECG, in which ECG data (v) measured on a body is processed by means of a control device (C; C*) and graphically displayed by means of a display device (D; D*) as an ECG signal varying with respect to time along a time axis (t), characterised in that the ECG data (v) is converted into a three-dimensional ECG signal (s) varying with respect to time and displayed three-dimensionally about the time axis (t).

2. Method according to claim 1, in which the conversion of the ECG data (v) into the three-dimensional ECG signal (s) is carried out as an ellipsoidal or circular ECG signal, which is displayed by corresponding ellipsoidal or circular structures.

3. Method according to claim 2, in which the conversion of the ECG data (v) into the three-dimensional ECG signal (s) is carried out as an ECG signal rotating ellipsoidally or circularly about the time axis (t), which signal is displayed by corresponding ellipsoidal or circular structures.

4. Method according to any preceding claim, in which the ECG data (v) is measured and provided by a time

sequence of data as a first two-dimensional time ECG signal (e) according to Einthoven from a first and a second contact (K1, K2) on hands (H) or arms of the body.

5. Method according to any one of claims 1 to 3, in which the ECG data (v) is measured and provided by a time sequence of data as a first two-dimensional time ECG signal (e) according to Einthoven from a first and a second contact (K1, K2) on hands (H) or arms of the body and by a further time sequence of data as a second two-dimensional time ECG signal (g) according to Goldberger by means of a third contact (K3) in another region of the body.

6. Method according to claim 5, in which the three-dimensional ECG signal (s) is formed in a first dimension to the side of the time axis (t) by the first two-dimensional ECG signal (e) and in a second dimension to the side of the time axis (t) by the second two-dimensional ECG signal (g) by the vectorial superimposition thereof.

7. Method according to any preceding claim, in which the time axis for displaying the three-dimensional ECG signal (s) is not placed spatially parallel to the

display plane of a display medium of the display device (v).

8. Method for displaying an ECG, in particular according to a preceding claim, wherein ECG data (v) measured on a body are processed by means of a control device (C; C*) and graphically displayed by means of a display device (D; D*) as an ECG signal varying with respect to time along a time axis (t) and wherein various measurable characteristic signal courses of the ECG signal (s) displayed flat or three-dimensionally is displayed by various colours (F1, F2), various brightness values or various grey stages of portions of the ECG signal (s) following one another with respect to time.

9. ECG arrangement for displaying an ECG comprising
- a measuring device (MS) with contacts (K1, K2, K3) for measuring ECG data (v) on a body,
- a control device (C; C*) for processing the measured ECG data (v) to form an ECG signal varying with respect to time along a time axis (t) and
- a display device (D; D*) for the graphic display of the ECG signal along a time axis (t), characterised in that
- the control device (C; C*) is configured or can be activated to convert the measured ECG data (v) into a

three-dimensional ECG signal (s) varying with respect to time and for the three-dimensional display of the three-dimensional ECG signal (s) about the time axis (t).

10. ECG arrangement according to claim 9, in which the contacts (K1 - K3) are arranged as contact faces for hands (H) or another body region (S) on the outside of the measuring device (MS).

11. ECG arrangement according to claim 9 or 10, in which the measuring device (MS) is configured as a subscriber device of a radio communication system.

12. ECG arrangement according to any one of claims 9 to 11, in which a first and a second of the contacts (K1, K2) are configured and connected to measure the ECG data (v) by a time sequence of data as a first two-dimensional time ECG signal (e) according to Einthoven on hands (H) or arms of the body.

13. ECG arrangement according to any one of claims 9 to 11, in which a first and a second of the contacts (K1, K2) are configured and connected to measure the ECG data (v) by a time sequence of data as a first two-dimensional time ECG signal (e) according to Einthoven on hands (H) or arms of the body, and a

third of the contacts (K3) is configured and connected to measure the ECG data (v) by a further time sequence of data as a second two-dimensional time ECG signal (g) according to Goldberger in another region of the body.

14. ECG arrangement according to claim 13, in which the first and the second contact (K1, K2) are arranged on two mutually opposing sides of the measuring device (MS) and the third contact (K3) is arranged on a further side of the measuring device (MS).

15. ECG arrangement according to any one of claims 9 to 14, in which the display device (D*) is configured as a component of a display mechanism (MS*) separated from the measuring device (MS).

16. ECG arrangement according to any one of claims 9 to 15, in which the control device (C; C*) of the measuring device (MS) or of a display mechanism (MS*) separated from the measuring device (MS), with the display device (D*), is configured or controlled to carry out a method according to any one claims 1 to 8.

17. A computer program product, comprising computer-or-machine-readable programme elements operative in data processing apparatus to implement a method

according to any one of claims 1 to 8, and/or configure an arrangement in accordance with any one of claims 9 to 16.

18. A computer program carrier medium carrying a computer program product according to claim 17.

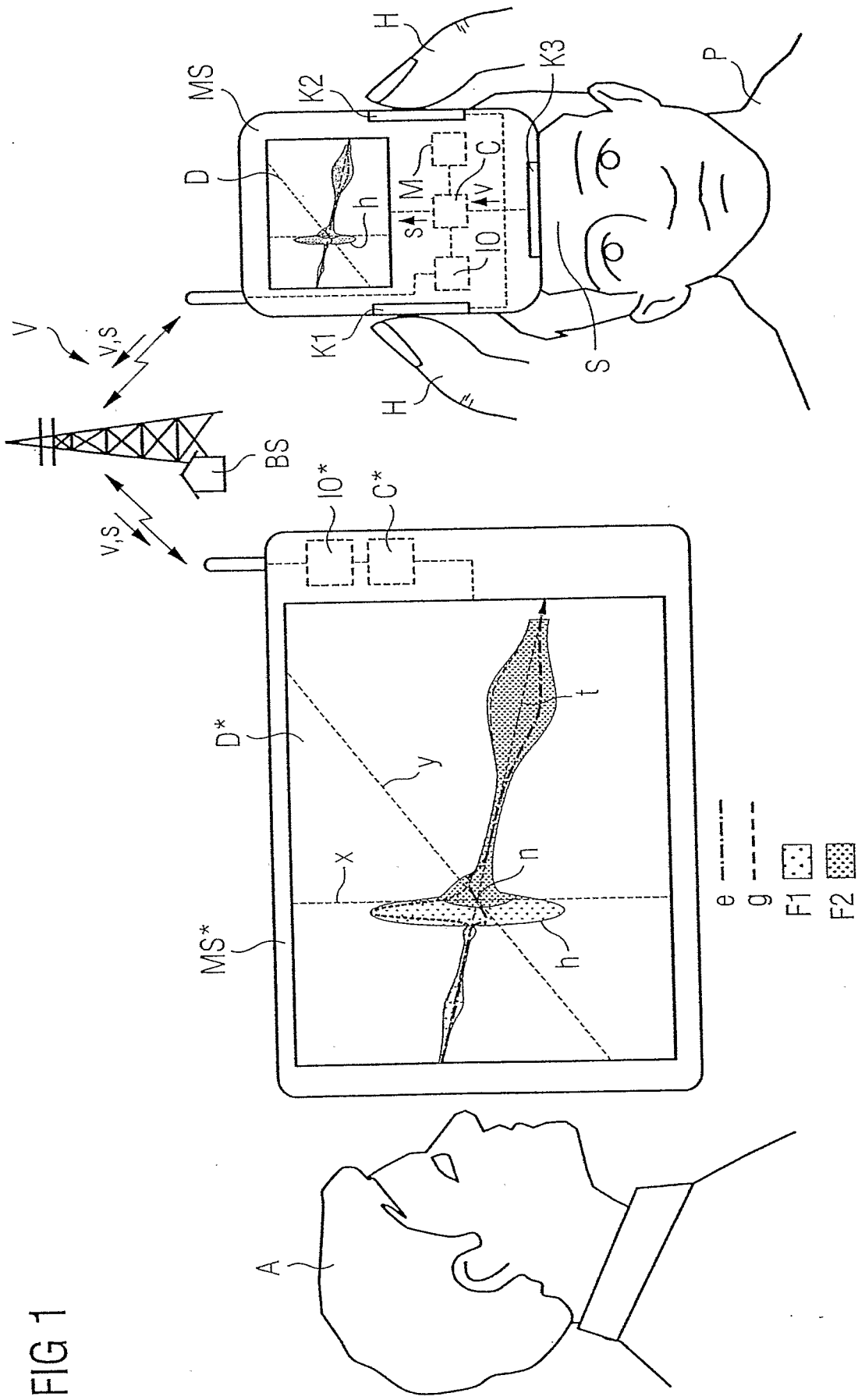

FIG 1

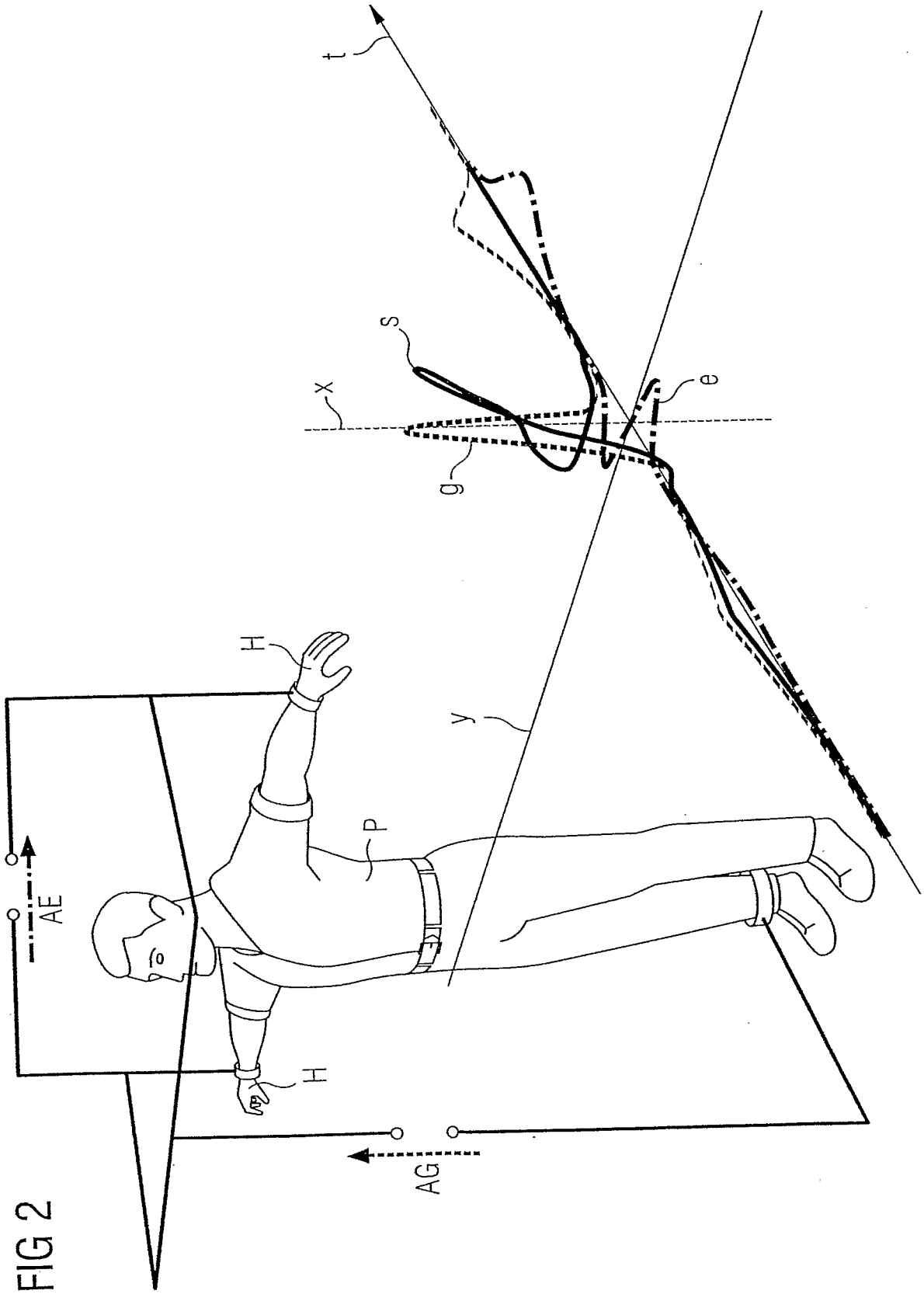

FIG 2

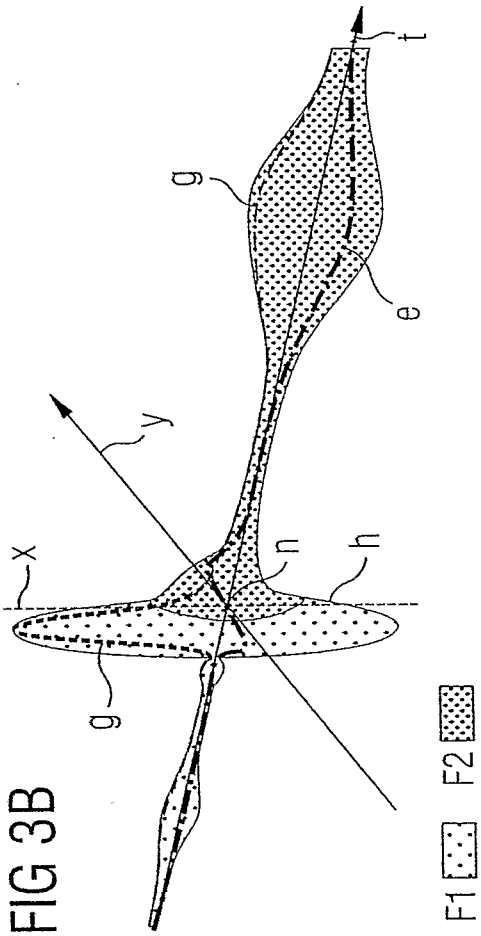

FIG 3B

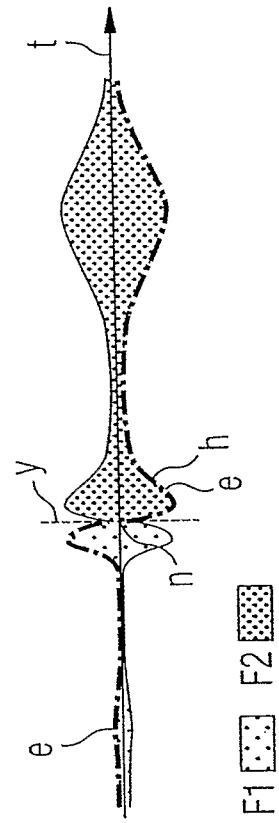

FIG 3D

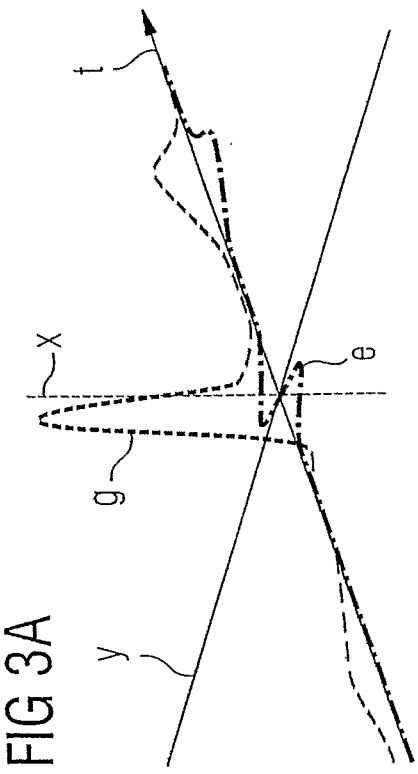

FIG 3A

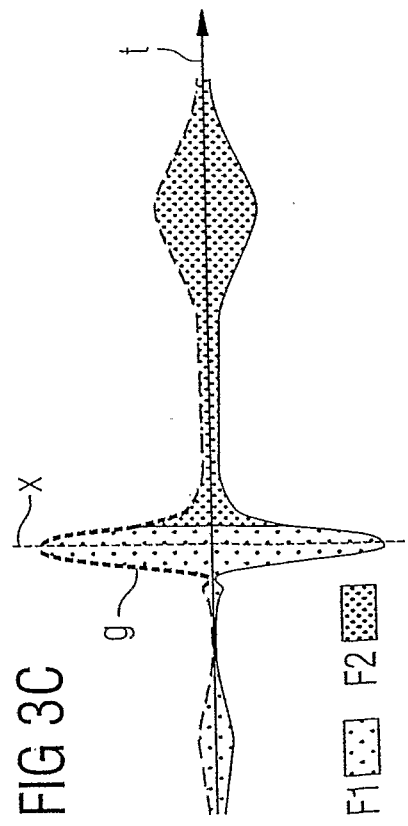

FIG 3C