For example, when looking to design a very sensitive induction coil magnetometer, the conventional approach would be to try to maximise the inductance of the coil. The Brooks coil (which is defined, for example, in: Grover, F.W.; Inductance calculations, working formulas and tables; 1946: D. Van Nostrand) is a well-known design of induction coil that maximises the inductance for a given length of wire. The Brooks coil recognises and teaches that the optimum value of the induction will be obtained with a coil having a square winding cross-section with the sides of the square equal to the radius of the core. Figure 1 illustrates this and shows the configuration of a Brooks coil: a square winding cross-section having a diameter (a side-length) a, with the core radius also being a. However, a coil of this configuration that has the sensitivity needed for magneto-cardiography will then have a diameter that is too large to provide the spatial resolution that is needed for magneto-cardiography.

Thus the literature currently teaches away from using induction coil magnetometers for magnetocardiography, notwithstanding their apparent advantages over SQUID sensors, as it is not believed possible to achieve a sufficiently sensitive induction coil magnetometer whilst still achieving sufficient spatial resolution to be medically useful.

The Applicants believe therefore that there remains scope for improvements to the design and use of magnetometers for medical use, and in particular for cardio-magnetic imaging. In particular, a compact, portable and relatively inexpensive device that can image magnetic fields of the human body, such as the magnetic field of the heart, would provide a number of significant advantages over existing medical and cardiomagnetometer designs.

According to a first aspect of the present ~~invention~~ disclosure there is provided a magnetometer system for medical use, comprising:

one or more induction coils for detecting a time varying magnetic field, each coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less; and

a detection circuit coupled to each coil and configured to convert a current or voltage generated in the coil by a time varying magnetic field to an output signal for use to analyse the time varying magnetic field.

According to a second aspect of the present disclosure, there is provided a cardiac magnetometer system for analysing the magnetic field of a subject's heart, comprising the magnetometer system as defined above.

According to a ~~second~~ third aspect of the present ~~invention~~ disclosure there is provided a method of analysing the magnetic field of a region of a subject's body, the method comprising:

using one or more induction coils to detect the time varying magnetic field of a region of a subject's body, each coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less;

using a detection circuit or circuits coupled to the coil or coils to ~~converting~~ convert a current or voltage generated in each coil by the time varying magnetic field of the region of ~~a~~ the subject's body to ~~an~~ a respective output signal for the coil; and

using the output signal or signals from the coil or coils to analyse the magnetic field generated by the region of ~~a~~ the subject's body.

According to a ~~third~~ fourth aspect of the present ~~invention~~disclosure, there is provided a coil for use to detect the time-varying magnetic field of a region of a subject's body, the coil comprising:

an induction coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less.

The present ~~invention~~ disclosure provides a method and apparatus for detecting and analysing magnetic fields that are medically useful, such as the magnetic field of a region of a subject's body (for example of a subject's heart). However, in contrast to existing medical (e.g. cardiac) magnetometer designs, the present ~~invention~~ disclosure uses an induction coil or coils (i.e. a coil that is joined to an amplifier at both ends) of a specific configuration to detect the magnetic field of the subject (e.g. of the subject's heart). As will be discussed further below, the Applicants have found that induction coils having the particular configuration of the present ~~invention~~ disclosure can be used to provide a medical magnetometer that can be portable, relatively inexpensive, usable at room temperature and without the need for magnetic shielding, and yet can still provide sufficient sensitivity, accuracy and resolution to be medically useful.

The configuration of the induction coil of the present ~~invention~~ disclosure provides a number of advantages. Firstly, by limiting the outer diameter of the coil to 7 cm or less, a coil having an overall size that can achieve a spatial resolution that is suitable for medical magnetometry (and in particular for magneto-cardiography) is provided.

Setting the ratio of the coil's length to its outer diameter to at least 0.5 effectively means that the coil is relatively long for its width compared to a Brooks coil configuration, for example (for a Brooks coil this ratio is 0.25). Similarly, setting the ratio of the coil's inner diameter to its outer diameter to 0.5 or less effectively increases the number of windings for a given outer diameter compared to a Brooks coil configuration, for example (for a Brooks coil this ratio is 0.5).

The combination of these two requirements for the induction coil's configuration has firstly been found by the Applicants to make the coil of the present ~~invention~~ disclosure relatively more sensitive to magnetic field components along the axis of the coil. This provides two benefits. Firstly, it results in a higher output voltage from the coil for a given axial magnetic component. Secondly, it helps the spatial resolution of the coil as the coil is relatively more sensitive to components extending vertically through the centre of the coil when it is placed over a subject's body (e.g. over a subject's chest), and thus can provide a directional pick-up. Furthermore, the Applicants have recognised that it is the vertical components of the magnetic field generated by a region of a subject's body (e.g. by a subject's heart) that it is of particular interest to detect.

Thus the coil configuration of the present ~~invention~~ disclosure can provide an increase in the output voltage generated by the coil for the magnetic field components of interest. Moreover, the Applicants have found that this can be achieved without adversely affecting (and indeed even with reducing) the signal to noise ratio.

Indeed, the Applicants have found that the coil design of the present ~~invention~~ disclosure can provide a factor of 3 increase in the output voltage for a given axial magnetic component compared to a Brooks coil having the same outer diameter and a reduction of a factor of 2 in the signal to noise ratio.

Although these gains on their face may seem relatively small, the Applicants have recognised that they can have a significant effect on the useability (or otherwise) of the coil for medical magnetometry, e.g. for magnetocardiography. For example, reducing the signal to noise ratio by a factor of two, reduces the data collection time needed for a given analysis by a factor of four (e.g. from 2 hours to 30 minutes). Similarly, increasing the output voltage of the coil by a factor of 3 can reduce the data collection time needed by a factor of 9 for the same signal output (this is because digitising errors grow with smaller signals when the signal size is within an order of magnitude of the digitization step). Thus the overall impact of the gains provided by the coil configuration used in the present ~~invention~~ disclosure can be a

factor of 36 in the data collection (scan) time. This can make all the difference between having a medically useful (and useable) magnetometer or not.

Accordingly the Applicants have found that the coil design of the present ~~invention~~ disclosure can provide an induction coil magnetometer that can perform sufficiently well for medical magnetometry, such as magnetocardiography, but without the drawbacks associated with a Brooks coil (or, indeed, SQUID magnetometers).

It should be noted here that the Applicants have achieved this not by following the conventional approach of attempting to optimise the inductance of the coil to optimise the signal detection strength (which would lead to a Brooke's coil configuration) but have instead sought to optimise the output voltage that the coil generates, whilst minimising the signal to noise ratio, whilst remaining within an overall size constraint that is suitable for medical magnetometry such as magnetocardiography. This results in a coil configuration that is a significant departure from a design that delivers the optimum inductance, and yet the Applicants have found that their coil design will provide a medically useful magnetometer, whereas a Brooks coil (i.e. a coil configured to maximise the inductance for a given length of wire) meeting the same overall size constraint will not.

The magnetometer system of the present ~~invention~~ disclosure can be used as a system and probe to detect any desired magnetic field produced by a subject (by the human (or animal) body). It is particularly suited to applications where it is desired to probe and measure relatively small magnetic fields with a spatial resolution of 2-3.5 cm, being half the diameter of the coils. It is preferably used to detect (and analyse) the time-varying magnetic field of (or produced by) a region of the subject's body, such as their bladder, heart, head or brain, womb or a foetus. Thus it may be, and is preferably, used to detect magnetic fields relating to the bladder, pregnancy, the brain, or the heart. In a preferred embodiment, the magnetometer is used for (and configured for) one or more of: magnetocardiography, magnetoencephalography, analysis and detection of bladder conditions (e.g. overactive bladder), analysis and detection of foetal abnormalities, and detection and analysis of pre-term labour.

In a particularly preferred embodiment the magnetometer is used as a cardiac magnetometer and to detect and analyse the magnetic field of a subject's heart.

Thus, according to another ~~aspect~~ embodiment of the present ~~invention~~ disclosure there is provided a cardiac magnetometer system for analysing the magnetic field of a subject's heart, comprising:

one or more induction coils for detecting the time varying magnetic field of a subject's heart, each coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less; and

a detection circuit coupled to each coil and configured to convert a current or voltage generated in the coil by the time varying magnetic field of a subject's heart to an output signal for use to analyse the magnetic field generated by the subject's heart.

According to a fifth aspect of the present disclosure, there is provided a method of analysing the magnetic field of a subject's heart, the method comprising:

using the method as defined above to analyse the time varying magnetic field of a subject's heart.

According to another ~~aspect~~ embodiment of the present ~~invention~~ disclosure there is provided a method of analysing the magnetic field of a subject's heart, the method comprising:

using one or more induction coils to detect the time varying magnetic field of a subject's heart, each coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less;

converting a current or voltage generated in each coil by the time varying magnetic field of the subject's heart to an output signal; and

using the output signal or signals from the coil or coils to analyse the magnetic field generated by the subject's heart.

According to another ~~aspect~~ embodiment of the present ~~invention~~disclosure, there is provided a coil for use to detect the time-varying magnetic field of a subject's heart, the coil comprising:

an induction coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less.

As will be appreciated by those skilled in the art, these ~~aspects~~ embodiments of the present ~~invention~~ disclosure can and preferably do include any one or more or all of the preferred and optional features of the ~~invention~~ disclosure described herein, as appropriate.

The magnetometer system of the present ~~invention~~ disclosure may comprise a single coil. In this case the coil will be moved over the subject (e.g. the subject's chest) to take readings from different positions in use, as is known in the art.

However, in one preferred embodiment, the system comprises plural coils, e.g., and preferably, 7-19, preferably 16-19 coils.

Where the system comprises plural coils, some or all of the coils are preferably arranged in a two-dimensional array. The coil array is preferably configured such that when positioned appropriately over a subject (e.g. a subject's chest) the coil array can take readings from a suitable set of sampling positions without the need to further move the array over the subject. The array can otherwise have any desired configuration, such as being a regular or irregular array, a rectangular or circular array (e.g. formed of concentric circles), etc..

It would also be possible to have a three-dimensional arrangement of coils. In this case, there are preferably plural, e.g. two, layers of coil arrays, one above the other, with each layer arranged as an array as discussed above for the two-dimensional array arrangement.

Each coil preferably has a non-magnetically active core (i.e. the coil windings are wound around a non-magnetically active core), such as being air-cored. This helps to reduce the noise in use. However, magnetically active, such as ferrite or other magnetic material, cores may be used if desired.

Each coil has a maximum outer diameter of 4-7 cm. This facilitates a medically applicable diagnostic using 16 to 19 sampling positions (detection channels) to generate an image. (As discussed above, and as will be appreciated by those skilled in the art, the data for each sampling position can, e.g., be collected either by using an array of coils, or by using one (or several) coils that are moved around the chest to collect the data.) In a preferred embodiment, coils of 7 cm diameter are used.

The or each coil is preferably configured to be sensitive to signals between 1 Hz and 60 Hz, as this is the frequency range of the relevant magnetic signals of the heart. The coils are preferably optimised for sensitivity to signals at around 30 Hz, as 30 Hz is the principle frequency component of a human heart beat.

The or each coil is preferably sensitive to magnetic fields in the range 1-150 pT. The coils do not need to be sensitive in the fT range. The Applicants have found, contrary to the belief in the art that a cardiac magnetometer needs to have sensitivity in the fT range, that in fact pT sensitivity is adequate for cardiac (and other medically useful) magnetic field measurements.

As discussed above, the outer diameter, D, of the coil, the coil's inner diameter, Di, and the coil's length, l, are carefully selected in the present ~~invention~~disclosure.

In a preferred embodiment, the ratio of the coil's inner diameter to its outer diameter, Di:D, is less than 0.5:1. In a particularly preferred embodiment, the ratio

most preferably 1. It should be noted here that such winding densities are contrary to the assumption that lower winding densities would be preferable (as they should lead to a lower noise floor). The Applicants have recognised that reducing the winding density reduces the strength of the signal from the coil and in fact it is more beneficial to maintain a higher signal strength, even at the expense of a higher noise floor.

The detection circuit that a coil is coupled to and that is used to detect the output from the coil should, as discussed above, generate an appropriate output signal for analysis from the voltage and/or current that is induced in the coil by the magnetic field. Any suitable detection circuit and arrangement that can do this can be used. Preferably the detection circuit converts the voltage or current generated in the coil by the magnetic field into a digital signal for post-processing and averaging.

Where the system includes plural coils, each coil preferably has its own, respective and separate, detection circuit (i.e. there will be as many detection circuits as there are coils). The output signals from the detection circuits can then be combined as desired in post-processing.

In a preferred embodiment, each detection circuit operates in either a voltage or current sensing mode (in other words, detects and measures a signal generated between the ends of the coil by a time varying magnetic field), preferably using a low noise amplifier.

Each detection circuit preferably uses (includes) a detection amplifier, preferably in the form of a microphone amplifier (a low impedance amplifier), connected to the ends of the coil.

Preferably the voltages produced by the detection circuit are digitised for post processing, noise reduction and signal recovery. Digitisation of the output voltage as early as possible (practical) in the detection setup is preferred to limit amplifier noise.

In a preferred embodiment, one or more steps are taken to eliminate and/or compensate for any background magnetic field interference that may exist. Any suitable such techniques may be used, although it should be noted here that the present ~~invention~~ disclosure does not require the use of a magnetically shielded environment (and, indeed, the recognition that a shielded environment is not necessary is part of the inventive concept of the present ~~invention~~ disclosure and is an important advantage of the present ~~invention~~disclosure).

In a particularly preferred embodiment, the mains (line) frequency (50 Hz in the UK) is removed from the output signal, preferably by using an appropriate filter, such as and preferably a notch filter, on the output signal. The Applicants have found that using a filter tuned to the line frequency is sufficient to eliminate most noise from the output signal. In a preferred embodiment, a low pass filter with an appropriate cut-off frequency (e.g. 40 Hz, where the line frequency is 50 Hz) is used additionally to (try to) remove any remaining high frequency noise.

The Applicants have found that, particularly if the line frequency noise is removed, suitable output signals can be obtained without, e.g. the need for magnetic shielding or closely match gradiometer coils.

Thus, in a particularly preferred embodiment, the method of the present ~~invention~~ disclosure further comprises removing the mains (line) frequency from the output voltage, preferably by applying an appropriate filter, preferably a notch filter, to the output signal. Most preferably the output signal for analysis is also low-pass filtered to try to remove any remaining high frequency noise.

Similarly, the or each detection circuit of the magnetometer system of the present ~~invention~~ disclosure preferably further comprises an appropriate filter, such as and preferably a notch filter, set to the mains (line) frequency that acts on the output signal from the coil, most preferably together with a further low pass filter that acts on the output signal of the mains (line) frequency filter.

In a preferred embodiment, the (or each) detection circuit comprises a low impedance amplifier connected to the ends of the coil, which amplifier is then connected to a low pass filter, e.g. with a frequency cut-off of 250 Hz, a notch filter to remove line noise (e.g. 50 Hz), and, optionally, to an averaging element (which could be triggered in the cardiomagnetometry case, e.g., by a biological signal that is correlated to the heartbeat, e.g. via Pulse-Ox or an ECG). The detection circuit may be coupled to an appropriate signal analysis unit for analysing and signal processing the output signal produced by the detection circuit.

In a preferred embodiment, the coil and detection circuit are arranged such that the coil and amplifier (that is coupled to the coil) of the detection circuit are arranged together in a sensor head or probe which is then joined by a wire to the remaining components of the detection circuit to allow the sensor head (probe) to be spaced from the remainder of the detection circuit in use.

Other or further techniques to try to eliminate or compensate for the effects of background noise can be used if desired. One preferred suitable such technique

is background field subtraction using a background field-only pick up coil (i.e. a coil that is not sensitive to the local field of the subject), preferably in conjunction with appropriate coil matching (active or passive). The background field-only pick up coil(s) should be, and preferably are, configured the same as the coil(s) that are being used to detect the "wanted" signal (the signal of interest) and coupled to corresponding detection circuits.

Thus in a preferred embodiment, the apparatus and method of the present ~~invention~~ disclosure uses background noise pickup subtraction, preferably with coil matching, to try to account for (and compensate for) the presence of background magnetic fields.

In this case, where the system uses plural coils, one or more of the coils could be used as background-pickup coils (i.e. to detect the background magnetic field, rather than the subject's heart's magnetic field). In this case, where there is an array of coils, one or more of the outer coils (e.g.) could be used to detect the background magnetic field, and/or if two or more layers of coil arrays are provided, one of the layers (or certain coils in one of the layers) could be used to detect the background magnetic field. Thus in a preferred embodiment, the system comprises an array of plural coils, and one or more of the coils are used to detect the background magnetic field, with the remaining coils being used to detect the magnetic field of interest (e.g. the subject's heart's magnetic field).

In one preferred embodiment, coil output signal matching is achieved by using two coils and adding a global field to both coils and then using lock-in amplification of the difference signal and feedback to an amplifier which controls the gain of one of the coils. This facilitates precision matching of the coils without the need for precision manufacturing of the coils (which can be very difficult and expensive). The frequency of the global modulation field is preferably significantly higher than the frequency that is needed for medical detection (10-60 Hz), so as to move the frequency for lock-in detection well above the frequency that is needed for medical detection. In a preferred embodiment the global modulation field has a frequency of at least 1 kHz.

A further advantage of using such a global modulation field coil matching technique is that it can then be used to subtract all global interfering (noise) fields, not just the mains (line) noise.

It should be noted that the Applicants have found that heart beat scale sensitivity can be achieved with the present ~~invention~~ disclosure without using gradient or

background noise subtraction (or any equivalent process to compensate for background noise), although using gradient or background noise subtraction (or an equivalent process) will allow a useful signal to be produced more quickly.

The output signal(s) from the magnetometer (from each detection circuit) can be processed in any suitable and desired fashion. Preferably, the signal(s) are subjected to appropriate signal processing, for example to generate false colour images of the magnetic field.

In a particularly preferred embodiment, the signal over a number of heart beats is averaged to provide the output signal that will be used for any subsequent analysis and diagnosis. (The Applicants have found that sensitivity to a single heart beat is not necessary, as although the heart rate fluctuates a great deal over a short period of time, the actual shape of each pulse is very similar.)

Preferably a high data collection speed is maintained, and signal post-processing is used to generate the required signal, rather than using solutions such as slowing the response time of the detection circuit(s) to produce a valid signal.

In a particular preferred embodiment, the analogue signal from each induction coil is digitised, and sorted into appropriate digital signal bins (and preferably then averaged over a number of heart beats).

An ECG or Pulse-Ox trigger from the test subject may be used as a detection trigger for the signal acquisition process, but this is not absolutely necessary.

The system and method of the present ~~invention~~ disclosure can be used as desired to analyse the magnetic field, e.g. of the subject's heart. Preferably, suitable measurements are taken to allow an appropriate magnetic scan image of the heart (or other body region of interest) to be generated, which image can then, e.g., be compared to reference images for diagnosis. The present ~~invention~~ disclosure can be used to carry out any known and suitable procedure for imaging the magnetic field of the heart.

Preferably 16 to 19 sampling positions (detection channels) are detected in order to generate the desired scan image.

The present ~~invention~~ disclosure accordingly extends to the use of the magnetometer system of the present ~~invention~~ disclosure for analysing, and preferably for imaging, the magnetic field generated by a subject's heart (or other body region), and to a method of analysing, and preferably of imaging, the magnetic field generated by a

subject's heart (or other body region) comprising using the method or system of the present ~~invention~~ disclosure to analyse, and preferably to image, the magnetic field generated by a subject's heart (or other region of the body). The analysis, and preferably the generated image, is preferably used for diagnosis of (to diagnose) a medical condition, such as abnormality of the heart, etc..

Thus according to another ~~aspect~~ embodiment of the present ~~invention~~ disclosure, there is provided a method of diagnosing a medical condition, comprising

using one or more induction coils to detect the time varying magnetic field of a region of a subject's body, each coil having a maximum outer diameter of 4 to 7 cm, and a configuration such that the ratio of the coil's length to its outer diameter is at least 0.5, and the ratio of the coil's inner diameter to its outer diameter is 0.5 or less;

using a detection circuit or circuits coupled to the coil or coils to convert a current or voltage generated in each coil by the time varying magnetic field of the region of the subject's body to a respective output signal for the coil;

using the output signal or signals from the coil or coils to analyse the magnetic field generated by the region of the subject's body; and

using the analysis of the magnetic field generated by the region of the subject's body to diagnose said medical condition.

In this ~~aspect~~ embodiment of the present ~~invention~~ disclosure, the output signal or signals from the coil or coils are preferably used to produce an image representative of the magnetic field generated by the region of the subject's body, and the method preferably then comprises comparing the image obtained with a reference image or images to diagnose the medical condition. The medical condition is, as discussed above, preferably one of: abnormality of the heart, a bladder condition, pre-term labour, foetal abnormalities or abnormality of the head or brain.

As will be appreciated by those skilled in the art, these aspects and embodiments of the present ~~invention~~ disclosure can and preferably do include any one or more or all of the preferred and optional features of the ~~invention~~ disclosure described herein, as appropriate.

As will be appreciated from the above, a particular advantage of the present ~~invention~~ disclosure is that it can be used in the normal hospital or surgery or other environment, without the need for magnetic shielding. Thus, in a particularly preferred embodiment, the methods of the present ~~invention~~ disclosure comprise using the magnetometer system to detect the magnetic field of a subject's heart (or other

body region) in a non-magnetically shielded environment (and without the use of magnetic shielding).

As will be appreciated by those skilled in the art, all of the aspects and embodiments of the ~~invention~~ disclosure described herein can and preferably do include any one or more or all of the preferred and optional features of the present ~~invention~~ disclosure, as appropriate.

The methods in accordance with the present ~~invention~~ disclosure may be implemented at least partially using software e.g. computer programs. It will thus be seen that when viewed from further aspects the present ~~invention~~ disclosure provides computer software specifically adapted to carry out the methods herein described when installed on data processing means, a computer program element comprising computer software code portions for performing the methods herein described when the program element is run on data processing means, and a computer program comprising code means adapted to perform all the steps of a method or of the methods herein described when the program is run on a data processing system. The data processing system may be a microprocessor, a programmable FPGA (Field Programmable Gate Array), etc..

The ~~invention~~ disclosure also extends to a computer software carrier comprising such software which when used to operate a magnetometer system comprising data processing means causes in conjunction with said data processing means said system to carry out the steps of the methods of the present ~~invention~~ disclosure. Such a computer software carrier could be a physical storage medium such as a ROM chip, CD ROM or disk, or could be a signal such as an electronic signal over wires, an optical signal or a radio signal such as to a satellite or the like.

It will further be appreciated that not all steps of the methods of the ~~invention~~ disclosure need be carried out by computer software and thus from a further broad aspect the present ~~invention~~ disclosure provides computer software and such software installed on a computer software carrier for carrying out at least one of the steps of the methods set out herein.

The present ~~invention~~ disclosure may accordingly suitably be embodied as a computer program product for use with a computer system. Such an implementation may comprise a series of computer readable instructions either fixed on a tangible medium, such as a non-transitory computer readable medium, for example, diskette, CD ROM, ROM, or hard disk. It could also comprise a series of computer readable instructions transmittable to a computer system, via a modem or other

14. The method of any one of claims 11 to 13, comprising:

using an array of plural induction coils to detect the time varying magnetic field of a region of a subject's body; and further comprising:

using one or more of the coils of the array to detect the background magnetic field, and using the remaining coils of the array to detect the magnetic field of interest.

15. The method of any one of claims 11 to 14, further comprising removing line frequency noise from the output signal for each coil before providing the output signal for analysis.

16. The method of any one of claims 11 to 15, wherein the region of the subject's body whose magnetic field is being analysed comprises one of: the bladder, heart, head, brain, womb or a foetus.

17. A method of analysing the magnetic field of a subject's heart, the method comprising:

using the method of any one of claims 11 to 16 to analyse the time varying magnetic field of a subject's heart.

18. The use of the magnetometer system of any one of claims 1 to 10 for analysing the magnetic field generated by a region of a subject's body.

~~19. A magnetometer system substantially as herein described with reference to any one of the accompanying drawings.~~

~~20. A coil for use to detect the time-varying magnetic field of a region of a subject's body substantially as herein described with reference to any one of the accompanying drawings.~~

~~21. A method of analysing the magnetic field of a region of a subject's body substantially as herein described with reference to any one of the accompanying drawings.~~