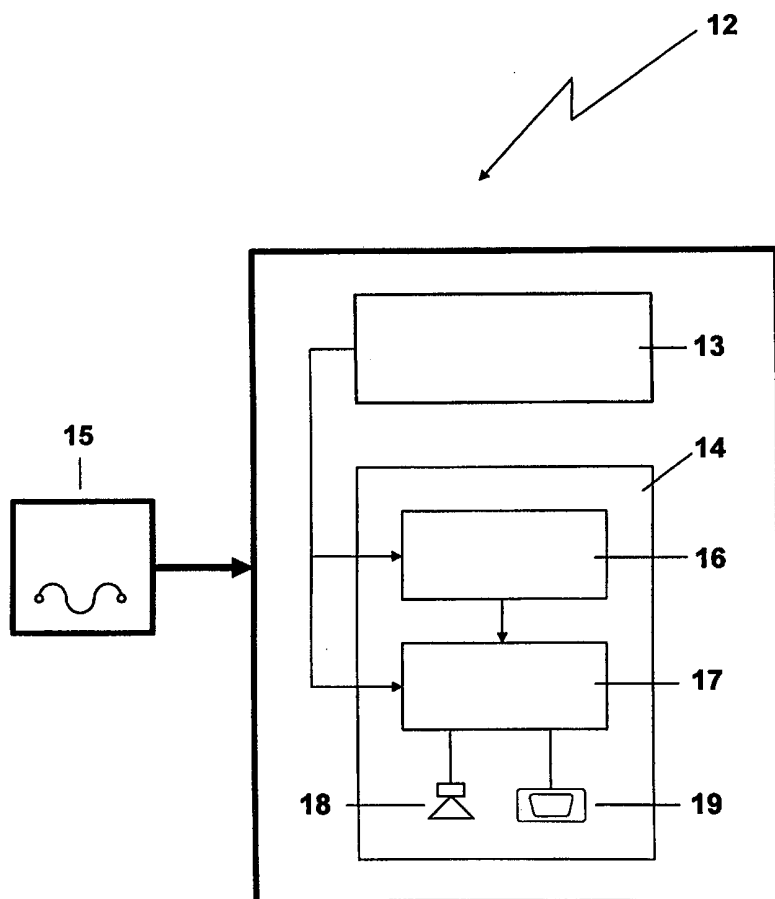


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(54) Title: REMOTE MONITORING APPARATUS FOR MEDICAL CONDITIONS**(57) Abstract**

A physiological monitoring apparatus comprising a cellular phone handset connected to a cellular phone network is disclosed. The handset includes a removable battery container (12) having a physiological monitoring device (14) contained therein as well as a battery power source (13). The battery power source (13) provides power for the operation of the handset (11) as well as providing power for the physiological monitoring device (14). The battery container (12) has detectors (15) located on its outer surface, communicating with the physiological monitoring device (14) through apertures in the battery container (12). Acoustic coupling means (18) are adapted to couple tones produced by the physiological monitoring device (14) with a sound microphone of the cellular phone handset. The physiological monitoring device (14) is activated by placing it against the chest of a patient and the cellular phone handset is used to connect to a remote monitoring station via the cellular phone network. The cellular phone handset sends an electromagnetic signal corresponding to the acoustically coupled tonal signal produced by the physiological monitoring device (14).



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REMOTE MONITORING APPARATUS FOR MEDICAL CONDITIONS

The present invention relates to the field of monitoring physiological parameters and, in particular, a cardiac patient's electrical cardiac activity at a central location by means of an apparatus associated with a cellular mobile phone handset and transmitting the information
5 over the cellular phone/ telephone network. The present invention can also be used to measure and control other physiological parameters such as in blood pressure monitoring, asthma control, pregnancy monitoring, oxygen saturation monitoring, diabetes measurement, heart sound monitoring and other like measurements.

BACKGROUND TO THE INVENTION

10 Although the following description refers generally to remote cardiac monitoring equipment, the equipment can also find utility in any situation in monitoring of other physiological parameters or any other possible use. Therefore, reference to cardiac monitoring is also meant to encompass any monitoring of other physiological parameters where, by suitable modification if necessary, the invention can also be utilised.

15 Throughout the world, cardiac disease, including heart attack and angina, is the leading cause of death. It is responsible for more deaths than any other diseases.

It is estimated that 2-4% of the general population suffer from heart disease and 10-12% of the general population are considered to have two or more heart disease risk factors which would ideally require periodic diagnostics or preventive medical treatments.

20 The activity of the heart is regulated by electrical impulses which can be measured and presented for diagnostic or preventive purposes, in the form of an electrocardiogram (ECG).

To acquire an ECG, electrodes are physically attached to a designated position on the patient's chest to pick up electrical impulses. Traditionally ECG diagnostic tests were carried out in hospitals or clinics where the patient would be attached to an ECG recorder.

25 Most people experience some form of arrhythmia (abnormal rhythm disturbance of the heart). Rarer forms of arrhythmia, such as ventricular fibrillation, often result in the heart

stopping and death. According to cardiologists, just under 20% of all people who experience some form of heart attack will die in the first hour due to the severity of the attack.

The most striking fact about survival after heart attacks is the predominance of deaths
5 within the first 24 hours after the attack begins and the significant proportion of these deaths which are within the first few hours. In fact, 60% or more of heart attack deaths occur before the victims reach a hospital. Once victims arrive at hospitals and survive the first day, overall chances of survival are much improved.

Denial time is the time interval between symptom onset and a request for medical care.
10 This so-called denial time contributes greatly to the 3 hour average time lapse between symptom onset and medical intervention. This 3 hour interval is of major significance. It is estimated that each year about 25% of all myocardial infarct patients die before reaching a hospital and that 66% of all sudden deaths occur outside the hospital in the first 2-3 hours after onset of symptoms.

15 Early therapy, ie within 3 hours of the onset of symptoms, for heart attack victims using anti-clotting agents has shown to significantly increase patient survival rates.

With the development of advanced microprocessors, computing and data transmission technologies, the remote transmission and acquisition of ECG is possible presenting new possibilities in home care, preventive diagnosis and emergency systems.

20 Existing systems for the remote monitoring of a patient's electrical cardiac activity use known ECG equipment which generate tone signals or the like to be sent via a telephone network to a central location which is used to record and monitor the tone signals. The tone signals are generally acoustically coupled to the telephone handset which transduces the tone signals into electrical signals to be sent over the telephone network.

25 Existing ECG equipment uses electrodes and wires to provide the electrical signals produced when detected from the patient's cardiac activity. These electrical signals travel

over the wires to a transducer device which produces tone signals which are then acoustically coupled to the telephone network.

The use of these existing systems is awkward and relatively user unfriendly as the patient is not always in a position or situation where its use is satisfactory or convenient such as when
5 the patient is in public places. The use of the existing ECG equipment including the electrodes and wires also introduces the possibility of errors in the readings due to noise pickup from the wires and electrodes.

It would be advantageous to provide a monitoring apparatus which includes the ECG equipment and telephone handset in the one device so that the apparatus is simple and
10 convenient to use by the cardiac patient in all circumstances as well as dispensing with the need to have the electrodes connected to the equipment by leads or wires which can introduce errors in the readings. It would also be advantageous to have the mobile telephone handset device connected to a cellular mobile telephone network so that the apparatus can be used at public locations which are not accessible by the normal telephone
15 network.

It would also be advantageous for the mobile cellular phone handset to be used in its normal way as a means for verbal or other communication over the cellular phone network when it is not being used for the remote monitoring of the cardiac activity of the patient.

It would also be advantageous for a monitoring apparatus which includes the other forms of
20 physiological measurement and telephone handset in the one device so that the apparatus is simple and convenient to use by the patient in all circumstances as well as dispensing with the need to have the electrodes or other such detectors connected to the equipment by leads or wires which can introduce errors in the readings.

OBJECT OF THE INVENTION

25 It is an object of the present invention to provide a physiological monitoring apparatus which substantially overcomes or ameliorates the above mentioned disadvantages. At the

very least, the object of the invention is to provide an alternative to known physiological monitoring apparatus.

DISCLOSURE OF THE INVENTION

According to one aspect of the present invention there is disclosed a physiological
5 monitoring apparatus comprising a cellular phone handset connected to a cellular phone
network, said handset including a removable modified battery power source pack container
having a physiological monitoring means contained therein as well as a battery power
source means, said battery power source means providing power for the operation of the
handset as well as providing power for the physiological monitoring means, said modified
10 battery power source pack container having located on its outer surface detector means are
in communication with the physiological monitoring means through apertures in the
modified battery power source pack container whereby the detector means are attached to
the modified battery power source pack container, acoustic coupling means adapted to
couple tones produced by said physiological monitoring means with a sound microphone of
15 the cellular phone handset wherein said physiological monitoring means is activated by
placing it against the chest of a patient and said cellular phone handset is used to connect to
a remote monitoring station via the cellular phone network, said cellular phone handset
sending an electromagnetic signal corresponding to the acoustically coupled tonal signal
produced by the physiological monitoring means.

20 Preferably, the physiological monitoring means monitors cardiac activity by means of an
electrocardiogram ECG apparatus. The present invention can also be used to measure and
control other physiological parameters such as in blood pressure monitoring, asthma and
respiratory function control, pregnancy and foetal condition monitoring, oxygen saturation
monitoring, diabetes and blood chemistry measurement, heart sound monitoring and other
25 like measurements.

In one preferred form of the invention, the cellular phone connection between the handset
and the network is activated by the production of the tonal signal by the ECG monitoring
means.

In a preferred form of the invention, the physiological monitoring means monitors signals received from a device implanted in the patient, such as a pacemaker or the like, such that the signals indicate correct functioning thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The present invention will be now be described with reference to the accompanying drawing in which:

Fig. 1 is a rear perspective view of a cellular phone handset incorporating the apparatus according to the preferred embodiment of the present invention; and

Fig. 2 is a block diagram of the apparatus according to the preferred embodiment of the
10 present invention.

BEST MODE OF CARRYING OUT THE INVENTION

A cellular phone handset 10 incorporating the apparatus of the preferred embodiment is illustrated in the drawings and as seen from the rear has a casing 11 including a removable modified battery power pack container 12 removably attached thereto.

15 The battery pack container 12 has contained therein a battery power source 13 together with a bio-aquisition unit 14 which is preferably an ECG monitoring device which formulates the results of electrical cardiac activity detected by a bio sensor 15 which are preferably electrodes which are fixedly attached to the container 12. The bio-aquisition unit 14 includes a bio-amplifier 16 connected to a acquisition controller 17 having a speaker output
20 18 and a connector interface 19 which is preferably a RS 232 connector. The electrodes 15 connect to the ECG monitoring device 14 via apertures in the container 12. In this embodiment three electrodes 15 are shown, however any number of electrodes can be used according to the specific requirements of the testing of the patient eg cardiac activity etc.

The battery power source 13 is used to power the operation of the ECG monitoring device 14 as well as the operation of the cellular phone handset 10 for its regular use and is able to be charged in the normal way.

The ECG monitoring device 14 produces tone signals corresponding to the signals detected
5 by the electrodes 15 and is acoustically coupled via the speaker output 18 to the microphone of the cellular phone handset 10 which is able to transmit these tone signals over a cellular phone network to a central location which collects and collates these signals as data which is then interpreted by medical practitioners.

In one preferred form, the ECG monitoring device 14 and cellular phone handset 10 are
10 activated by the receipt of electrical cardiac signals received from the electrodes 13 when the patient places the electrodes against his or her chest in the appropriate manner. The ECG is recorded and simultaneously transmitted to a service centre for diagnostic evaluation after it is received down the "phone line".

The advantages of the apparatus of the preferred embodiment is that the handset 10 with
15 electrodes 15 "built in" provides a simple and convenient method of detecting and transmitting data corresponding to electrical cardiac activity without the possibility of noise and errors being present as is the case with present methods of existing devices. The patient is able to carry a single device in the form of a cellular phone handset and be able to be connected at any time to the central location for analysis of the data.

20 Naturally the device of the present invention is suitable for the detection of other physiological parameters and use the appropriate detection as required.

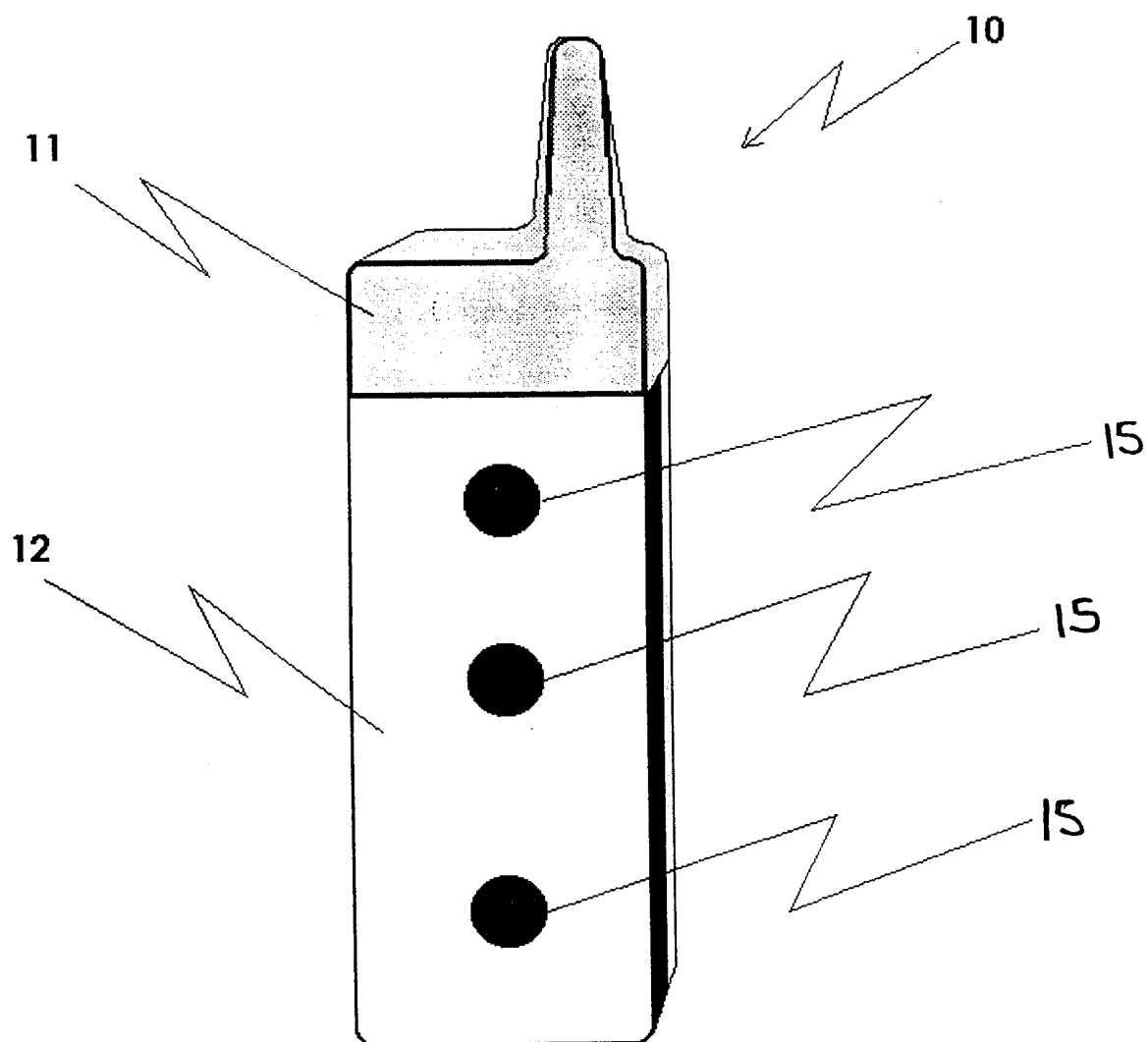
In a preferred form of the invention, the physiological monitoring means monitors signals received from a device implanted in the patient, such as a pacemaker or the like, such that the signals indicate correct functioning thereof.

25 The foregoing describes only one embodiment of the present invention, and modifications obvious to those skilled in the art can be made thereto without departing from the scope of the present invention.

CLAIMS

1. A physiological monitoring apparatus comprising a cellular phone handset connected to a cellular phone network, said handset including a removable modified battery power source pack container having a physiological monitoring means contained therein as well as a battery power source means, said battery power source means providing power for the operation of the handset as well as providing power for the physiological monitoring means, said modified battery power source pack container having located on its outer surface detector means are in communication with the physiological monitoring means through apertures in the modified battery power source pack container whereby the detector means are attached to the modified battery power source pack container, acoustic coupling means adapted to couple tones produced by said physiological monitoring means with a sound microphone of the cellular phone handset wherein said physiological monitoring means is activated by placing it against the chest of a patient and said cellular phone handset is used to connect to a remote monitoring station via the cellular phone network, said cellular phone handset sending an electromagnetic signal corresponding to the acoustically coupled tonal signal produced by the physiological monitoring means.
2. The apparatus as claimed in claim 1, wherein the cellular phone connection between the handset and the network is activated by the production of the tonal signal.
3. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors cardiac activity by means of an electrocardiogram ECG apparatus.
4. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors blood pressure.
5. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors respiratory function.
6. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors pregnancy and foetal condition.

7. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors oxygen saturation.
8. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors blood chemistry measurement.
- 5 9. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors heart sounds.
10. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors electrical impulses from the patient's body.
11. The apparatus as claimed in claim 1, wherein the detector means are at least one
10 electrode fixedly attached to the case.
12. The apparatus as claimed in claim 1, wherein the physiological monitoring means monitors signals received from a device implanted in the patient, such as a pacemaker or the like, such that the signals indicate correct functioning thereof.

*Fig. 1*

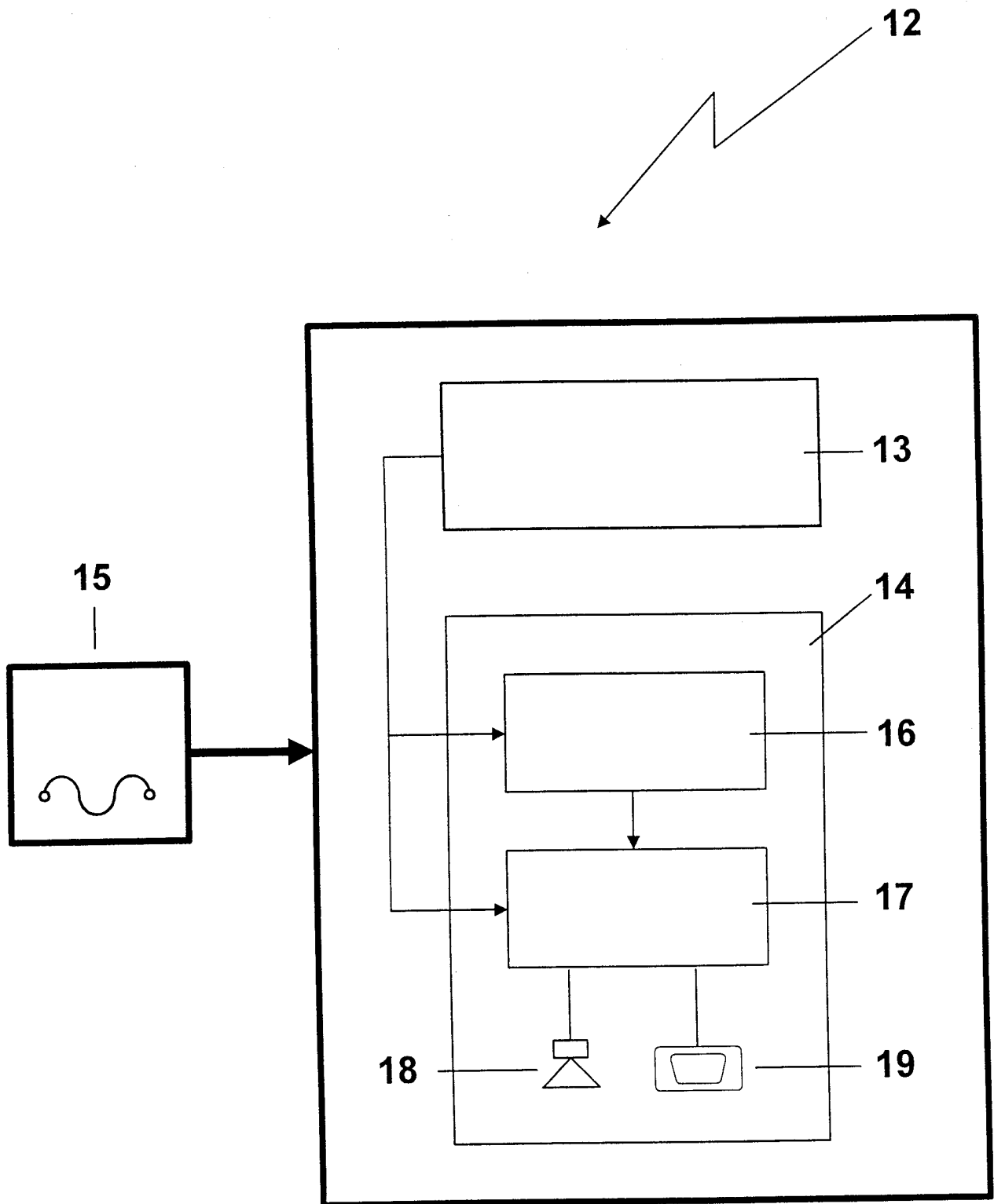


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 98/00591

A. CLASSIFICATION OF SUBJECT MATTER												
Int Cl ⁶ : A61B 5/0404												
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 5/ , A61N, G01N, G12B, H04B, H04Q												
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 practicable, search terms used) DERWENT cardi., heart, physiolog, transmit, send, telephon, phone#												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
P,X	WO 98/38611 A (Erbel et al) 3 September 1998 Claims 5 to 7	1 to 12										
P,X	WO 97/28736 A (Nokia Mobile Phones Ltd) 14 August 1997 Page 3, line 30 to page 4, line 11 and figures	1 to 12										
X	US 5544661 A (DAVIS et al) 13 August 1996 Column 2, line 55 to Column 9, line 6 and figures	1 to 12										
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex												
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Date of the actual completion of the international search 14 October 1998		Date of mailing of the international search report 22 OCT 1998										
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer PETER T. WEST Telephone No.: (02) 6283 2108										

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 98/00591

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5462051 A (Oka et al) 31 October 1995 Column 5, line 14 to Column 9, line 3 and Figures 1-2	1 to 12
X	US 4337377 A (Van Riper et al) 29 June 1982 Whole document	1 to 12

Information on patent family members

PCT/AU 98/00591

Patent Document Cited in Search Report				Patent Family Member			
WO	98/38611	DE	19707681				
WO	97/28736	AU	17266/97	FI	960636	US	5772586

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