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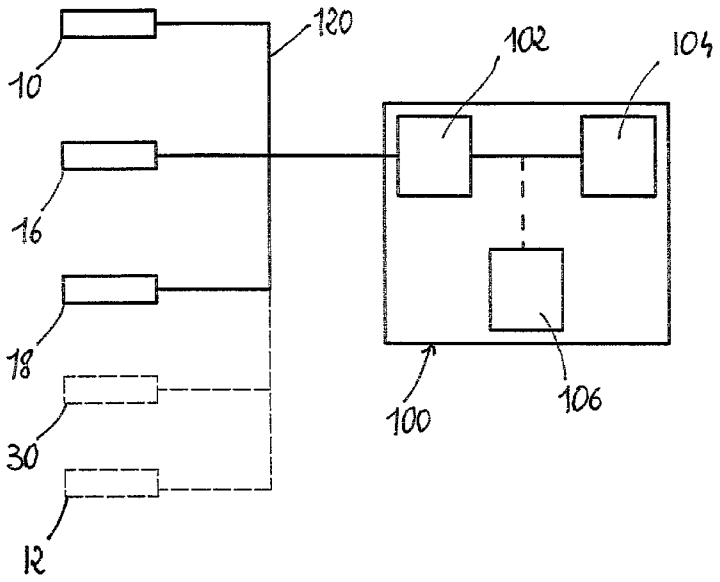
(54) Title: DATA LOGGERS AND THEIR USE IN A GARMENT TO MONITOR PARAMETERS OF THE WEARER



(57) Abstract: The information relating to physical and/or biomedical parameters of a person carrying out, in real conditions, an activity distinguished by high mechanical stresses is detected by sensors (10, 12, 16, 18, 20, 22, 30) which are mounted on, or form part of, a garment worn while carrying out said activity. During all the stages of said activity this information is converted into data in digital format which are stored in an electronic recording device (100) or "data logger". Advantages: the stored data may be used by other persons also far from the location where the activity is being performed and/or at a later time.

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DATA LOGGERS AND THEIR USE IN A GARMENT TO MONITOR PARAMETERS OF THE WEARER

Description

The present invention relates to the use of a so-called "data logger" in order to record data relating to the physical and/or biomedical condition of the persons while actually performing an activity distinguished by high mechanical stresses acting on the body, such as for example a high-speed sport.

Data loggers associated with means for detecting exclusively biomedical parameters of persons while exerting physical effort are known, such as that disclosed in the patent US-A-6,206,837 where the parameter detected consists in the person's respiration. In order to detect the parameter, however, means are used - in the case in question a mask - which are not compatible with actual carrying out of the activity in real conditions. As a result devices of this kind may only be used in laboratories.

It is also known that manufacturers of garments for motor sports are attempting to provide maximum protection for the end users of their products by proposing solutions able to counteract and/or eliminate the stresses to which the body is subject, for example during car or motorcycle races, in the event of accidents, the consequences of which may also be of a serious nature.

In addition to the development of fireproof and highly resistant materials which constitute so-called "passive protection systems", with the aid of electronic technology it has been possible to design so-called "intelligent garments" or "active protection systems". For example, the patent application WO-A-02 19850 describes a garment comprising a motorcyclist's jacket and a waistcoat or “gilet” containing three inflatable bags which form an air cushion or "air-bag" and also containing a rigid protection for the back. The jacket contains acceleration sensors and the data detected by them are sent to a central control unit so as to trigger, in a dangerous event (falling or impact suffered by the pilot), electrically operated valves which connect three gas cylinders to the said inflatable bags which are normally flat and are concealed inside the jacket. It should be noted that the main purpose of this system is to ensure the automatic activation of the protective system

during the dangerous event and that this system does not envisage any recording of the motorcyclist's biomedical data during normal use, i.e. in conditions other than accidents. In the same patent application it is envisaged manufacturing the jacket and the waistcoat using composite textile materials incorporating optical-fibre sensors which convey in real time information in relating to mechanical, physical and thermal parameters to a display which is sewn onto the jacket. This information is for exclusive use of the person wearing the garment and is not recorded. No precise indication is given, however, as to the parameters involved, apart from the relative acceleration of pilot and motorcycle.

The main object of the present invention is to provide, also for other persons situated far away and/or at a later time, an information relating to physical and/or biomedical parameters detected directly during carrying out of the abovementioned demanding activities, i.e. in real conditions, by means of at least one of the garments worn by a person. Said detection is performed not only during a dangerous event (falling, impact, etc), but also for the whole of the time said activities are being performed.

This object, together with others, is achieved using a data logger in accordance with the characteristic features claimed hereinbelow.

The particular features of said use and the advantages arising therefrom will emerge more clearly from the following description provided purely by way of a non-limiting example where the activity in which the person is engaged is a motorcycling competition and the garment worn is a bodysuit. In the description reference will be made to the accompanying drawings in which:

Figure 1 shows a block diagram of a system for recording physical and/or biomedical data relating to a person during motorcycle racing;

Figures 2a and 2b show the position of the various sensors which form part of the system, with respect to the person's body, viewed from the front and rear, respectively.

In a motorcycling competition the pilot assumes various riding positions, depending on a series of variables such as the speed, acceleration, riding posture, the characteristics of the circuit, etc. For each riding position every part of the pilot's body is subject to various forces. These forces are of two types: those which

through the bodysuit transfer the movement to the pilot's body and those exerted on the bodysuit, and therefore on the body itself, by the fluid within which the pilot is moving, in this case air.

According to the invention, the bodysuit comprises (see Figure 1) a data logger 100 housed in a position which is usually protected, such as the aerodynamic "hump" of the bodysuit. Said data logger:

- is connected by means of connections 120 to a plurality of sensors 10, 12, 16, 18, 20, 22, 30 which are variable in number and situated in various parts of the bodysuit,;

- comprises means 102 for acquiring and processing the information supplied by said sensors;

- comprises memory structures 104 for recording the data relating to the parameters detected by said sensors and preferably also for storing permanent data;

- may comprise means 106 for remote transmission of the data.

An arrangement of the system according to Figure 1 is shown in Figures 2a and 2b, but in reality the sensors are incorporated in the bodysuit, even though they may be in direct contact with the body of the person.

Said bodysuit, in the region of the shoulders, knees, elbows and ends of the spinal cord, is provided respectively with sensors 10, 16, 18, 22 for detecting the pressure which is exerted by the bodysuit on the person's body, said pressure being positive or negative depending on the direction of the force from which it is derived. Said sensors, for example, may be chosen from among the models "FlexiForce" manufactured by the firm Tekscan. An alternative solution envisages providing, not a single sensor, but an array of smaller sensors. It is thus possible to increase the surface area to be monitored and at the same time obtain within the data a greater definition for the surface area in question.

Said bodysuit also comprises a temperature sensor 30 which is situated in the centre of the back, in the lumbar region, an accelerometer 12 situated below the neck and two plates 20 for sensing the heart rate. It is obvious that the position, the type and the number of all the sensors may vary depending on the application.

Moreover, also depending on the their constructional characteristics and the type of material from which the bodysuit is made (leather, elasticized fabric,

meshed fabric, etc.), the sensors may be incorporated into the structure of the bodysuit or may be mounted on the surface in physical contact with the body of the person and/or on the opposite (external) surface.

The data logger 100 is arranged of the rigid aerodynamic "hump" (not shown) of the racing bodysuit. Obviously, other locations are possible, such as, for example, mounting the data logger 100 on the motorcycle. When it is arranged on the bodysuit, said data logger 100 is connected to the sensors by means of flexible connections 120 which may or may not be incorporated in said bodysuit. Said connections 120 may be of a varying nature, for example leads made of copper, optical fibres, etc., and are chosen in each case depending on the type of signal produced by the sensor (voltage, current, photons, etc.). The conversion of the information into an electrical signal may therefore be performed by means of various systems of transduction (for example from photons to electrical variables or vice versa) and the associated interfaces may be either directly connected to the sensor output or to the input of the data logger 100.

Owing to the possibility of recording and analysing the pressure exerted on the various parts of the pilot's body, and therefore determining the stresses to which the pilot's body is subjected, many applications of the data logger 100 may be envisaged. For example:

- in the case of a professional racing team it is possible to assess the riding technique of the pilot and therefore correct any defects associated therewith. This results in an improvement in performances of the person and of the driven vehicle, also providing the possibility of planning an effective race strategy adapted to the circuit;

- knowing the stresses it is possible to develop garments which are specifically designed for the individual application. By redefining *ad hoc*, for example, the structure and the position of the protective systems it is possible to provide the pilot with a garment which is optimized for his/her activity, together with the advantages in terms of safety and reliability, resulting therefrom;

- having access to a dynamic recording of the dangerous event as well of its effect on the person's body is of potential interest in the legal sector also; for example, for the purposes of determining civil or criminal responsibility in the case

of an accident and preparing evaluations or settling insurance claims;

- the data relating to a dangerous event (or in any case all the data, including those detected during an activity without accident) may be processed and transmitted to monitoring operators. In this way immediate transmission of the data concerning a dangerous event to specific operators, for example to medical staff, allows assistance to be provided as rapidly and efficiently as possible. Even if the data are not transmitted to a base station, it is obvious that the rescue personnel, once they have reached the person suffering the accident, are able to obtain information about his/her condition precisely because said information is stored and can be extracted in a comprehensible form from the data logger 100.

It is pointed out that the scope of protection of the present patent, as defined by the claims below, also includes other variations and embodiments. In particular, the garment worn for carrying out an activity may also be different from a bodysuit, namely may be not only a jacket or a pair of trousers, but also a helmet or other garment for protecting the head or a garment for protecting a limb, such as a shoe or a glove.

* * *

Claims

1. Use of an electronic device (100) for recording data, comprising:

- detection of information by means of sensors (10, 12, 16, 18, 22, 30);
- conversion of said information into data in digital format;
- transfer of said data to said device;
- storage of said data in the said device,

characterized in that:

- said information relates to physical and/or biomedical parameters of a person carrying out, in real conditions, an activity distinguished by high mechanical stresses on the body of said person;
- the detection of said information takes place during all the stages of execution of said activity;
- said sensors (10, 12, 16, 18, 20, 22, 30) are mounted on, or form part of, a garment worn by the person whilst carrying out said activity.

2. Use of an electronic device (100) for recording data according to Claim 1, characterized in that said sensors are sensors (10, 16, 18, 22) for detecting the pressure exerted by the garment on the person's body and other sensors such as, for example, sensors (30) for detecting the temperature of the garment and/or the temperature of the body, the arterial pressure, the heart rate (20) of the person, and/or moisture sensors.

3. The use of an electronic device (100) for recording data according to Claim 2, characterized in that, when the activity is performed by the person on-board a vehicle, some of said sensors are sensors for detecting the relative acceleration between the person and the vehicle.

4. Use of an electronic device (100) for recording data according to any one of the preceding claims, characterized in that it is mounted on, or forms part of, a garment worn by the person while carrying out said activity.

5. Use of an electronic device (100) for recording data according to Claim 4, characterized in that the connection means (120) which ensure transfer of said data to the said device (100) are also mounted on, or form part of, a garment worn by the person while carrying out said activity.

6. Garment worn by a person for carrying out, in real conditions, an

activity distinguished by high mechanical stresses on the person's body, characterized in that it comprises a plurality of sensors for detecting physical parameters (10, 12, 16, 18, 22) and/or sensors for detecting biomedical parameters (20, 30) which are incorporated in the structure of the said garment.

7. Garment worn by a person for carrying out, in real conditions, an activity distinguished by high mechanical stresses on the person's body, characterized in that it comprises a plurality of sensors for detecting physical parameters (10, 12, 16, 18, 22) and/or sensors for detecting biomedical parameters (20, 30) which are mounted on the surface of the garment which is in physical contact with the body of the person and/or on the opposite surface of the garment.

8. Garment worn by a person for carrying out, in real conditions, an activity which is distinguished by high mechanical stresses on the person's body according to Claim 6 or 7, characterized in that it is provided with a housing, preferably in a position protected against impacts, for an electronic device (100) comprising means (102) for acquiring and processing in digital format information detected by the said sensors (10, 12, 16, 18, 20, 22, 30) and associated memory structures (104) and in that it comprises and/or houses connection means (120) which ensure transfer of said information to the said electronic device (100).

9. Garment worn by a person for carrying out, in real conditions, an activity distinguished by high mechanical stresses on the person's body according to any one of Claims 6 to 8, characterized in that it is a bodysuit or the like for high-speed sport, for example for motorcycle or car racing.

10. Garment worn by a person for carrying out, in real conditions, an activity distinguished by high mechanical stresses on the person's body according to any one of Claims 6 to 8, characterized in that it is of the type for protecting the head of the person, for example a helmet.

11. Garment worn by a person for carrying out, in real conditions, an activity distinguished by high mechanical stresses on the person's body according to any one of Claims 6 to 8, characterized in that it is of the type for protecting the limbs of the person, for example a footwear or glove.

12. Garment worn by a person for carrying out, in real conditions, an activity distinguished by high mechanical stresses on the person's body according

to any one of Claims 8 to 11, characterized in that it is provided with a housing for the means (106) for remote transmission of the data stored in the memory structures (104) of said electronic recording device.

* * *

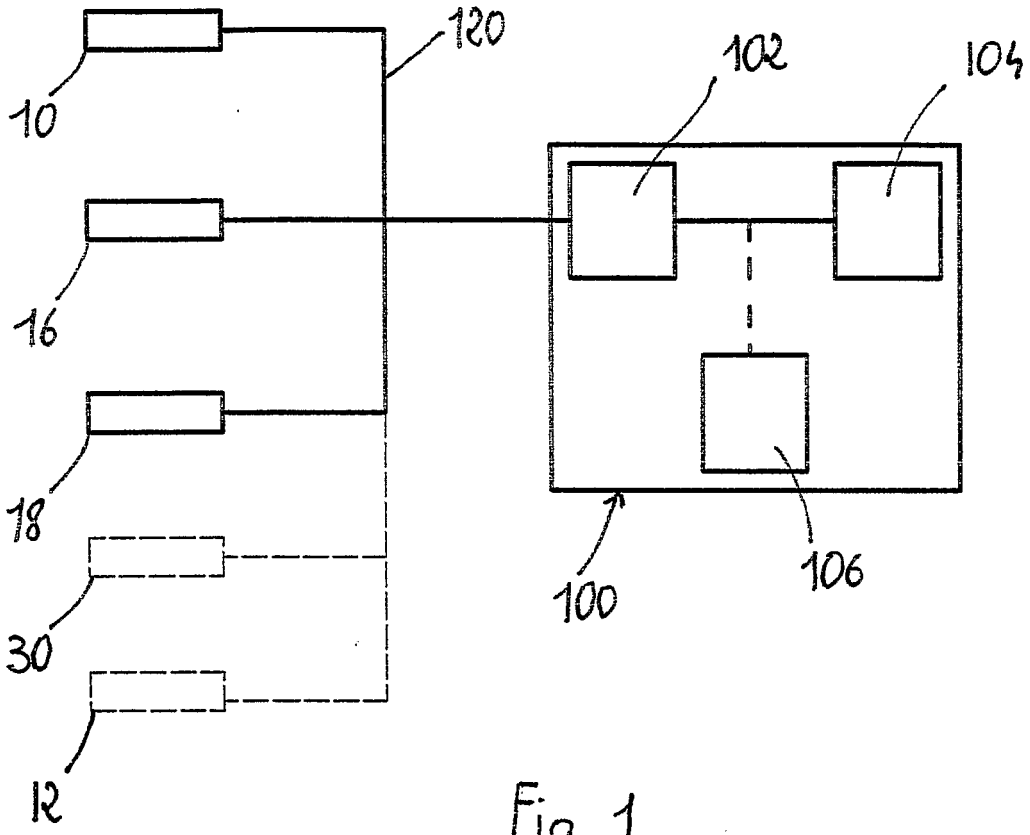

Fig. 1

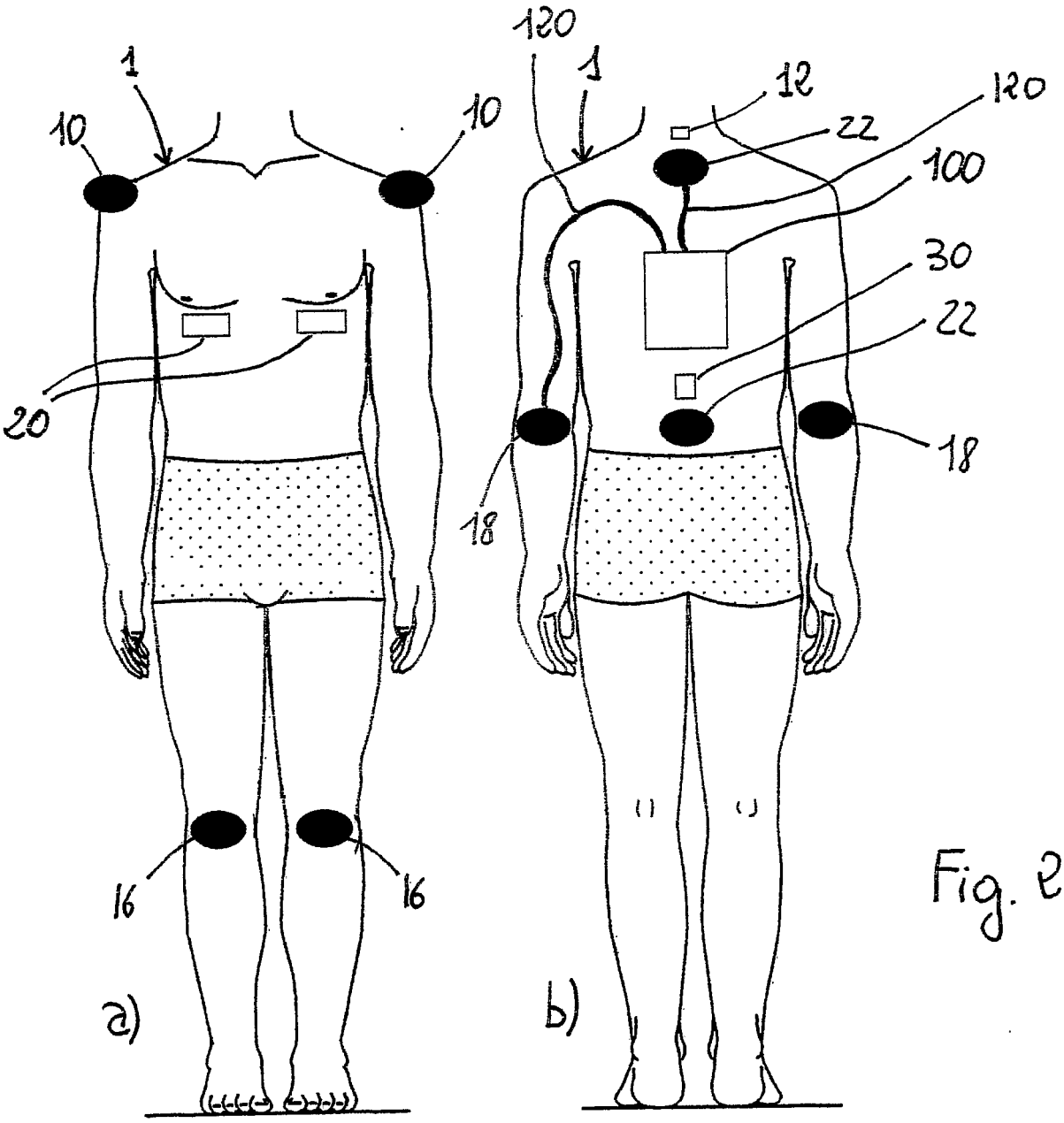

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/006117

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B5/02

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)
IPC 7 A61B A41D

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 02/100200 A (GEORGIA TECH RES INST ; PARK SUNGMEE (US); JAYARAMAN SUNDARESAN (US)) 19 December 2002 (2002-12-19) page 9, line 8 - page 12, line 6 page 16, line 20 - page 17, line 3	1-12
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/006117

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/EP2004/006117

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专利名称(译)	数据记录器及其在服装中的使用以监测佩戴者的参数		
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