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(56) Documents Cited:
WO 2003/061382 A1 **JP 070160362 A**
US 6458331 B1 **US 6278122 B1**

(58) Field of Search:
UK CL (Edition X) **A5G, B6F**
INT CL⁷ **A61B, B41J, G06F**
Other: **Online: EPODOC WPI**

(54) Abstract Title: **Method and apparatus for automatic sterilisation and auditing of computer keyboards and associated peripherals**

(57) An apparatus includes an enclosure (1) having a lid (2) and a tray (3) that is extended by use of a slide mechanism (4). The slide mechanism (4) may be manually operable or motor driven (15, fig.3). A keyboard (5) may be placed on the tray (3) and located inside the enclosure (1) by use of the slidable tray (3). Sterilisation is carried out by use of ultraviolet light from lamps (14, fig.3) and is accelerated by photo catalytic action using a titanium dioxide pigment or coating on the devices being sterilised. The apparatus is controlled by a control unit (8, fig.4) that is connected to a host computer via a bi-directional interface cable (9). The host computer controls the sterilisation process and modifies the control parameters of the control unit (8, fig.4). The control unit (8, fig.4) records details of sterilisation processes and transmits details of the sterilisation processes to the host computer. The host computer then logs the details into an audit trail log.

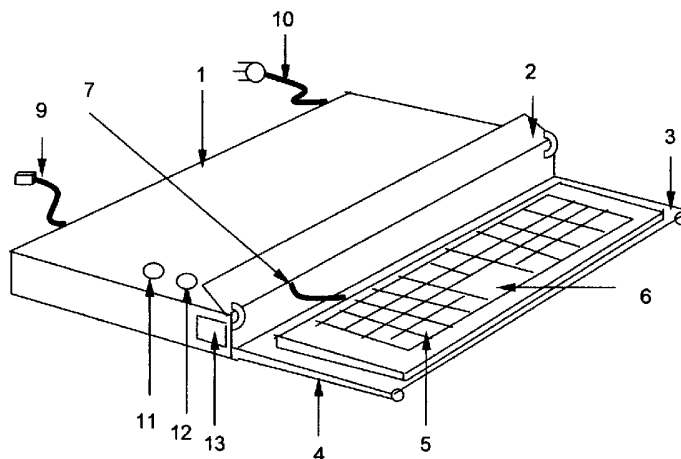


Figure 1

**AUTOMATIC STERILISATION AND AUDITING OF COMPUTER KEYBOARDS
AND ASSOCIATED USER PERIPHERALS, METHOD AND APPARATUS**

DRAWINGS

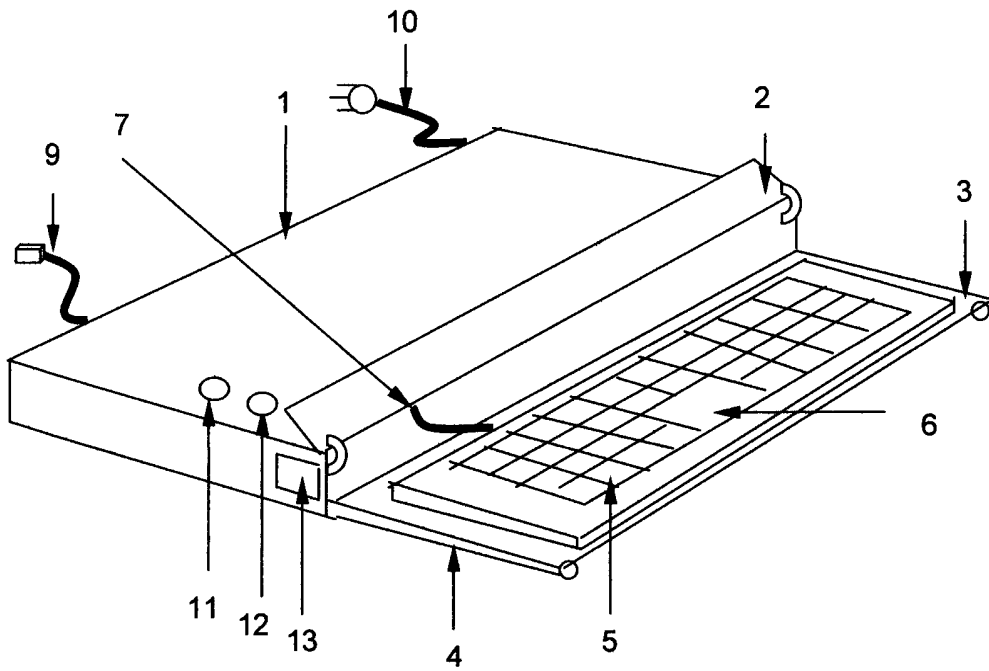


Figure 1

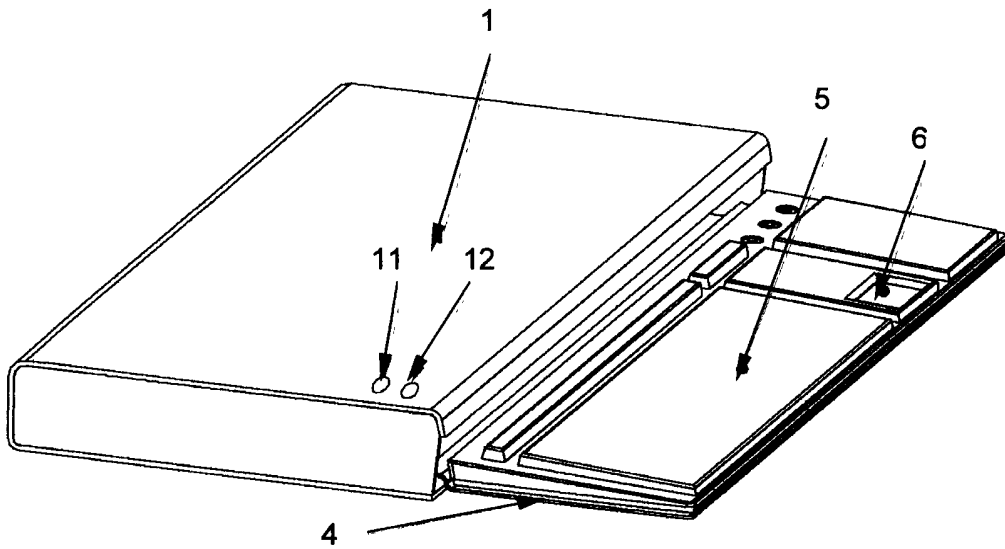


Figure 2

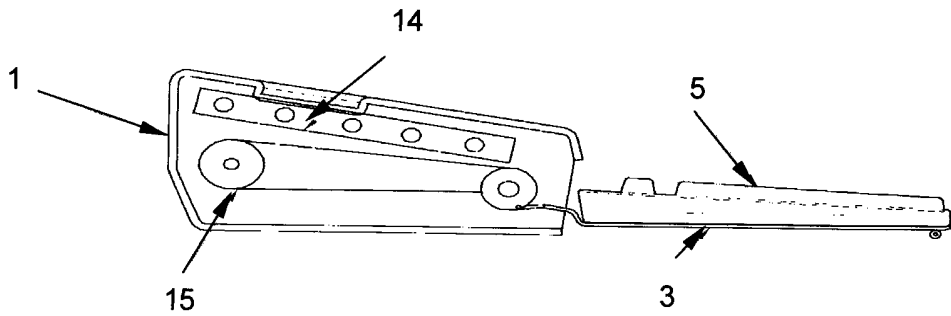


Figure 3

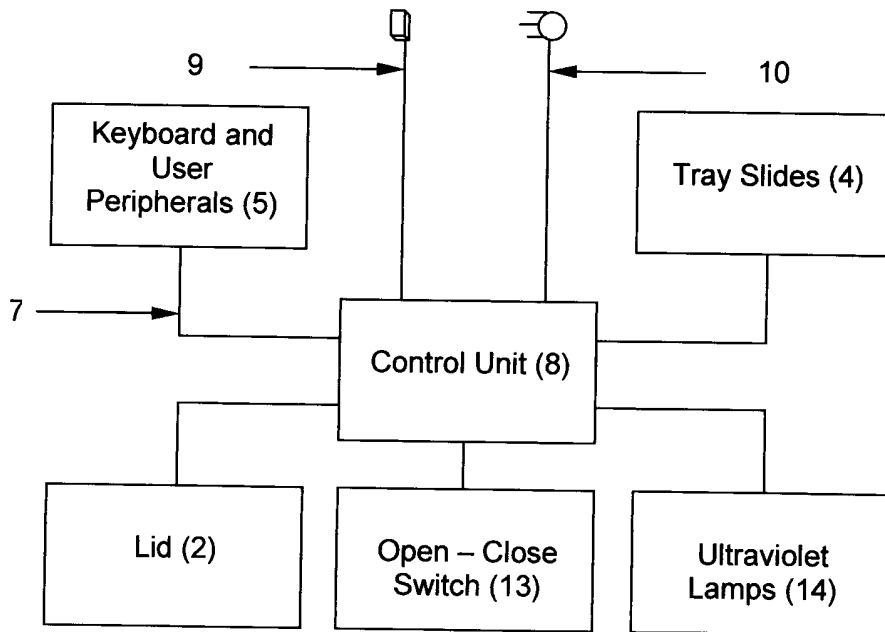


Figure 4

AUTOMATIC STERILISATION AND AUDITING OF COMPUTER KEYBOARDS AND ASSOCIATED USER PERIPHERALS, METHOD AND APPARATUS

FIELD OF THE INVENTION

This invention relates to sterilising computer keyboards and other associated user peripherals in order to minimise cross contamination of bacteria between different users. The invention utilises ultraviolet light as the sterilising agent within a closed container. More particularly, but not exclusively, titanium dioxide on the surfaces being sterilised, is used to accelerate the process. A preferred embodiment of the invention includes automated computer control and recording of the sterilisation process.

BACKGROUND OF THE INVENTION

Computer keyboards generally use the "QWERTY" layout of letters as used and liked on typewriters because typists developed special skills such as touch typing, which, together with the tactile action on pressing each key, permits rapid accurate typing without looking at the keyboard. The problem is that the touched surface of each key becomes grease stained and any grease and debris can smear down the side of each key to even become harboured in the crevices around each key in the keyboard. The computer keyboard has additional keys such as the numeric pad and function keys. Risk of cross contamination is increased when more than one operator uses the same keyboard and mouse etc. While cleaning fluids and alcohol impregnated pads are available to clean the keys and keyboard, the mouse and mouse mat etc., their use is laborious and likely to be occasional rather than regular. An automatic, regular treatment, which can be recorded, is desirable.

Patent WO0041733 (ROBERTS) admits, as already known, that

- (i) several patents relating to toothbrush sterilisers using ultraviolet lamps, such as US4,884,072 (RITTER) describing a toothbrush steriliser with automatic control.
- (ii) US 4,973,847 (LACKEY) discloses a toothbrush sanitation device having ultraviolet light source and removable lid.
- (iii) UV light in the "below 200 to 300 nm wavelength range" known for its germicidal and sterilisation effect. See page 2, line 27.
- (iv) Ultraviolet radiation below 200 nm can produce small quantities of ozone from oxygen in the atmosphere

This patent WO0041733 describes and claims a method for sterilising a computer input device comprising;

- (a) box like structure comprising;
- (b) a UV light source attached to the inside of the box like structure;
- (c) a timer/power circuit for providing a timed application of power connected to the UV light source;

(d) a steriliser switch biased to the "off" position connected to the timer/power circuit;

(e) a power supply connected to the steriliser switch; and generating UV light when the box like structure is placed over the computer input device resting on a surface, thereby actuating the steriliser switch, applying power to the timer/power circuit, thereby applying power to the UV light source, thereby producing UV light, thereby killing bacteria and pathogens that may be present on the computer input device.

Hsing-Chien Cheng (TW) has applied for a US patent under the title "Mouse Seat With Sterilizing And Deodorizing Ability" (US20030071790) which utilises ultraviolet light and titanium dioxide to sterilise only a computer mouse. When exposed to light (e.g. sunlight or ultraviolet light), titanium dioxide acts as a catalyst and accelerates the oxidation process so that any germs, oils, fumes, smells or even little algae spores which land on a surface near the photo catalyst will be burned off in a few minutes.

A problem arises with this manually operated apparatus is that its regularity of use depends on the operator. Apart from the ultraviolet radiation treatment there is no interaction between the device being irradiated and the steriliser.

The UK health industry has reviewed a portable device that uses ultraviolet technology and has reported that it is unlikely to be of benefit. It is suggested here that lack of benefit is not in the use of ultraviolet itself, but rather in any pragmatic way that general purpose apparatus is used and known to have been used. The mechanism to ensure that the apparatus is used in a timely fashion and it's use is recorded for audit purposes is a significant feature of this invention.

Specialised "Medical Keyboards" are marketed but these are expensive. Designs include silicone rubber keypads offering a desirable tactile action but are too difficult to clean and keyboards with flat membrane surface keys, which are easier to clean but provide little or no tactile feedback. Even if an acceptable compromise can be found, the regular application of a germicidal agent cannot be guaranteed and certainly not recorded for audit analysis. The cleaning agents themselves can be a form of pollution.

This invention utilises ultraviolet as the main decontaminant, which is safe when the light is contained; it avoids ozone, which is difficult to contain and a contaminant and uses photo catalysation, which is safe.

The invention allows the use of well proven low cost standard keyboard and associated peripherals, e.g. pointing devices, with the preferred design including titanium dioxide pigment or coating. It provides sterilisation under computer program control, adaptable to the particular environment and facilitates the continuous monitoring of sterilisation in order to enable analysis of sterilising activity over time so that any outbreak of infection, such as Methicillin Resistant *Staphylococcus Aureus* (MRSA), can be thoroughly investigated.

SUMMARY OF THE INVENTION

Accordingly this invention provides :-

- 1 Apparatus to sterilise a computer keyboard and associated user peripherals, such as the mouse and mouse mat or other pointing device using ultraviolet light and comprising :-
 - (a) an enclosure with a front lid which when opened, allows the computer input devices to be made available to the operator on a tray supported by side runners;
 - (b) an ultraviolet light source;
 - (c) a control unit that can have its control parameters modified by the host computer, record details of both manual and automated sterilisation processes and return these details to the host computer;
 - (d) a host computer program to modify the sterilisation parameters in the control unit and record details of sterilisation processes within an audit trail log;
- 2 In the preferred embodiment the apparatus includes electric motors to enable the input devices to be withdrawn into the enclosure and the lid closed automatically by control of a switch.
- 3 The apparatus may be of a size to accommodate and to sterilise keyboards, mice, mice mats, touch pads, tracker balls, pen devices, scanners and other associated user peripherals.
- 4 The keyboard and user peripherals are preferably pigmented or coated with titanium dioxide to facilitate photo catalytic action.
- 5 The apparatus accordingly may provide convenient storage space for the computer keyboard and associated user peripherals underneath the computer monitor, or elsewhere, when not in use, access being by use of the switch.

The main objective of the invention is to sterilise keyboards and user peripherals attached to computers so as to minimise the cross contamination caused by harmful microorganisms and the like.

Additional objectives are set out below.

To sterilise the user peripherals commonly touched by operators when using a computer and thereby avoid the spread of disease and cross contamination.

To allow the use of user peripherals that have the same operational characteristics as existing devices.

To contain the ultraviolet light so as not to expose the operator to the ultraviolet light.

To utilise ultraviolet light and titanium dioxide in order to accelerate sterilisation.

To minimise the production of ozone.

To avoid the use of liquid disinfectants.

To initiate sterilisation cycles either manually or automatically under computer control, programmed to suit the particular environment.

To record details of sterilisation processes.

To provide an audit trail in an electronic format suitable for analysis by computer program.

The Steriliser is an enclosure into which a keyboard and associated user peripherals (e.g. mouse) can be contained, allowing free access to the peripherals under normal use but are mechanically withdrawn into an enclosure in order to irradiate ultraviolet light onto the touched surfaces to perform sterilisation. There can be a plurality of ultraviolet lamps and reflectors so that radiation reaches as much of the surface area as possible. The oxidation process, which causes sterilisation, may be accelerated by the photo catalytic action of the ultraviolet light on the titanium dioxide pigmentation or coating the touched surfaces.

The peripherals can be manually withdrawn or automatically withdrawn into the sterilising enclosure when not in use or when sterilisation is required. Small electric motors are used in the automatic configuration and these can be activated by an operator switch or under computer control. In one configuration the pointing device will be built into the keyboard such as a "Touch Pad" and so only the one combined unit will be withdrawn into the enclosure. In another configuration, both the keyboard and a separate mouse can be withdrawn into the enclosure for sterilising. In yet another configuration, the keyboards, mouse and mouse mat can be withdrawn into the enclosure. In the latter configuration the mouse to be parked in a predefined position that allows ultraviolet light to be irradiated from beneath as well as onto other surfaces of the mouse. An indicator light on the enclosure warns the operator that mains electric power is present and another indicator light warns the operator that sterilisation is in progress.

The keyboard and associated user peripherals connect to the control unit, which in turn connects them to the host computer. The data cable connecting to the host computer allows data to be transmitted between the control unit and host computer in both directions. The control actions, such as when to activate a sterilising cycle, how long to apply ultraviolet light, what electrical power to apply, etc. are determined by parameters that can be changed by a host computer program. These control parameters will be set during manufacture to customer agreed default values. However, they can be modified from a computer program operating on the host computer, which downloads them into the control unit. This

allows different schemes to be applied to suit different environments. The control unit also records details of sterilisation so that they can be logged into an audit trail by the host computer. Reports can be created automatically by the host computer and optimum conditions established for any particular environment. In the event of an outbreak of an infection, the audit trail will provide an invaluable source of data by which to analyse the situation, assist in determining the cause and facilitate early corrective action.

The host computer program control software is an intrinsic part of the invention.

The Steriliser will operate from normal electrical mains power.

The Steriliser enclosure top surface may be horizontal so as to locate the host computer monitor on top of the enclosure. The keyboard and associated user peripherals can be stored in the enclosure when not in use, thereby reducing the ingress of atmospheric dirt and providing additional desk space.

In one configuration, the operator will open the door to extend and withdraw the keyboard and associated user peripherals manually. In another configuration the control unit will initiate these actions automatically.

The invention allows utilisation of existing keyboard technology and associated user peripheral technology. Existing technology is generally known to meet recognised industry standards such as key area, depression force, key travel and tactile feedback. These recognised industry standards are difficult to achieve with keyboards that are designed to be wiped clean. In the preferred configuration, existing design technology will be incorporated into the keyboard and associated user peripherals supplied as part of the apparatus and will also benefit from titanium dioxide pigmentation or coating.

A well defined level of sterilisation can be planned and program controlled to suit the environment. The sterilisation process details will be recorded and produce an audit trail. The audit trail can be analysed under management direction at many different geographical levels. For example, by department, by hospital, by hospital trust or group and nationally.

Audit trail analysis can be at any time interval, either regularly or on-demand. For example, daily, weekly, monthly and annually or on-demand as might be the case required in the case of the outbreak of an infection.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention will now be described with reference to the accompanying drawings in which :-

Figure 1 is an isometric schematic of the Steriliser with keyboard and integrated touch pad in extended for operational use.

Figure 2 is an isometric drawing of the Steriliser.

Figure 3 is a sectional side elevation of the Steriliser

Figure 4 is a schematic diagram of the electrical modules.

DETAILED DESCRIPTION OF THE INVENTION

The drawings listed above are used in this description by referring to the numbered components.

Figure 1 is an isometric outline of one embodiment of the apparatus with the computer input devices in their operational position. The sterilising enclosure (1) is in the open position with its lid (2) raised and tray (3) extended by use of a slide mechanism (4). In one configuration of the invention, the slides can be manually actuated, whilst in preferred configurations they can be motor driven.

A keyboard (5) is located on the tray. The particular configuration shown includes a touch pad pointing device (6) integrated into the keyboard. In the preferred embodiment, the keyboard will be supplied as part of the apparatus and will incorporate titanium dioxide, either as a pigment or as a coating. In another embodiment, the pointing device will be a separate mouse and will be placed on the tray, by the side of the keyboard immediately before the sterilising cycle commences. A further embodiment includes a mouse mat that will also be placed on the tray so that this too can be sterilised. In this embodiment, the tray will have a cut-out in order that the underside of the mouse can be irradiated with ultraviolet light. Again, the preferred embodiment will include mouse and mouse mat supplied with a pigmentation or coating comprising titanium dioxide.

A data cable (7) connects the keyboard to the control unit (8 in Figure 4), which in turn connects the apparatus to the host computer (not shown) via a bi-directional interface cable (9). There may be a plurality of data cables between user peripherals and the control unit, depending on the particular configuration. Electrical power is supplied to the Steriliser by a mains cable (10) and the presence of power is evident by indicator light (11) being lit. When the tray (3) carrying the keyboard and user peripherals is withdrawn into the enclosure and the sterilising process commences, the presence of ultraviolet light is evident by indicator light (12) being lit or by a small window of ultraviolet opaque glass. An "Open - Close" safety switch (13) allows radiation of ultraviolet light only when the enclosure is securely closed. The switch (13) provides an operator with the facility to store the keyboard and associated user peripherals when not in use and retrieve them when required.

Figure 3 shows a sectional side elevation. One configuration of ultraviolet lamps is indicated (14), with the lamp tubes extending along the length of the enclosure. However, many different configurations are possible and there may be a plurality

of ultraviolet lamps. Above and behind the lamps are reflectors (not shown) to encourage the light beams to radiate onto as much of the exposed surface of the input devices as is practicable. The lamps may also be protected by a transparent cover (not shown) to avoid damage. In the configuration shown, the tray slides are driven by motors (15) that extend and withdraw the tray (3).

Figure 4 is a block diagram of the main electrical modules.

The keyboard and user peripherals connect to the control unit by data cable (7) of which there may be a plurality. The control unit is connected to the host computer by the interface cable (9). Any parameters that are changed by operational staff e.g. length of sterilisation cycle, time of activation etc. are sent from the host computer to the control unit. The control unit (8) also records details of the sterilisation process and transmits them to the host computer via interface cable (9) for logging into the audit trail.

A method and apparatus for sterilisation of computer keyboards and associated pointing devices has been described above. The method of sterilisation is ultraviolet light plus the photo catalytic effect created by titanium dioxide which is the preferred material of the surface of the devices to be sterilised. The wavelength of ultraviolet light used by this invention is generally in the 200 to 300 nano metres wave band. Below 200 nano metres ozone can be produced, which can be harmful and so these lower wavelengths are avoided.

The apparatus described allows the sterilisation of :-

- (a) A keyboard, possibly with an integrated pointing device.
- (b) A keyboard and a separate pointing device, such as a mouse.
- (c) A keyboard, plus a mouse, plus a mouse mat.

The invention does not exclude other combinations of computer input devices.

Parameters controlling automated sterilisation can be adjusted by operational staff via a program operating on the host computer. In all cases, whether manual sterilisation is adopted or automated sterilisation is utilised, all relevant control actions and times are logged back to an audit trail for analysis by hospital, trust or group and nationally.

CLAIMS

- 1 Apparatus to sterilise a computer keyboard and associated user peripherals, such as the mouse and mouse mat or other pointing device using ultraviolet light and comprising :-
 - a. an enclosure with a front lid which when opened, allows the user peripherals to be made available to the operator on a tray supported by side runners;
 - b. an ultraviolet light source;
 - c. a control unit that can have its control parameters modified by the host computer, record details of both manual and automated sterilisation processes and return these details to the host computer;
 - d. a host computer program to modify the sterilisation parameters in the control unit and record details of sterilisation processes within an audit trail log;
- 2 Apparatus according to Claim 1 where electric motors enable a keyboard and associated user peripherals to be withdrawn into the enclosure and the lid closed automatically by control of a switch.
- 3 Apparatus according to Claim 1 or Claim 2 which is of a size to accommodate and to sterilise keyboards, mice, mice mats, touch pads, tracker balls and other associated user peripherals.
- 4 Apparatus according to any of the preceding claims where a keyboard and associated user peripherals are pigmented or coated with titanium dioxide to facilitate photo catalytic action.
- 5 Apparatus according to any of the preceding claims which provides convenient storage space for the computer keyboard and associated user peripherals underneath the computer monitor, or elsewhere, when not in use, access being by use of a switch.
- 6 A steriliser substantially as herein described above and illustrated by the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB0502297.5

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Examiner: Mr Marc Collins

Claims searched: 1-6

Date of search: 21 June 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	US 6458331 B1 (ROBERTS) See whole document.
A	-	US 6278122 B1 (GAGNON) See whole document.
A	-	JP 07160362 A (HITACHI LTD.) 23.06.95. See whole document and PAJ Abstract.
A	-	WO 03/061382 A1 (XENON CORPORATION) See whole document.

Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art
Y Document indicating lack of inventive step if combined with one or more other documents of same category	P Document published on or after the declared priority date but before the filing date of this invention.
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

A5G; B6F

Worldwide search of patent documents classified in the following areas of the IPC⁰⁷

A61B; B41J; G06F

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI