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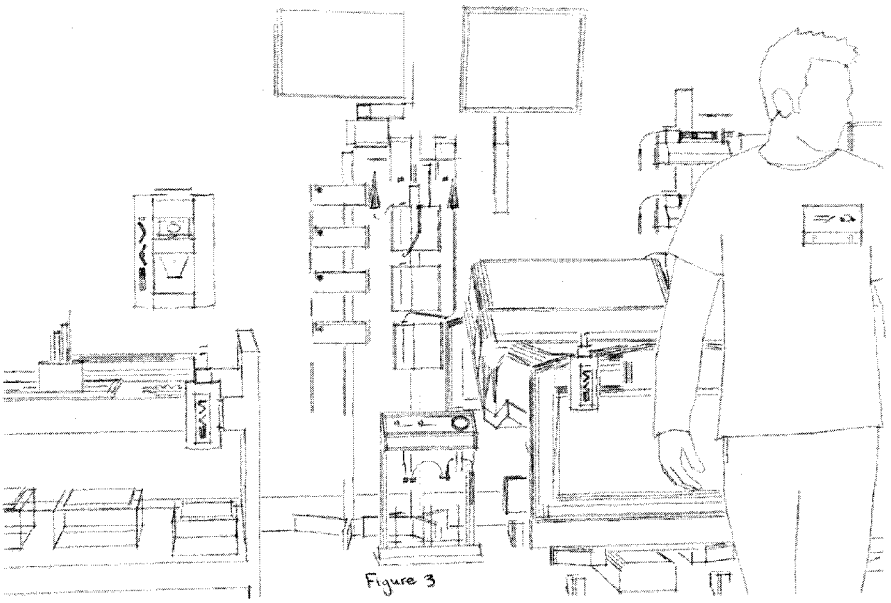


(57) Abstract: This invention relates to a system for monitoring hand hygiene compliance, including at least one hand hygiene fluid dispenser device and at least one indicator worn by a healthcare worker, wherein said dispenser and said indicator are in communication. The dispenser comprises a dynamo for converting mechanical energy spent for activating the dispenser into electrical current fed to a transmitter, which sends a signal to the indicator to record activation of the dispenser. The indicator visually displays when the healthcare worker has recently used said dispenser to wash his or her hands.

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# HAND HYGIENE MONITORING SYSTEM

This invention relates to a system, including at least one dispenser device and at least one indicator, for monitoring hand hygiene; a dispenser for use in said system; and an indicator also for use in said system.

## Introduction

Healthcare-associated infections (HCAIs), or nosocomial infections, are those that are acquired by a patient during the course of receiving treatment within a healthcare setting, such as in hospitals, nursing homes, or from treatment in their own home. HCAIs affect hundreds of millions of patients worldwide every year often resulting in a more serious illness, prolonged hospital stay, long-term disability or even death.

HCAIs can affect any part of the body, including the urinary system (urinary tract infection), the respiratory system (pneumonia or respiratory tract infection), the skin, surgical wounds (surgical site infection), the gastrointestinal system and even the bloodstream (bacteraemia). Many such infections may arise from the presence of micro-organisms present on the body of the patient; however, they may also be caused by those originating from another patient or from those transmitted from the hospital environment due to poor hygiene standards.

HCAIs are amongst the major causes of death and increased morbidity in hospitalised patients. Each year, at least 2,000,000 patients in the USA and over 320,000 patients in the UK acquire one or more HCAIs during their stay in hospital. It is predicted that 1 in 4 patients in intensive care worldwide will acquire an infection during their treatment, with this estimate doubled in less developed countries. It has been reported that at any one time more than 1.4 million people worldwide are suffering from and HCAI (Vincent, 2003). In the US, 1 in every 136 patients a day becomes severely ill as a consequence of contracting an HCAI, which equates to 2 million cases per year (Starfield, 2000). As a consequence, it is predicted patients spend an average of 2.5 times longer in hospital (Turner, 2008). In addition to a direct consequence on patient safety, HCAIs also contribute to a significant financial burden on healthcare systems. In the USA, the risk of HCAIs has risen steadily over

the last decade with accompanying costs estimated at US$ 4.5-5.7 billion a year. Similarly in the UK, HCAIs are estimated to cost the NHS £1 billion a year (Turner, 2008).

The micro-organisms giving rise to HCAIs are numerous, and may be in the form of any number of pathogens such as bacteria, virus, fungus, parasites or prions. The most commonly known nosocomial pathogens include methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridium difficile* (*C.difficile*) and *Escherichia coli* (*E. coli*). In 2007, it was documented that 7,000 people were infected in the UK with MRSA resulting in 2,000 deaths. In the same year, nearly 50,000 cases of *C. difficile* were recorded in patients aged 65 years or over along with a reported 6,000 deaths (*Office for national statistic, 2008: Health Statistics quarterly, 39*).

There are many risk factors that can lead to a patient contracting an HCAI. For example, advancements in medicine, whilst leading to new treatments of disease, can also result in an increased susceptibility to infection e.g. immunosuppression as a consequence of chemotherapy or for organ transplantation. Similarly, certain chronic diseases can present certain risks to infection e.g. Diabetics have increased susceptibility, whereas sufferers of chronic obstructive pulmonary disease are known to have an increased risk of respiratory tract infections. The use of certain invasive medical devices, such as intubation tubes, catheters and surgical drains, provide entry points for pathogens bypassing the body's natural defences. Such predispositions are in addition to the fact that many patients are already in a poor state of health, wherein their risk to contracting an infection is already greater than in a healthy individual.

Furthermore, the current demand on healthcare systems has resulted in the overall pathogenic burden on clinical settings increasing. When this is taken in combination with other factors, such as increased microbial resistance to antibiotics, the risk of infection is much greater. This is further increased as HCAIs can be spread from an infected patient to another as a consequence of poor clinical practice, hygiene and overall sterility. This has therefore led to an increased requirement for strict guidelines and control measures, the purpose of which is to limit the likelihood of

spreading pathogens, and as a result reduce the incidence of nosocomial infections thereby improving patient safety and the burden on healthcare systems.

It has been estimated that the incidence of HCAIs can be reduced significantly. It is thought that about 15% - 30% could be avoided by improved practices and better application of existing knowledge. Such measures include stringent use of personal protective equipment e.g. gloves and aprons to minimise contamination of skin and clothing, which furthermore are not used for more than one patient. By improving levels of hygiene, and also by minimising the risk of transmitting pathogens around the healthcare setting, it is known that the occurrence of HCAIs decreases.

One of the most effective means by which this can be achieved is through implementation of good levels of hand hygiene. Evidence demonstrates that hand antisepsis through use of antiseptic hand washes and alcohol washes reduces the incidence of HCAI by greater than 50% or more (Pratt *et al.,* 2007). The WHO has published guidelines for hand washing and hand antisepsis, and states hands should be washed thoroughly with soap and water when visibly dirty, preferably followed by the use of an alcohol based hand rub or rinse. There are also guidelines for the method of hand washing. This should be done routinely, and especially before and after contact with patients, after removing gloves, before the handling of invasive devices, after moving from a contaminated body site to a clean site, and after contact with inanimate objects in the vicinity of the patient (World Health Organisation *Guidelines on Hand Hygiene in Healthcare)*.

Alcohol hand rubs are recommended for routine hand decontamination as they have been shown to be more effective, quicker to use, better tolerated and can be provided at the patient point of care. It has been shown that hand sanitisers, specifically containing a minimum of 60% alcohol kill many different bacteria (including MRSA), and viruses (including HIV, rhinovirus, vaccinia, influenza, hepatitis, and herpes simplex virus). To meet the minimum European guidelines for alcohol hand rubs (EN 1500) in the healthcare environment, rub sanitizers must contain at least 60% alcohol and be capable of killing 99.9% of the bacteria on hands 30 seconds after application and 99.99 to 99.999% of the bacteria on hands 1 minute after application (Boyce & Pittet, 2002). However, alcohol asepsis does not

remove dirt or organic matter, and also does not kill some nosocomial pathogens, and therefore good practice is to incorporate both soap and water in addition to the use of sanitising rubs (Boyce & Pittet, 2002).

Compliance with hand hygiene is generally very low (often less than 50%). Healthcare notices must continuously remind practitioners and visitors on the proper procedure for washing their hands to comply with responsible hand washing. It has been reported that levels of hand hygiene remain at unacceptable levels in most medical environments, with large numbers of medical staff often forgetting to wash their hands before and after contact with patients (Goldman, 2006). Furthermore, it has been shown that alcohol hand rinses have limited efficacy which can vary depending upon the type of hand rinse used, the volume used, the type of alcohol, and the contact time; thus the duration for which they remain effective can range from several minutes to several hours (Boyce & Pittet, 2002; Kramer *et al.,* 2002). There is therefore a requirement for frequent and regular decontamination. As a consequence, effective and applicable guidance on measures to control spread of infection are required, and ensuring compliance with hand hygiene is one such measure (World Health Organisation *Guidelines on Hand Hygiene in Healthcare*).

Currently, the simplest and most effective means of determining compliance with hand hygiene is via direct observation. This approach suffers from significant disadvantages; lack of standardisation, high costs, observer bias, and modification of behaviour as users are aware that they are being observed (Hawthorne Effect). As a consequence, several devices and systems to enforce compliance with good hand antisepsis have previously been disclosed. WO2011085292 teaches a simple sanitiser device which reports the number of uses of a soap dispenser compared to a targeted expectation. WO2011058293 teaches of a dispenser with an attached printer which provides a record of hand hygiene compliance. Similarly, US2010/231385 teaches the use of a volatile hand washing agent which can be detected by a sensor capable of detecting said compound to confirm when a hand hygiene event has occurred. Such devices have obvious drawbacks, however, and do not encourage user compliance with hand antisepsis.

An effective hand hygiene compliance system must incorporate means by which specific users are encouraged to perform hand hygiene procedure e.g. by timely, proactive prompts, and also a means by which a user's compliance record can be reported. There are many teachings in the prior art of hand hygiene devices and systems which are aimed at encouraging and recording compliance. US2008/0087719 teaches a system whereby data readers worn by users are activated by portal triggers located in doorways of patient rooms, prompting hand hygiene procedure and also recording compliance by Radio Frequency Identification (RFID). Similar such systems are disclosed in U2011/234407 and US2008/0100441, which consist of room and dispenser sensors to track movement and prompt hygiene compliance, with users identifiable from unique Tags that are in communication by RFID (thereby storing user specific compliance data). WO2008119158 teaches a system where users move from zone to zone and are required to perform hand hygiene between the zones. Users carry a wearable zone sensor which detects zones and hand hygiene actions. WO2010070072 teaches a system where healthcare workers and patients wear tags. The healthcare worker also wears a sensor which detects such tags from patients and also washing stations, and also a control unit, which detects and records whether a worker has used said washing stations before and after patient contact.

Many of these systems work zonally, in which sensors detect the whereabouts of users and their compliance with hand hygiene, on either locally (around each patient) or in different defined areas (for different rooms). As a consequence, they are very complex requiring expensive sensor and detector equipment which require regular maintenance. Implementation of such equipment is also very disruptive, requiring installation of inconvenient devices and associated wiring. Interpretation of compliance data is complicated requiring specialist hardware and software, and also technical expertise. There is a requirement for zones to be accurately defined and the systems rely heavily on detectability. Additionally, many of these real-time location systems which use Wi-Fi signals (time of flight or time of arrival) are severely limited in accuracy, providing estimated locations which are one to three meters from actual locations, a range that is too great to be used to monitor whether patient contact occurs. Due to the heavy reliance on motion and proximity sensors in these systems, there is often the requirement for an external power source, as the

use of remote batteries is not possible without introducing further maintenance issues.

Furthermore, these systems do not address many basic issues required in hand hygiene compliance procedures as they are zoned to specific areas and are not patient specific. Consequently, they do not work in healthcare systems in which patients are not in individual rooms, such as in a ward system. In such systems, a healthcare professional may spend a greater length of time with more than one patient therefore requiring several hand decontaminations; the use of an entry/exit or zoned system is ineffective and difficult to regulate.

We have therefore developed a simple system that monitors and encourages hand hygiene compliance, and ideally permits such compliance to be recorded and analysed. The system dispenses with the need for multi-site identification of zones and the concomitant wiring this requires during installation and maintenance. Additionally the dispensers used in the system are stand-alone items requiring no on-going maintenance, other than re-filling. Moreover the system is entirely visible to both healthcare workers and patients in real-time thus encouraging patient participation in the healthcare process.

Statements of Invention

According to a first aspect of the invention there is provided a system for monitoring hand hygiene, comprising:

i) at least one dispenser for dispensing a hand hygiene fluid comprising

a hand hygiene receptacle in fluid communication with a delivery outlet which is functionally coupled to a manual activator; and a signal emitter also functionally coupled to said manual activator;

wherein said manual activator includes a dynamo, whereby manual activation of said manual activator results in both the dispensing of a hand hygiene fluid from said outlet and the emission of a signal from said signal emitter;

ii) at least one indicator adapted to be worn by a least one person whose hand hygiene is to be monitored comprising

a signal receiver functionally coupled to a status display device, which can display at least a first and second status, and which indicator also includes a timing mechanism that is functionally coupled to said status display device, whereby upon receipt of a signal from said signal emitter said signal display device displays a first status and after a selected period of time countered by said timing mechanism said signal display device displays a second status.

In a preferred embodiment of the invention said system, including said dispenser and said indicator, is wireless.

In yet a further preferred embodiment of the invention there is provided a plurality of hand hygiene dispensers and/or a plurality of indicators.

It will be further appreciated by those skilled in the art that hand hygiene fluid is to be construed as any substance that can be used to improve hand hygiene. This includes, but is not limited to, water, soap and detergents, antibacterial soap, antiseptic solutions, antibacterial hand rubs, antimicrobial soaps and rubs, alcoholic based hand rubs and rinses, or water based hand rubs and rinses. Said reagent may therefore be in any number of forms, such as liquid, gels, foams, creams, or the like.

In a preferred embodiment said receptacle is either partially or wholly transparent whereby the amount of fluid therein can be assessed, or it includes a further information means relaying to a user, or via said signal emitter to a remote station, when the receptacle has to be re-filled.

In yet a further preferred embodiment said manual activator includes a dynamo connected to a handle or push device whereby once the handle is depressed or the push device pushed, or indeed either moved in any preferred fashion, the dynamo is activated to generate a current which, via suitable circuitry, activates said signal emitter to send a signal that is representative of use of the dispenser. In this way, the dispenser operates as a stand-alone piece of equipment that requires no wiring or on-going maintenance. Further the use of said handle or push device also results in

the dispensing of a selected amount of hand hygiene fluid. Thus, two functions are accomplished by a single manoeuvre.

In yet a further preferred embodiment, said dispenser comprises an instrument cleaning pad located adjacent said delivery outlet whereby use of said manual operator results in the dispensing of hand hygiene fluid to a user and also, at the same time or before or after, dispensing of said fluid to said pad which can then be used to clean a selected instrument, such as a stethoscope, by a clinician wiping said instrument against said pad. In a preferred embodiment said pad is fixed to said dispenser but in some embodiments it may be removable therefrom.

More preferably, said pad is a cloth, sponge or gauze. More ideally still, said material is a sponge.

In a further preferred embodiment of the invention, the signal from said signal emitter can be one of numerous types known by one skilled in the art, such as an audio or electromagnetic signal. More preferably, said signal is an electromagnetic signal including, but not limited to, a radio signal, infrared signal, or optical signal. More ideally still, said signal is an infrared signal. Similarly, said signal receiver is capable of detecting a variety of types of signal which will depend upon the nature of the emitting signal including, but not limited to, an audio, radio, infrared or optical signal, and the like.

In a further preferred embodiment of the invention, the status display device may provide a visual or audible signal or result. More preferably, said status display device comprises a visual signal such as at least one visual display or light, which is activated upon detection of the signal from said dispenser. More preferably still, the status display device displays different coloured lights for the different status signals. For example, the status display device displays a green light for the first status, indicating hand hygiene has been complied with, and a red light for the second status, indicating a further hand hygiene procedure is required. Moreover, the two coloured light displays may be provided by a single light emitter or two separate ones dedicated to displaying one colour.

In the instance where an audible signal is used different types of sound are used to indicate the different status and the sounds may be continuous or intermittent. The nature of the sounds is less important than ensuring they are representative of the information to be relayed.

In a preferred embodiment, the time mechanism is set for a pre-determined time period of between 1-30 min, or more ideally 1-10 min, and more ideally still selected from one of the following options 1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 7 min, 8 min, 9 min, and 10 min. Alternatively, the time mechanism is set according to the efficacy of the hand hygiene fluid and so is designed to lapse after an interval commensurate with the effectiveness of the selected hand hygiene fluid.

In a yet a preferred embodiment of the invention, said indicator is a badge. More preferably still the badge is provided in a card-shaped housing which ideally permits user identification cards to be held and displayed from within said housing.

In a preferred embodiment, the indicator further comprises an internal disposable battery to power said status display device. Alternatively, and more preferably, said battery is rechargeable, permitting said indicator to be used indefinitely. Ideally, said rechargeable battery is readily accessible to permit charging. More ideally still, said indicator is adapted to be docked into a device for recharging and so comprises a docking device.

In a preferred embodiment of the invention, said indicator further comprises a device for data storage on which data can be stored such as, but not limited to, identification of the wearer, the number of hand hygiene procedures, dispenser used and time logs of hand hygiene compliance.

In yet a further preferred embodiment of the invention, the indicator further comprises an internal clock operably connected to the signal receiver, whereby the time at which the signal is received is recorded.

In a further preferred embodiment there is also provided a device for accessing and displaying said information recorded on said indicator whereby hand hygiene can be monitored for at least one wearer of said indicator and preferably a group of wearers.

Such information ideally will relate to each individual user, and provide statistics on daily hand hygiene performance that can be used in audits and in the preparation of reports. Furthermore, such data can be used to assess compliance with accepted minimum compliance levels. The device for accessing and displaying said information may be a conventional computer or technology equivalent to same.

Additionally, said device may store information relating to the number of dispense actions of each dispenser and, ideally, automatically send an email to whoever is appropriate, e.g. maintenance staff, when one or more dispensers require filling or replacement. Advantageously, this allows prompt auditing and monitoring of dispenser maintenance and provides the means to keep the dispensers constantly usable.

In use, the system therefore permits the monitoring of hand hygiene practice. The user's compliance with hand hygiene is indicated by the status display device of the indicator, most preferably a red or green light. The user, who has sight of the device, is able to execute a hand hygiene procedure when required. Upon dispensing the hand hygiene fluid, via the manual activator, the functionally coupled dynamo generates an electrical current that is converted into a signal, most preferably an infrared signal that is emitted by the dispenser. The signal receiver of the indicator, worn by the user, detects said signal and via the status display device notifies the wearer (and a patient) of the hand hygiene status of the healthcare worker. Activation of the indicator, upon performing a hand hygiene procedure, also results in a count-down of the timing mechanism, for a pre-determined time period, at the end of which period the second status indicates further compliance with hand hygiene is required.

Advantageously, the indicator allows the user and other individuals to recognise when a further hand hygiene procedure is required, thereby maintaining hand antisepsis during healthcare procedures.

This simple system has obvious benefits in minimising the risk of transmitting nosocomial pathogens. Further, the relatively simple dispensing device converts mechanical energy into electrical energy to generate the infrared signal by means of a dynamo, therefore negating the requirement for an additional power supply.

According to a second aspect of the invention there is provided a dispenser for dispensing a hand hygiene fluid comprising:

a hand hygiene receptacle in fluid communication with a delivery outlet which is functionally coupled to a manual activator; and a signal emitter also functionally coupled to said manual activator; and

wherein said manual activator includes a dynamo;

whereby manual activation of said manual activator results in both the dispensing of a hand hygiene fluid from said outlet and the emission of a signal from said signal emitter.

In a preferred embodiment of the invention said dispenser is wireless.

In yet a further preferred embodiment, said dispenser comprises an instrument cleaning pad located adjacent said delivery outlet whereby use of said manual operator results in the dispensing of hand hygiene fluid to a user and also, at the same time or before or after, dispensing of said fluid to said pad which can then be used to clean a selected instrument, such as a stethoscope, by a clinician wiping said instrument against said pad. In a preferred embodiment said pad is fixed to said dispenser but in some embodiments it may be removable therefrom.

More preferably, said pad is a cloth, sponge or gauze. More ideally still, said material is a sponge.

According to a third aspect of the invention there is provided an indicator adapted to be worn by a least one person whose hand hygiene is to be monitored comprising:

a signal receiver functionally coupled to a status display device, which can display at least a first and second status; and

a timing mechanism that is functionally coupled to said status display device;

whereby upon receipt of a signal from said signal emitter said signal display device displays a first status and after a selected period of time countered by said timing mechanism said signal display device displays a second status.

In a preferred embodiment of the invention said indicator is wireless.

According to yet a further aspect of the invention there is provided a kit of parts for monitoring hand hygiene, comprising at least one dispenser as herein described and at least one indicator as herein described.

It will be apparent to those skilled in the art that the system can be used to achieve hand antisepsis for medical purpose. Furthermore, the system can be used in any environment wherein hand antisepsis is a requirement including, but not limited to, hospitals, medical clinics, nursing homes, scientific research facilities, restaurants or other food service areas, food preparation and manufacturing industries, or the like.

Any of the aforementioned aspects of the invention may, in preferred embodiments, include or be characterised by any of the aforementioned features pertaining to the system, dispensers or indicators. Thus, preferred features of each aspect of the invention may be as described in connection with any of the other aspects.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word “comprises”, or variations such as “comprised” or “comprising” is used in an inclusive sense i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

All references, including any patent or patent application, cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. Further, no admission is made that any of the prior art constitutes part of the common general knowledge in the art.

Other features of the present invention will become apparent from the following examples. Generally speaking, the invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including the accompanying claims and drawings). Thus, features, integers, characteristics, compounds or chemical moieties described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein, unless incompatible therewith.

Moreover, unless stated otherwise, any feature disclosed herein may be replaced by an alternative feature serving the same or a similar purpose.

An embodiment of the invention will now be described by way of example only with reference to the following figures wherein:-

Figure 1 shows a perspective view of the individual components of the system;

Figure 2a shows a perspective view of a wall-mounted dispensing device;

Figure 2b shows a perspective view of a semi-permanently mounted dispensing device when attached to a bed;

Figure 2c shows a perspective view of a semi-permanently mounted dispensing device when attached to a trolley;

Figure 3 shows an indicator being worn by a healthcare worker in an environment where a number of dispenses are in use; and

Figure 4 shows a portable dispenser being worn by a healthcare worker.

Referring to the figures, and particularly to figure 1 there is shown the individual components of the system.

Towards the left hand side of figure 1 there is shown two alternative embodiments of a dispensing device.

Dispenser A has a cylindrical receptacle [1] for storing a hand hygiene fluid and positioned there above a manual activator in the form of a depressible handle [2] having an associated outlet [3] through which said hand hygiene fluid is dispensed. Although not shown, inside dispenser A is a dynamo and a signal emitter which is functionally coupled to the dynamo. Further the dynamo is connected to the handle [2].

In use the dispenser A is portable and can be located on any suitable surface. When a hand hygiene procedure is required a user simply depresses handle [2] and this results in the dispensing of an amount of cleaning fluid and also the generation of an electric current, via the dynamo, which results in a signal being emitted from the signal emitter. Those skilled in the art will appreciate that a number of configurations may be used to achieve the above function and so the invention is not to be limited to a single way of arranging the aforementioned components.

The hand hygiene fluid that is dispensed includes, but is not limited to, water, soap and detergents, antibacterial soap, antiseptic solutions, antibacterial hand rubs, antimicrobial soaps and rubs, alcoholic based hand rubs and rinses, or water based hand rubs and rinses. Said reagent may therefore be in any number of forms, such as liquid, gels, foams, creams, or the like.

Further, receptacle [1] is either partially or wholly transparent whereby the amount of fluid therein can be assessed, or it includes a further indicator relaying to a user when the receptacle has to be re-filled.

Dispenser B is trapezoidal in cross-section and comprises receptacle [1b] for storing a hand hygiene fluid and recessed therein a manual activator in the form of a pull (or push) device [2b] having an associated outlet [3b] through which said hand hygiene fluid is dispensed. A signal emitter [4b] is also recessed in the receptacle [1b]. Although not shown, inside dispenser B is a dynamo functionally coupled to pull

device [2b]. Moreover, the signal emitter [4b] is also functionally coupled to the dynamo.

In use the dispenser B is wall mounted using conventional fixings provided on the rear of the dispenser. When a hand hygiene procedure is required a user simply pushes (or pulls) handle [2b] and this results in the dispensing of an amount of cleaning fluid and also the generation of an electric current, via the dynamo, which results in a signal being emitted from the signal emitter [4b]. Those skilled in the art will appreciate that a number of configurations may be used to achieve the above function and so the invention is not to be limited to a single way of arranging the aforementioned components. In the instance where water soluble hand hygiene fluid is dispensed the dispenser is advantageously located near or adjacent a washing facility.

Ideally, dispensers A and B are marked in a manner that renders them highly visible so as to serve as a reminder that they are to be used.

The signal emitter in dispenser A or B is made to emit any one, or in some instances more than one, of the following signals audio or electromagnetic signal including, for example, a radio signal, infrared signal, or optical signal. We prefer to use an infrared signal.

Although not shown, dispensers A or B may also include an instrument cleaning pad located adjacent said delivery outlet whereby use of said manual operator results in the dispensing of hand hygiene fluid to a user and also, at the same time or before or after, dispensing of said fluid to said pad which can then be used to clean a selected instrument, such as a stethoscope. This is simply done by a clinician wiping said instrument against said pad. Ideally, said pad is fixed to said dispenser but in some embodiments it may be removable therefrom. Typically, said pad is a cloth, sponge or gauze. We prefer to use a sponge.

Towards the right hand side of figure 1 there is shown an indicator for use in the system of the invention.

In this embodiment the indicator is shown as a badge but it may be in the form of a bracelet, wrist strap, band, sash, lanyard or any clothing with a built in indicator.

Although not shown, inside badge [5] there is provided a signal receiver for receiving a signal transmitted by signal emitter [4b]. This signal receiver is connected to a status display device in the form of back-lit hand images [6] and [7]. Image [6] is back-lit using a red light and image [7] is back-lit using a green light. Upon receiving an infra-red signal from signal emitter [4b] the signal receiver sends a signal to the green light so illuminating image [7]. This then indicates to the person wearing the badge, and any other person in his or her vicinity, that the person has clean hands. At the same time that the signal is received by badge [5] a timing mechanism (not shown) inside badge [5] is activated and so begins a count-down, at the end of which the signal receiver sends a signal to the red light so illuminating image [6]. This then indicates to the person wearing the badge, and any other person in his or her vicinity, that the person has un-clean hands.

Those skilled in the art will appreciate that any types of signal my used in the working of the invention.

Moreover, the status display device may comprise only a single image which is either on or off according to whether it is back-lit or not. Alternatively, the status display device may comprise a number of images back-lit with a number of coloured lights. Alternatively again, the status display device may comprise any other form well known to those skilled in the art provided the relevant information is conveyed to a wearer of those in his or her vicinity.

Although not shown, badge [5] is also provided with a data storage device and docking device. The data storage device stores information relating to the number of signals that are received, their intervals and their frequency over a given time. However, other types of information may be stored according to a user's requirements. The docking device is ideally in the form of a USB port or any other known data transfer means.

Also not shown, badge [5] is provided with suitable power supply means in the form of a battery which, ideally, is rechargeable. This battery powers the signal receiver and the status display device.

Referring now to figures 2a, 2b and 2c there are shown a number of clinical environments in which the dispenser can be used. In figure 2a a portable dispenser is shown attached to the side of a trolley using conventional means.

In figure 2b a portable dispenser is shown attached to the side of a bed using conventional means. In figure 2c a fixed dispenser is shown attached to a wall in a ward using conventional means.

Referring now to figure 3 there is shown the system in use where it can be seen that a clinician is wearing a badge and a number of dispensers are available to activate same to ensure hand hygiene compliance.

Referring now to figure 4 there is shown a clinician wearing a badge and a portable belt dispenser to activate same at any time when hand hygiene compliance is required.

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# Claims

1. A system for monitoring hand hygiene, comprising:
   i) at least one dispenser for dispensing a hand hygiene fluid comprising
      a hand hygiene receptacle in fluid communication with a delivery outlet which is functionally coupled to a manual activator; and a signal emitter also functionally coupled to said manual activator;
      wherein said manual activator includes a dynamo, whereby manual activation of said manual activator results in both the dispensing of a hand hygiene fluid from said outlet and the emission of a signal from said signal emitter;
   ii) at least one indicator adapted to be worn by a least one person whose hand hygiene is to be monitored comprising
      a signal receiver functionally coupled to a status display device, which can display at least a first and second status, and which indicator also includes a timing mechanism that is functionally coupled to said status display device, whereby upon receipt of a signal from said signal emitter said signal display device displays a first status and after a selected period of time countered by said timing mechanism said signal display device displays a second status.
2. A system according to claim 1 wherein said system is wireless.
3. A system according to any preceding claim comprising a plurality of hand hygiene dispensers and/or a plurality of detectors.
4. A system according to any preceding claim wherein said receptacle is either partially or wholly transparent.
5. A system according to any preceding claim wherein the signal from said emitter is an audio or electromagnetic signal.
6. A system according to claim 5 wherein said signal is an infrared, radio, or optical signal.

7. A system according to any preceding claim wherein said status display device includes an audio or visual display of status.
8. A system according to claim 7 wherein said display device status includes at least one coloured light.
9. A system according to any preceding claim wherein said timing mechanism is set to count a selected interval of time commensurate with the effectiveness of said hand hygiene fluid dispensed by said dispenser.
10. A system according to any preceding claim wherein said indicator is a badge
11. A system according to any preceding claim wherein said indicator further comprises a battery.
12. A system according to claim 11 wherein said battery is rechargeable
13. A system according to claim 12 wherein said indicator further comprises a docking device for recharging said battery.
14. A system according to any preceding claim wherein said indicator comprises a device for data storage.
15. A system according to any preceding claim wherein said indicator comprises a clock operably connected to said signal receiver.
16. A system according to claim 14 further comprising a device for accessing and displaying said data recorded on said indicator whereby hand hygiene can be monitored for at least one wearer of said indicator.
17. A system according to any preceding claim wherein said dispenser comprises an instrument cleaning pad located adjacent said delivery outlet whereby use of said manual operator results in the dispensing of hand hygiene fluid to a user and also, at the same time or before or after, dispensing of said fluid to said pad which can then be used to clean a selected instrument.
18. A system according to claim 17 wherein said pad is either fixed to said dispenser or removable therefrom.
19. A device for dispensing a hand hygiene fluid comprising:

a hand hygiene receptacle in fluid communication with a delivery outlet which is functionally coupled to a manual activator; and a signal emitter also functionally coupled to said manual activator; wherein said manual activator includes a dynamo;

whereby manual activation of said manual activator results in both the dispensing of a hand hygiene fluid from said outlet and the emission of a signal from said signal emitter.

20. A device according to claim 19 wherein said device is wireless

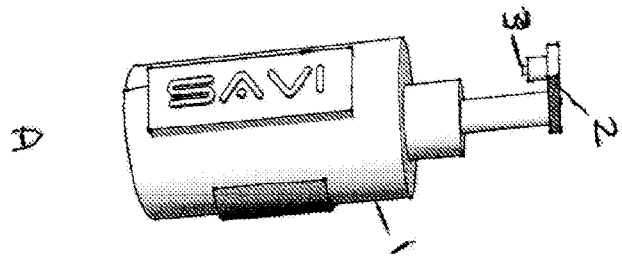
21. An indicator adapted to be worn by a least one person whose hand hygiene is to be monitored comprising:

a signal receiver functionally coupled to a status display device, which can display at least a first and second status; and a timing mechanism that is also functionally coupled to said status display device;

whereby upon receiving a signal from a signal emitter located on a hand hygiene dispenser said signal display device displays a first status and after a selected period of time countered by said timing mechanism said signal display device displays a second status.

22. An indicator according to claim 21 wherein said indicator is wireless.

23. A kit of parts for monitoring hand hygiene, comprising at least one dispenser and at least one indicator according to any preceding claim.



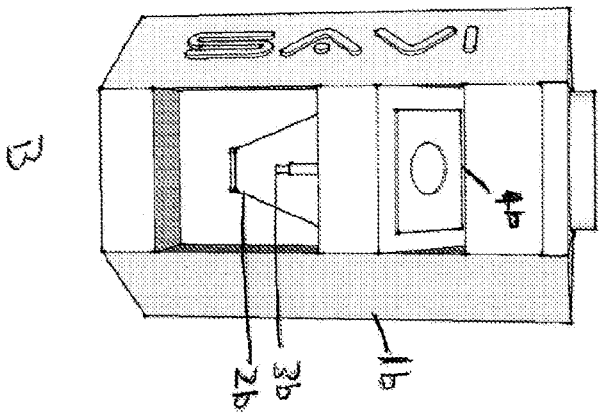




Figure 1

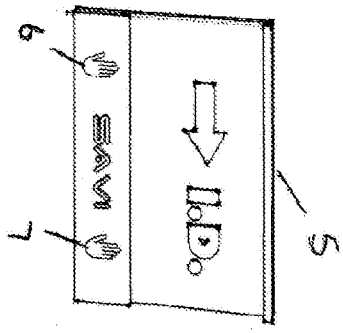
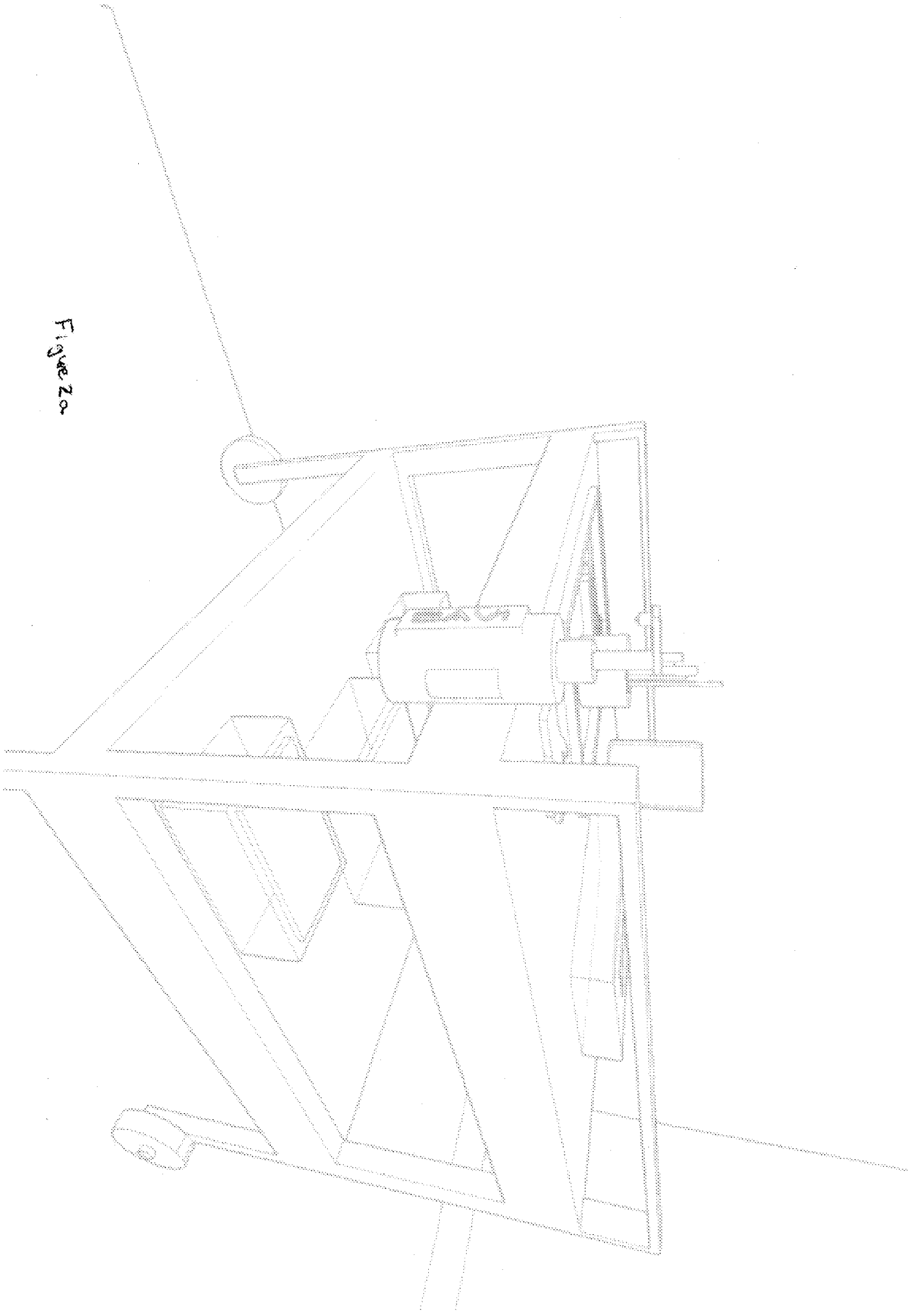


Figure 2a



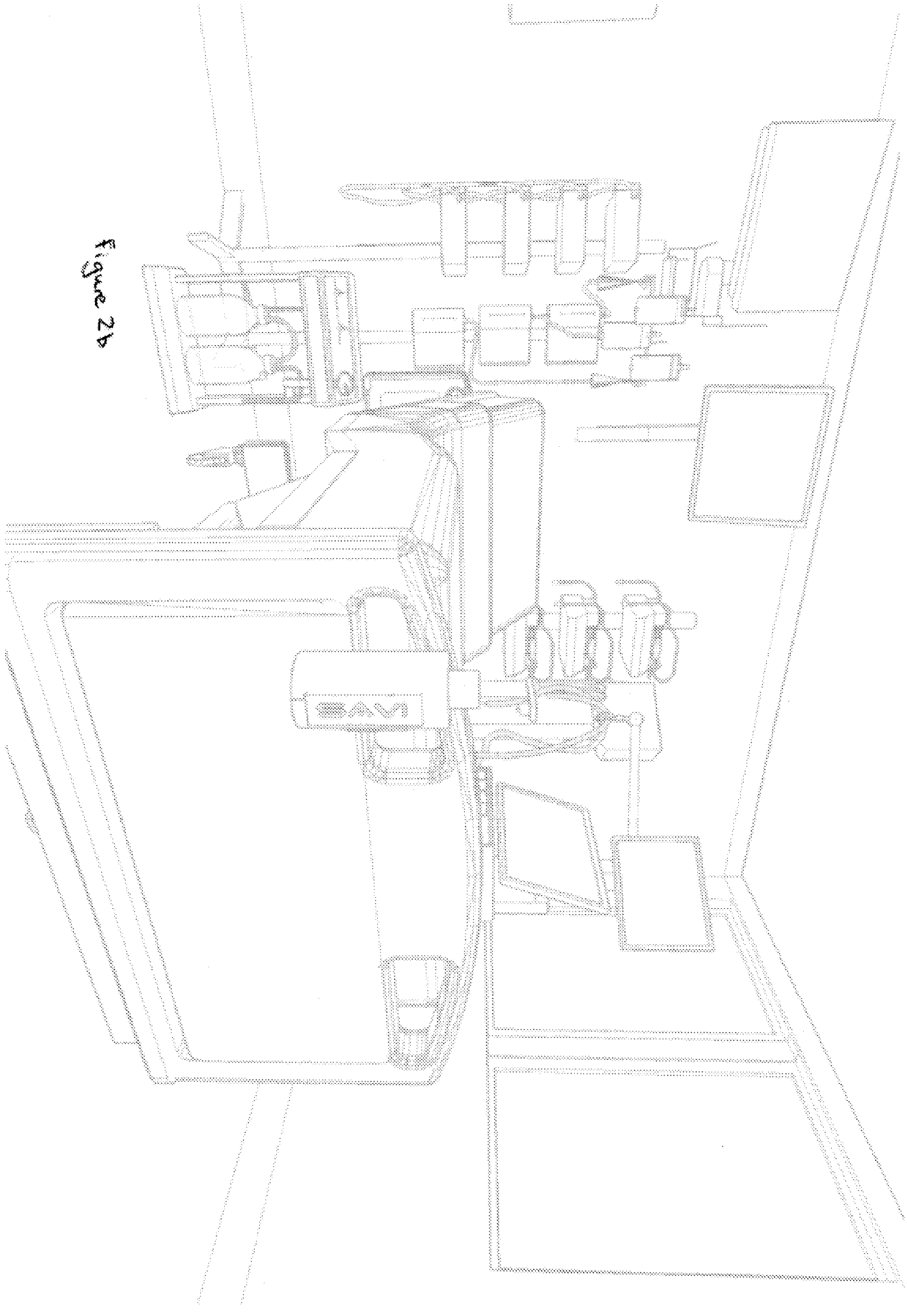


Figure 2a

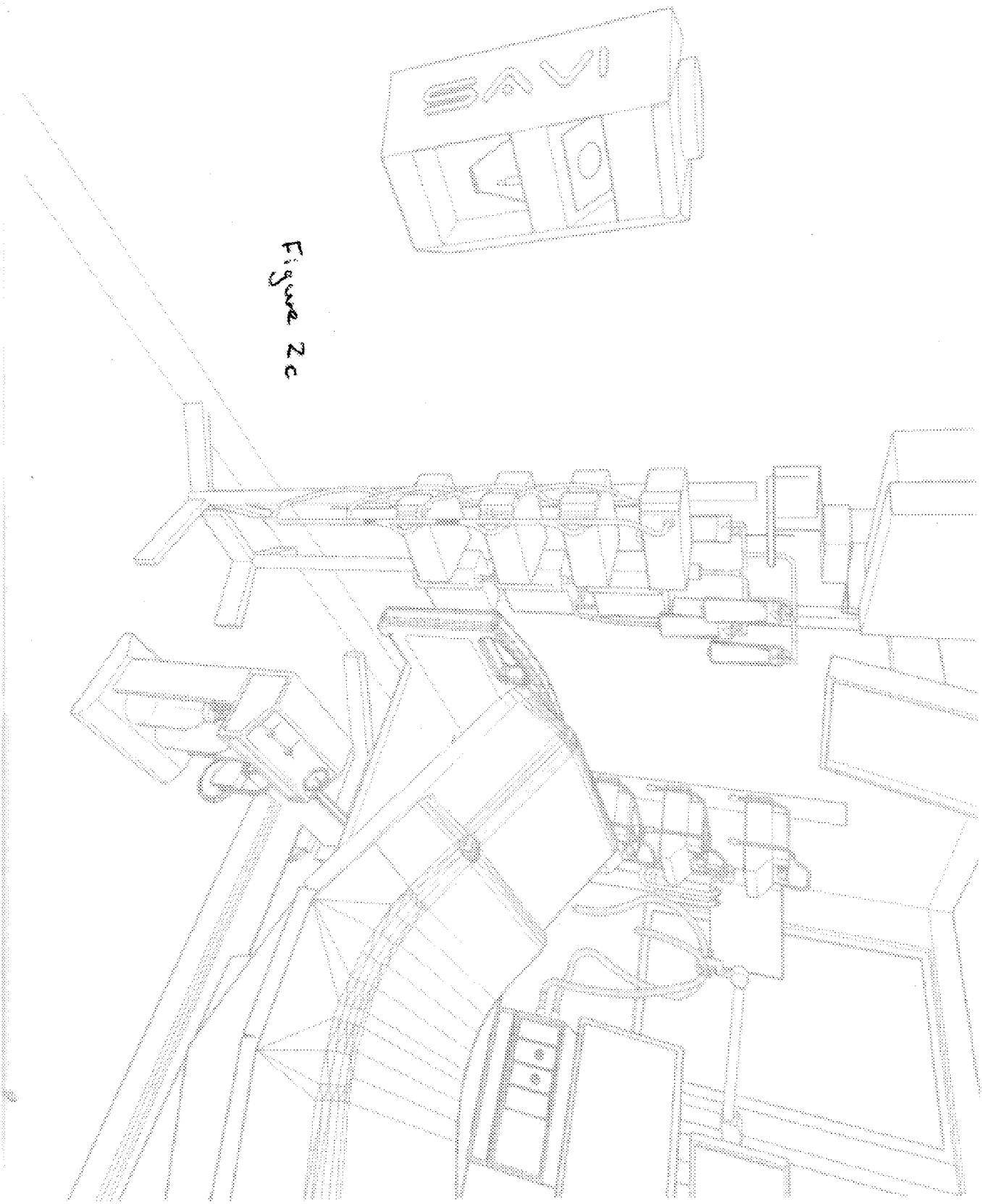


Figure 2c

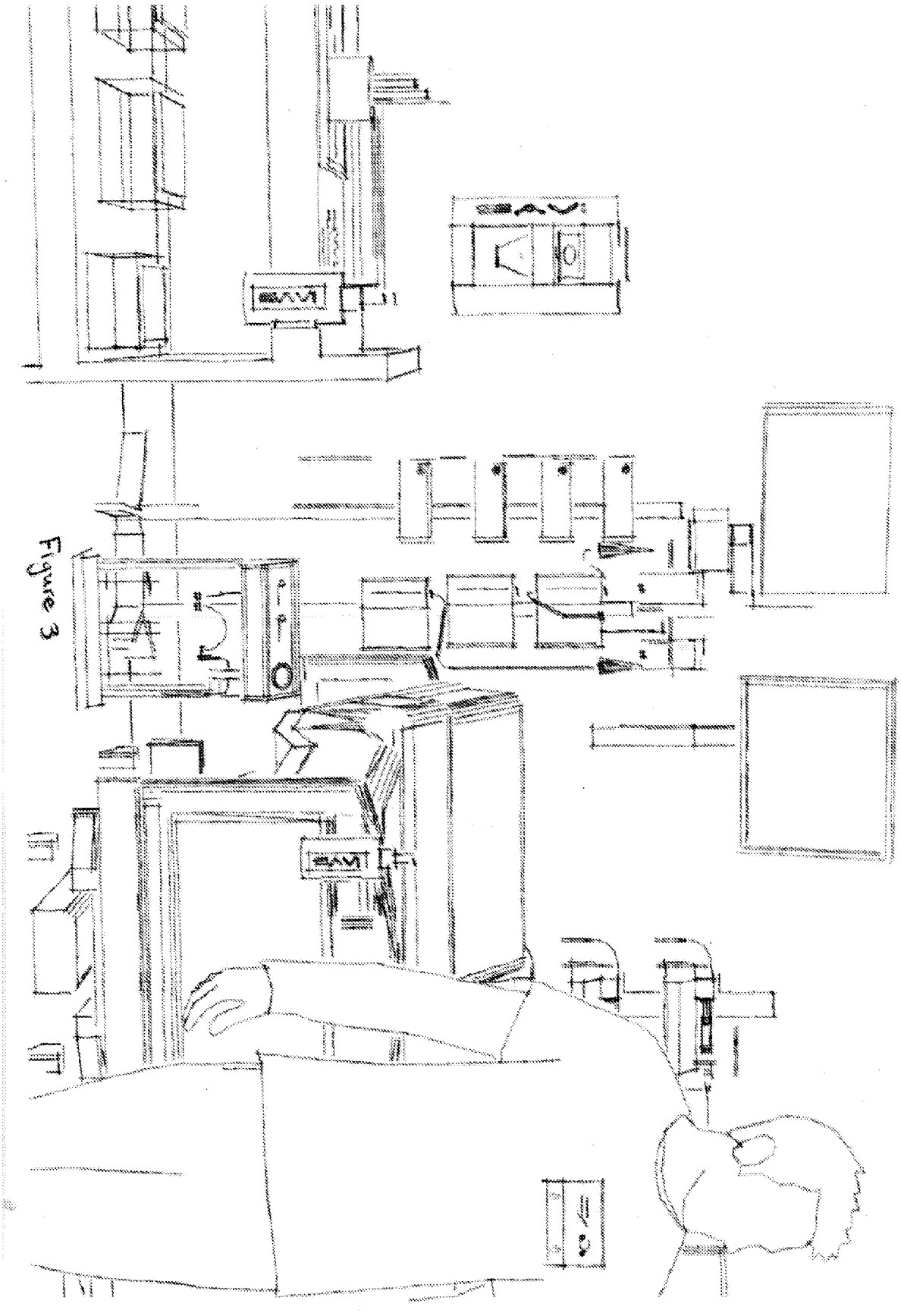
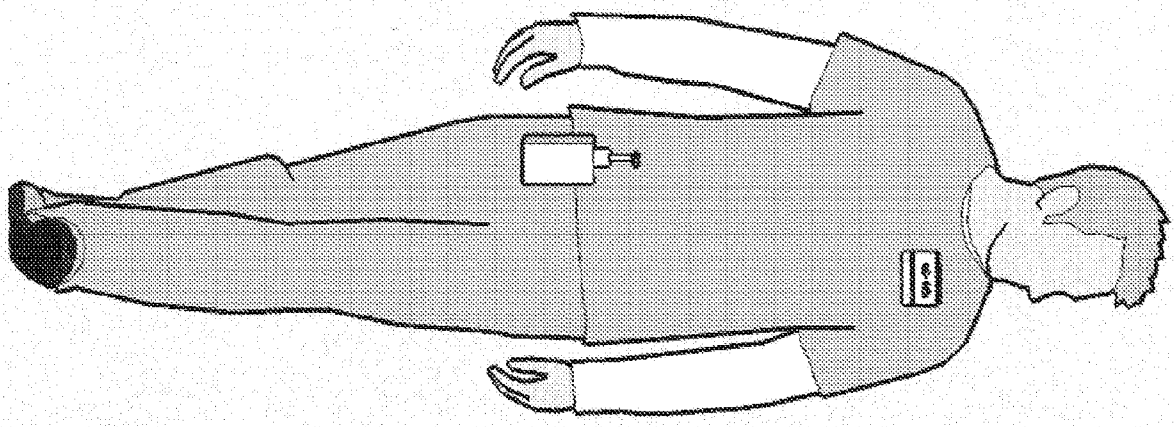


Figure 3

Figure 4.



# INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/052656

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08B21/24 B05B11/00 G06F19/00 A47K5/12
ADD.

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)
G08B B05B G06F A47K

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)
EPO-Internal, WPI Data

C. 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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| Y | paragraphs [0090] - [0095]; figures 1-2<br>paragraphs [0102], [0103], [0107]<br>paragraphs [0130] - [0132]; figures 2a,3a<br>paragraphs [0138], [0140], [0142] - [0145], [0154] | 1-18,23 |

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 22 January 2014 | 30/01/2014 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Russo, Michela |

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International application No
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