

**NON-CONTACT RESPIRATION MONITOR**

This application claims the benefit of priority under 35 U.S.C. § 119(e) from U.S. Application Ser. No. 60/501,403 filed Sep. 10, 2003.

## FIELD OF THE INVENTION

The present invention relates to devices for detecting or monitoring a vital of a patient. More particularly, the present invention relates to a device for detecting or monitoring the respiration of a patient.

## BACKGROUND OF THE INVENTION

Determining whether an unconscious patient's heart is beating and whether the patient is breathing are the two most important vital signs in an emergency situation. In many situations, rescuers can check these vitals by touching the individual with their hands or an instrument, such as a stethoscope. However, as will be appreciated, there are situations and environments where contacting the patient's body with hands or instruments is not recommended or feasible. One particular example involves situations where a patient loses consciousness while in protective gear, such as chemical gear, which, obviously, cannot be removed to allow access to the body of the wearer without risk of exposing the patient to the environment the protective gear is protecting the patient from. In these situations, the patient typically has to be removed to a safe environment before the protective gear can be removed and the condition and vitals of the patient examined.

There are devices for continuously detecting and monitoring a patient's vital signs in chemical gear, or otherwise, known in the art. Typically, these devices are monitors operatively associated with the wearer such that the vital to be detected may be sensed and continuously transmitted to a remote receiver in a safe area. For example, a pulse monitor may be attached to the wearer and adapted to broadcast the wearer's pulse rate to a remote receiver for monitoring the wearer's pulse. These prior art devices are used in numerous fields for a wide variety of applications where continuous monitoring of the condition of a subject is important.

A device for detecting (or monitoring) the pulse of a patient is extremely important in emergency situations. Various treatment options depend on the existence and/or strength of the patient's pulse. For example, a person without a detectable pulse requires immediate life-saving measures to be undertaken. Accordingly, it is desirable to provide remote monitors for pulse and/or other vitals in connection with chemical protective gear. However, there are situations where this is unfeasible. For example, take the modern battlefield. Modern warfare and weapons of mass destruction pose severe risk of mass casualty situations involving soldiers (and possibly civilians) wearing protective gear, such as for example, Level IV MOPP gear or gas masks. It is difficult to attempt to remotely monitor continuous broadcasts of the vitals of a battlefield full of soldiers wearing protective gear that sends out signals of the wearer's vital(s). Accordingly, as will be appreciated, in the unfortunate event of a catastrophic incident resulting in mass casualties, there is no way of triaging the condition of an unconscious patient in view of the fact that the protective masks and/or garments cannot be removed to allow detection of pulse or respiration until the patient is moved out of harms way. In such a catastrophe, numerous lives may be

lost as medical personnel and rescuers cannot determine which unconscious soldiers have a pulse and which do not, and therefore, which soldiers to extract from the battlefield first.

Similar problems, yet on a smaller scale, are faced by firefighting personnel wearing supplied-air masks. Typically, rather than monitor the vital signs of firefighters, their gear is equipped with certain sensors having audible alarms. The most common sensor utilized by firefighters projects a loud audible alarm (and strobe light) if the wearer has not moved in a given span of time. Such an alarm indicates to other firefighters that the individual may be trapped under debris, may need assistance, or may be unconscious. One drawback with these devices is that it does not allow others to determine the vitals of the wearer, instead only the lack of movement. These devices are simply alarms to allow others to find the individual needing assistance (despite low visibility) and extract them to safety for further treatment. As will be appreciated, these devices are ill-suited for the battlefield for a number of reasons. First, soldiers often lie motionless for extended periods to avoid detection or otherwise. Secondly, and more importantly, in mass casualty situations such as those on a battlefield, alarms indicating the lack of movement are of no use. It is not the movement of the soldier, but rather the soldier's condition, that is critical to evaluate immediately.

The foregoing underscores some of the disastrous consequences associated with conventional prior art devices for detecting or monitoring the vital(s) of a patient. Furthermore, the foregoing highlights the critical, yet unresolved need in the art for a device and method for detecting and/or monitoring the vital(s) of a patient wearing protective gear.

## SUMMARY OF THE INVENTION

The present invention overcomes the serious practical problems described above and offers new advantages as well. One object of the invention is to provide a non-contact device for detecting a vital of a patient. According to this object of the invention, one aspect of the invention is to provide a device for detecting the vital of a patient wearing protective gear, such as a gas mask. According to this object, another aspect of the invention is to provide a device for detecting respiration of a patient wearing protective gear, such as a gas mask. According to these aspects of the invention, one advantageous feature of the invention allows the device to monitor a vital of a patient. In one preferred embodiment, the device provides visual confirmation of the presence or absence of respiration in a patient. In another preferred embodiment, the device provides audible confirmation of the presence or absence of respiration of a patient. In yet another preferred embodiment, the device provides quantitative information concerning the respiration of a patient.

Another object of the invention is to provide a non-contact device such as those described above which may be selectively associated with a patient to detect a vital of the patient. According to this object of the invention, one aspect of the invention is to provide a device which may be removably coupled to the mask of a patient to detect the presence or absence of a vital. According to this object, another aspect of the invention is to provide a portable device which a user may couple to a patient's gas mask to detect the presence or absence of respiration and then remove the device.

It is yet another object of the invention to provide a non-contact device such as those described above which is