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(54) **Cardio-pulmonary resuscitation device with feedback from measurement of pulse and/or blood oxygenation**

Apparat für kardiopulmonäre Reanimation mit Feedback von Messungen des Pulses und/oder des Sauerstoffgehalts des Blutes

Dispositif de réanimation cardio-respiratoire avec feedback de mesure du rythme cardiaque et/ou de l'oxygénation sanguine

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Description

Technical Field

[0001] This invention relates to devices for assisting cardiac resuscitation.

Background

[0002] This invention relates to the field of cardiac resuscitation, and in particular to devices for assisting rescuers in performing cardio-pulmonary resuscitation (CPR). CPR is used to mechanically support circulation in subjects with cardiac arrest. Although, the American Heart Association (AHA) has proposed guidelines for CPR, the effectiveness of this intervention is difficult to actively assess as it is performed. The ZOLL Medical AED Plus system provides rescuers with valuable feedback on compression rate (metronome) and depth (audible prompts) to promote the proper CPR methodology.

[0003] US 2001/0047140 discloses a resuscitation system comprising a CPR pad interconnected with a substrate configured to be located over a region of a patient's body appropriate for chest compressions when electrodes are positioned over regions of the patient's body appropriate for defibrillation. A pulse detection system detects whether the patient has a pulse when the substrate is in contact with the patient. A force-sensing resistor is used to sense the force and timing of chest compressions, and provides information to a resuscitation control box, which provides the rescuer with feedback if the rescuer is providing insufficient force and provides coaching as to the rate at which CPR is performed.

[0004] WO 02/091905 discloses a CPR chest compression/decompression device with electronic stethoscope comprising an applicator body that is configured to be adhered to a patient's chest. A stethoscope system is operably coupled to the applicator body to sense the patient's heartbeat and to disseminate information on the heartbeat to a rescuer. A force sensor may be employed to measure and display a force applied, and a metronome timer circuit may be employed to provide visual and audio timing signals to guide the rescuer in performing chest compressions and decompressions. The system may be configured to produce voice commands to guide the rescuer during a procedure. Infonnation on the patient's heartbeat may be provided to the rescuer by voice prompts produced by the stethoscope system.

Summary

[0005] I have discovered that improved feedback can be provided is a rescuer providing CPR by providing adjustments to the metronome and additional audible prompts based on the effectiveness of the CPR on the victim's circulation as measured by pulse rate and SpO2 from oximetry.

[0006] In a first aspect, the invention features an apparatus for assisting a rescuer in performing CPR on a victim. The apparatus comprises at least one of a pulse sensor for measuring the pulse rate of the victim and an SpO2 sensor for measuring blood oxygenation; electronics for processing the output of the sensor or sensors and determining one or more actions that the rescuer should perform to improve the CPR being performed; and a prompting device for conveying the one or more actions to the rescuer.

[0007] Preferred implementations of this aspect of the invention may incorporate one or more of the following. The apparatus may further comprise an external defibrillator. The apparatus may comprise an SpO2 sensor but not a pulse sensor. The apparatus may comprise a pulse sensor but not an SpO2 sensor. The apparatus may further comprise a chest compression sensor. The chest compression sensor may be an acclerometer. The electronics may be provided with information on compression rate. The compression rate may be sensed or derived from a chest compression sensor. The prompting device may comprise a device that conveys a desired rate of compression to the rescuer. The device that conveys a desired rate of compression to the rescuer may comprise a metronome. The prompting device may comprise a speaker and associated electronics for conveying audible instructions. The electronics may comprise a digital computer executing computer software. The electronics may compare compression rate to a desired CPR rate. The electronics may compare a measured level of blood oxygenation to a desired level. The electronics may provide a prompt instructing the rescuer to release from the chest during CPR delivery if the sensors indicate that the rescuer is not adequately releasing from the chest. The electronics may provide a prompt to the user to press harder if the pulse sensor indicates that there is no measured pulse rate. The electronics may provide a prompt to press harder if the sensor indicate that a pulse is detected but SpO2 is below a defined level. The electronics may provide a prompt to increase compression rate if the sensors indicate that a pulse is detected, that chest compressions are at a defined level, and that SpO2 is still below a defined level. The electronics may provide prompts to increase compression rate and compression pressure simultaneously based on measurements from sensors. The electronics may provide a prompt for the user to interrupt chest compressions to give one or more breaths. The prompt to give one or breaths may be issued when sensor measurements show that blood circulation is occurring and that the cause of a falling SpO2 level may be an increase in metabolism. The electronics may provide a prompt to continue CPR without interruption for breathing

based on SpO2 levels that were above a given threshold so as to ensure that there would be no break in circulation when blood oxygen levels remained high and ventilation was not yet required.

[0008] Other features and advantages of the invention will be apparent from the following detailed description, and from the drawings and claims.

Brief Description of the Drawings

[0009]

FIG. 1 is a diagrammatic view of a rescuer providing CPR to a victim with the aid of an implementation of the invention.
FIG. 2 is a block diagram of an implementation of the invention.
FIG. 3 is a flow chart of the operation of an implementation of the invention.

Detailed Description

[0010] There are a great many possible implementations of the invention, too many to describe herein. Some possible implementations that are presently preferred are described below. It cannot be emphasized too strongly, however, that these are descriptions of implementations of the invention, and not descriptions of the invention, which is not limited to the detailed implementations described in this section but is described in broader terms in the claims.

[0011] The descriptions below are more than sufficient for one skilled in the art to construct the disclosed implementations. Unless otherwise mentioned, the processes and manufacturing methods referred to are ones known by those working in the art

[0012] FIGS. 1-2 show an AED implementation of the invention that can measure CPR rate and depth with an accelerometer, and SpO2 and pulse rate with an oximeter probe (FIG. 1). These measures are provided as inputs to a software module, which assesses whether the CPR is producing adequate pulse rate and oxygenation (FIG. 2). The SpO2 sensor can be located in various locations, e.g., on the finger to provide measurements on the peripheral circulation and/or on the forehead to reflect cerebral circulation.

[0013] The user is initially prompted with the use of a metronome (i.e., a rate indicating prompt) and audible instructional prompts to perform CPR optimally according to AHA guidelines (100 cpm, 1.5 - 2.0 inch compression). Based on the current compression rate, compression depth, SpO2 measurement, and pulse rate, the compression rate and compression depth can be altered from the recommended guideline via the metronome and voice prompts to improve circulation. For example, the feedback control system via the AED metronome and audible prompts can operate with the user in the following ways based on the state of the CPR and the state of the patient (FIG. 3):

1. If a pulse rate is measured that matches the CPR rate and the SpO2 has reached a defined level, CPR may be considered adequate and no changes to the metronome or additional voice prompts may be required.
2. The user may be prompted to release the chest if the CPR system has determined that the chest is not being completely released at the end of each compression.
3. If there is no pulse rate from the oximeter, the user may be prompted to pressure harder until the pulse rate is detected.
4. If there is a detected pulse rate and the SpO2 level has not reached a defined level, the user may be prompted to press harder to increased in the oxygen saturation.
5. If the increase in compression depth meets a safe maximum and does not achieve the desired SpO2 level (in item 3), the metronome rate can be increased to a safe maximum rate to increase saturation.
6. Based on the current state of the compression rate and depth and the pulse rate and SpO2, both the metronome rate and the compression prompts can be used simultaneously to more quickly move to a desired operating point.
7. The user may be prompted to continue CPR without interruption for breathing based on SpO2 levels that were above a given threshold. This would ensure that there would be no break in circulation when blood oxygen levels remained high and ventilation was not yet required. There is literature which indicates that within an initial period following collapse there is sufficient oxygen reserve in the blood that ventilation is not necessary and CPR should not be interrupted. Monitoring the SpO2 and guiding the user through audible prompts would suppress breathing and direct uninterrupted CPR.

[0014] The feedback system may, also, be used to prompt the rescuer to deliver rescue breathing when chest compression depth and rate are appropriate but arterial blood oxygen saturation is falling from a previously higher level. This condition may indicate that although chest compressions are adequate to circulate blood, the level of blood oxygen has diminished due to metabolism and additional oxygen delivery (accomplished by rescue breathing) is required to improve the victim's condition. Based upon detection of this set of conditions, the feedback control system will issue audible

prompts instructing the rescuer to stop compressions for a brief period and deliver one or several rescue breaths. The system will then prompt the rescuer to resume chest compressions as it monitors CPR, pulse and oxygen saturation parameters to estimate the success of CPR efforts and provide further prompts related to compression rate, depth and breathing.

[0015] Similarly, if the pulse oximetry sensor detects an increase from a lower level to a higher level of blood oxygen saturation in peripheral tissues during CPR, the feedback control system may determine that CPR is being effectively delivered. Under these conditions, the system will continue prompting the rescuer to maintain his/her rate and depth of chest compressions until the oxygen saturation plateaus and/or begins to decrease. When this occurs, the feedback system may (based upon detected compression rate, depth, pulse rate and blood oxygen saturation) prompt the rescuer to change his/her chest compression depth or rate or alternatively recommend the delivery of rescue breaths to the victim.

[0016] The system is designed as a feedback control system utilizing program logic (Figure 3), or linear and/or non-linear optimization techniques focused on maximizing the SpO2 as the cost function.

[0017] The CPR rate and depth measures can be used to ensure the control system remains within reasonable bounds based on predefined compression rate and depth ranges. These ranges are determined based on the established range for effective CPR.

[0018] Many other implementations of the invention other than those described above are within the invention, which is defined by the following claims. For example, other types of sensors could be used to provide SpO2 and pulse rate; each could be measured by a separate sensor. In some implementations, only one or the other of the parameters could be measured and used as the basis for feedback to the rescuer. The term SpO2 sensor has been used herein, but it should be understood that any sensor that provides a measure of blood oxygenation or pulmonary function is within what is meant by SpO2 sensor. Similarly, the pulse sensor can be any of various types that detect pulsatile movement of blood in the circulatory system (e.g., pulse oximetry based pulse sensors, piezoelectric sensors, etc.).

Claims

1. Apparatus for assisting a rescuer in performing CPR on a victim, the apparatus comprising:

at least one of a pulse sensor for measuring the pulse rate of the victim and an SpO2 sensor for measuring blood oxygenation;
electronics for processing the output of the sensor or sensors and determining therefrom one or more actions that the rescuer should perform to improve delivery of chest compressions;
and
a prompting device for conveying the one or more actions to the rescuer

wherein the actions conveyed to the rescuer to improve chest compressions include at lest one of the following: changing the rate at which the rescuer delivers chest compressions; and changing the pressure applied to the chest.

2. The apparatus of claim 1 further comprising an external defibrillator.

3. The apparatus of claim 1 wherein the apparatus comprises an SpO2 sensor but not a pulse sensor.

4. The apparatus of claim 1 wherein the apparatus comprises a pulse sensor but not an SpO2 sensor.

5. The apparatus of claim 1 further comprising a chest compression sensor.

6. The apparatus of claim 5 wherein the chest compression sensor is an accelerometer.

7. The apparatus of claim 1 wherein the electronics is provided with information on compression rate.

8. The apparatus of claim 7 wherein the compression rate is sensed or derived from a chest compression sensor.

9. The apparatus of claim 1 wherein the prompting device comprises a device that conveys a desired rate of compression to the rescuer.

10. The apparatus of claim 9 wherein the device that conveys a desired rate of compression to the rescuer comprises a metronome.

11. The apparatus of claim 1 wherein the prompting device comprises a speaker and associated electronics for conveying audible instructions.

12. The apparatus of claim 1 wherein the electronics comprises a digital computer executing computer software.

13. The apparatus of claim 1 wherein the electronics compares compression rate to a desired CPR rate.

14. The apparatus of claim 1 wherein the electronics compares a measured level of blood oxygenation to a desired level.

15. The apparatus of claim 1 wherein the electronics provides a prompt instructing the rescuer to release from the chest during CPR delivery if the sensors indicate that the rescuer is not adequately releasing from the chest.

16. The apparatus of claim 1 wherein the electronics provides a prompt to the user to press harder if the pulse sensor indicates that there is no measured pulse rate.

17. The apparatus of claim 1 wherein the electronics provides a prompt to press harder if the sensor indicate that a pulse is detected but SpO2 is below a defined level.

18. The apparatus of claim 1 wherein the electronics provides a prompt to increase compression rate if the sensors indicate that a pulse is detected, that chest compressions are at a defined level, and that SpO2 is still below a defined level.

19. The apparatus of claim 1 wherein the electronics provides prompts to increase compression rate and compression pressure simultaneously based on measurements from sensors.

20. The apparatus of claim 1 wherein the electronics provides a prompt for the user to interrupt chest compressions to give one or more breaths.

21. The apparatus of claim 20 wherein the prompt to give one or more breaths is issued when sensor measurements show that blood circulation is occurring and that the cause of a falling SpO2 level may be an increase in metabolism.

22. The apparatus of claim 1 wherein the electronics provide a prompt to continue CPR without interruption for breathing based on SpO2 levels that were above a given threshold so as to ensure that there would be no break in circulation when blood oxygen levels remained high and ventilation was not yet required.

Patentansprüche

1. Vorrichtung zum Unterstützen von Rettungspersonal bei der Durchführung einer Herz-Lungen-Reanimation an einem Opfer, wobei die Vorrichtung umfasst:

   einen Pulssensor zum Messen der Pulsrate des Opfers und/oder einen SpO2-Sensor zum Messen der Sauerstoffversorgung des Blutes,
   eine elektronische Einrichtung zum Verarbeiten der Ausgabe des Sensors oder der Sensoren und zum Bestimmen einer oder mehrerer Aktionen, die das Rettungspersonal durchführen sollte, um die Aufbringung von Brustkorbkompressionen zu verbessern, und
   eine Mittelungsvorrichtung zum Vermitteln der einen oder mehreren Aktion (en) an das Rettungspersonal, wobei die dem Rettungspersonal übermittelten Aktionen zur Verbesserung der Brustkorbkompressionen mindestens eine der folgenden umfasst/umfassen: Ändern der Rate, mit der der Rettungspersonal Brustkorbkompressionen aufbringt, und Ändern des auf den Brustkorb ausgeübten Drucks.

2. Vorrichtung nach Anspruch 1, ferner mit einem externen Defibrillator.

3. Vorrichtung nach Anspruch 1, wobei die Vorrichtung einen SpO2-Sensor, aber keinen Pulssensor umfasst.

4. Vorrichtung nach Anspruch 1, wobei die Vorrichtung einen Pulssensor, aber keinen SpO2-Sensor umfasst.

5. Vorrichtung nach Anspruch 1, ferner mit einem Brustkorbkompressionssensor.

6. Verrichtung nach Anspruch 5, wobei der Brustkorbkompressionssensor ein Beschleunigungsmesser ist.

7. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung mit Information zur Kompressionsrate versorgt ist bzw. wird.

8. Vorrichtung nach Anspruch 7, wobei die Kompressionsrate von einem Brustkorbkompressionssensor abgetastet oder abgeleitet wird.

9. Vorrichtung nach Anspruch 1, wobei die Mitteilungsvorrichtung eine Vorrichtung umfasst, die dem Rettungspersonal eine gewünschte Kompressionsrate vermittelt.

10. Vorrichtung nach Anspruch 9, wobei die Vorrichtung, die dem Rettungspersonal eine gewünschte Kompressionsrate vermittelt, ein Metronom umfasst.

11. Vorrichtung nach Anspruch 1, wobei die Mitteilungsvorrichtung einen Lautsprecher und zugeordnete elektronische Einrichtungen zum vermitteln hörbarer Anweisungen umfasst.

12. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung einen Computersoftware ausführenden Digitalcomputer umfasst.

13. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung die Kompressionsrate mit einer gewünschten Herz-Lungen-Reanimationsrate vergleicht.

14. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung einen gemessenen Pegel der Sauerstoffversorgung des Bluts mit einem gewünschten Pegel vergleicht.

15. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung eine Mitteilung lieferte die das Rettungspersonal anweist, vom Brustkorb während einer kardiopulmonalen Reanimation abzulassen, wenn die Sensoren angeben, dass das Rettungspersonal nicht in angemessener Weise von dem Brustkorb loslässt.

16. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung eine Mitteilung an den Anwender liefert, fester zu drücken, falls der Pulssensor angibt, dass keine gemessene Pulsrate vorhanden ist.

17. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung eine Mitteilung liefert, fester zu drücken, falls der Sensor angibt, dass ein Puls erfasst wird, aber das SpO2 unter einem festgelegten Pegel ist.

18. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung eine Mitteilung liefert, die Kompressionsrate zu steigern, falls die Sensoren angeben, dass ein Puls erfasst wird, dass sich Brustkorbkompressionen auf einem festgelegten Pegel befinden, aber dass SpO2 immer noch unter einem festgelegten Pegel liegt.

19. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung Mitteilungen liefert, die Kompressionsrate und den Kompressionsdruck gleichseitig, basierend auf Messungen von den Sensoren, zu steigern.

20. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung eine Mitteilung für den Anwender liefert, Brustkorbkompressionen zu unterbrechen, um einen oder mehr Atemzüge zu vermitteln.

21. Vorrichtung nach Anspruch 20, wobei die Mitteilung, einen oder mehr Atemzüge zu vermitteln, erfolgt, wenn Sensormessungen zeigen, dass eine Blutzirkulation stattfindet und dass die Ursache eines Abfalls des SpOP2-Pegels eine Steigerung des Metabolismus sein kann.

22. Vorrichtung nach Anspruch 1, wobei die elektronische Einrichtung eine Mitteilung liefert, diet Herz-Lungen-Animation ohne Unterbrechung zum Atmen fortzusetzen, basierend auf SpO2-Pegeln, die über einem gegebenen Schwellenwert lagen, um sicherzustellen, dass keine Unterbrechung in der Zirkulation erfolgt, wenn Blutsauerstoff-Pegel hoch blieben und eine Beatmung noch nicht erforderlich war.

Revendications

1. Appareil permettant d'aider un secouriste à pratiquer une RCR sur une victime, l'appareil comprenant :

   au moins un élément parmi un capteur de pouls destiné à mesurer le rythme cardiaque de la victime et un capteur de SpO2 destiné à mesurer l'oxygénation du sang ;
   des équipements électroniques destinés à traiter la sortie du ou des capteur(s) et à déterminer à partir de cela une ou plusieurs action(s) que le secouriste devrait effectuer pour améliorer l'exercice de compressions thoraciques ; et
   un dispositif de messages guides permettant de transmettre la ou les action(s) au secouriste,

   dans lequel les actions transmises au secouriste pour améliorer les compressions thoraciques comprennent au moins une des actions suivantes : modification de la cadence à laquelle le secouriste exerce les compressions thoraciques ; et modification de la pression appliquée sur le thorax.

2. Appareil selon la revendication 1 comprenant en outre un défibrillateur externe.

3. Appareil selon la revendication 1 dans lequel l'appareil comprend un capteur de SpO2 mais pas de capteur de pouls.

4. Appareil selon la revendication 1 dans lequel l'appareil comprend un capteur de pouls mais pas de capteur de SpO2.

5. Appareil selon la revendication 1 comprenant en outre un capteur de compressions thoraciques.

6. Appareil selon la revendication 5 dans lequel le capteur de compressions thoraciques est un accéléromètre.

7. Appareil selon la revendication 1 dans lequel les équipements électroniques reçoivent des informations sur la cadence des compressions.

8. Appareil selon la revendication 7 dans lequel la cadence des compressions est détectée ou dérivée à partir du capteur de compressions thoraciques.

9. Appareil selon la revendication 1 dans lequel le dispositif de messages guides comprend un dispositif qui transmet une cadence des compressions souhaitée au secouriste.

10. Appareil selon la revendication 9 dans lequel le dispositif qui transmet une cadence des compressions souhaitée au secouriste comprend un métronome.

11. Appareil selon la revendication 1 dans lequel le dispositif de messages guides comprend un haut-parleur et les équipements électroniques associés permettant de transmettre des instructions sonores.

12. Appareil selon la revendication 1 dans lequel les équipements électroniques comprennent un ordinateur numérique exécutant un logiciel informatique.

13. Appareil selon la revendication 1 dans lequel les équipements électroniques comparent la cadence des compressions à une cadence de RCR souhaitée.

14. Appareil selon la revendication 1 dans lequel les équipements électroniques comparent un niveau d'oxygénation du sang mesuré à un niveau souhaité.

15. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent un message guide qui donne pour instruction au secouriste de relâcher le thorax pendant l'exercice de la RCR si les capteurs indiquent que le secouriste ne relâche pas de façon appropriée le thorax.

16. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent un message guide indiquant à l'utilisateur d'appuyer plus fort si le capteur de pouls indique qu'aucun rythme cardiaque n'est mesuré.

17. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent un message guide indiquant d'appuyer plus fort si le capteur indique qu'un pouls est détecté mais que la SpO2 est en dessous d'un niveau défini.

18. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent un message guide indiquant d'augmenter la cadence des compressions si les capteurs indiquent qu'un pouls est détecté, que les compressions thoraciques sont à un niveau défini, et que la SpO2 est toujours en dessous d'un niveau défini.

19. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent des messages guides indiquant d'augmenter la cadence des compressions et la pression des compressions simultanément sur la base de mesures provenant des capteurs.

20. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent un message guide indiquant à l'utilisateur d'interrompre les compressions thoraciques pour effectuer une ou plusieurs insufflations.

21. Appareil selon la revendication 20 dans lequel le message guide indiquant d'effectuer une ou plusieurs insufflations est délivré lorsque les mesures des capteurs montrent que la circulation sanguine a lieu et que la cause d'une chute du niveau de la SpO2 peut être une augmentation du métabolisme.

22. Appareil selon la revendication 1 dans lequel les équipements électroniques proposent un message guide indiquant de poursuivre la RCR sans s'interrompre pour effectuer des insufflations sur la base de niveaux de la SpO2 dépassant un seuil donné afin de garantir une circulation ininterrompue lorsque les niveaux d'oxygène dans le sang restent élevés et qu'une ventilation n'est pas encore nécessaire.

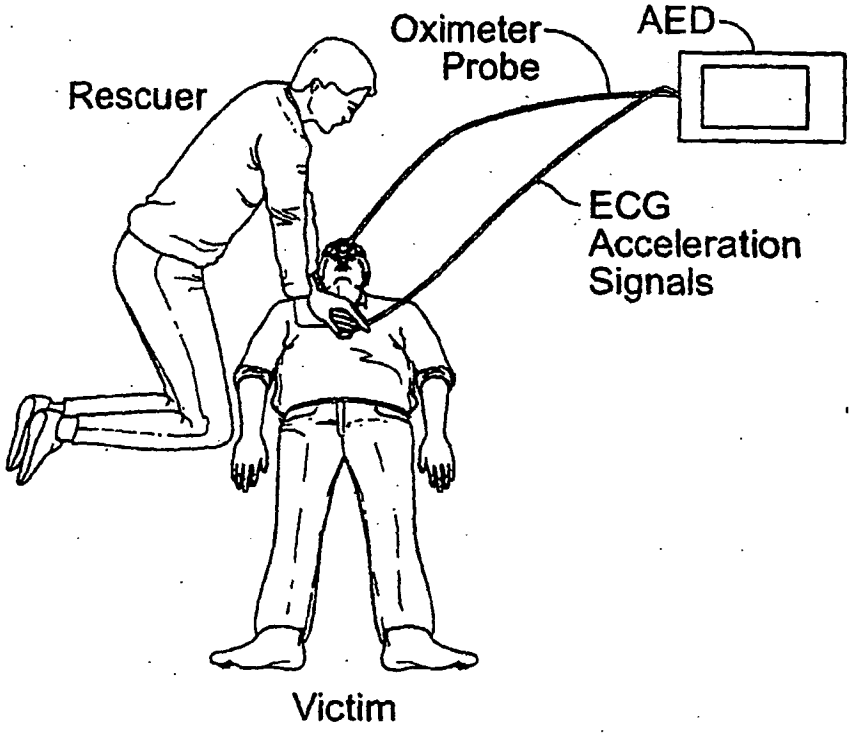
Oximeter
Probe
AED
Rescuer
ECG
Acceleration
Signals
Victim

FIG. 1

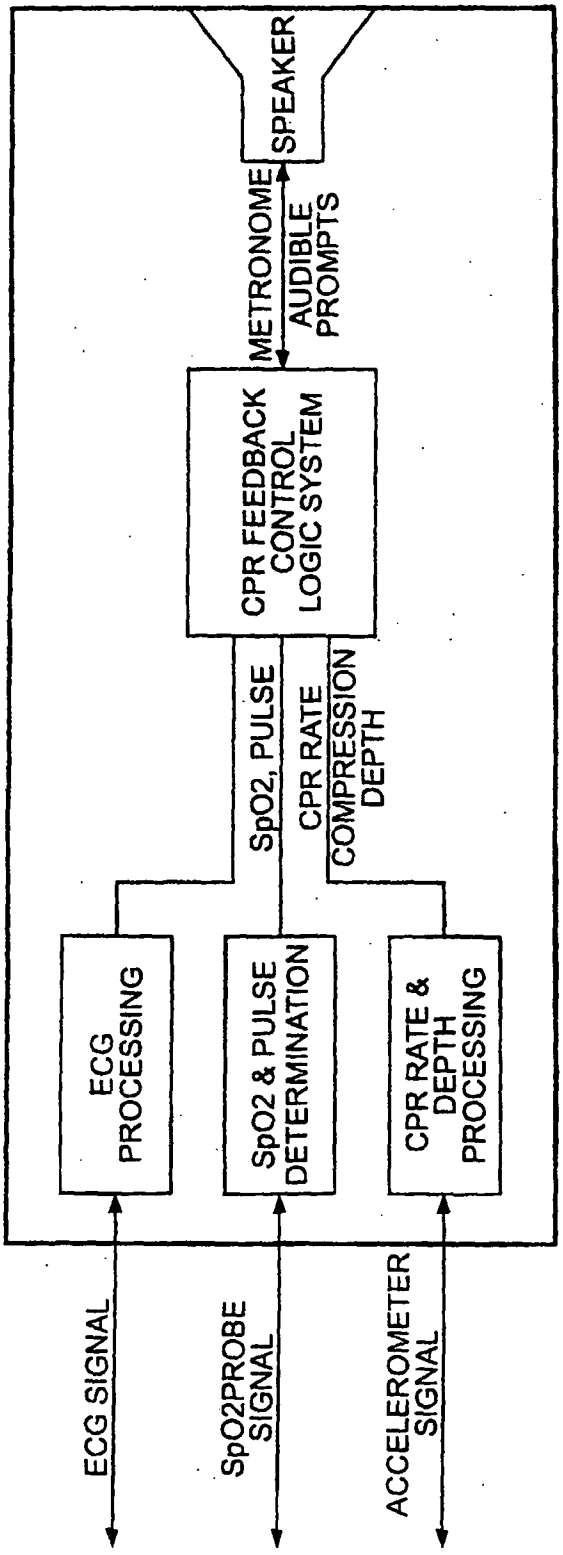
SPEAKER
METRONOME
AUDIBLE PROMPTS
CPR FEEDBACK CONTROL LOGIC SYSTEM
SpO2, PULSE
CPR RATE
COMPRESSION DEPTH
ECG PROCESSING
SpO2 & PULSE DETERMINATION
CPR RATE & DEPTH PROCESSING
ECG SIGNAL
SpO2PROBE SIGNAL
ACCELEROMETER SIGNAL

FIG. 2

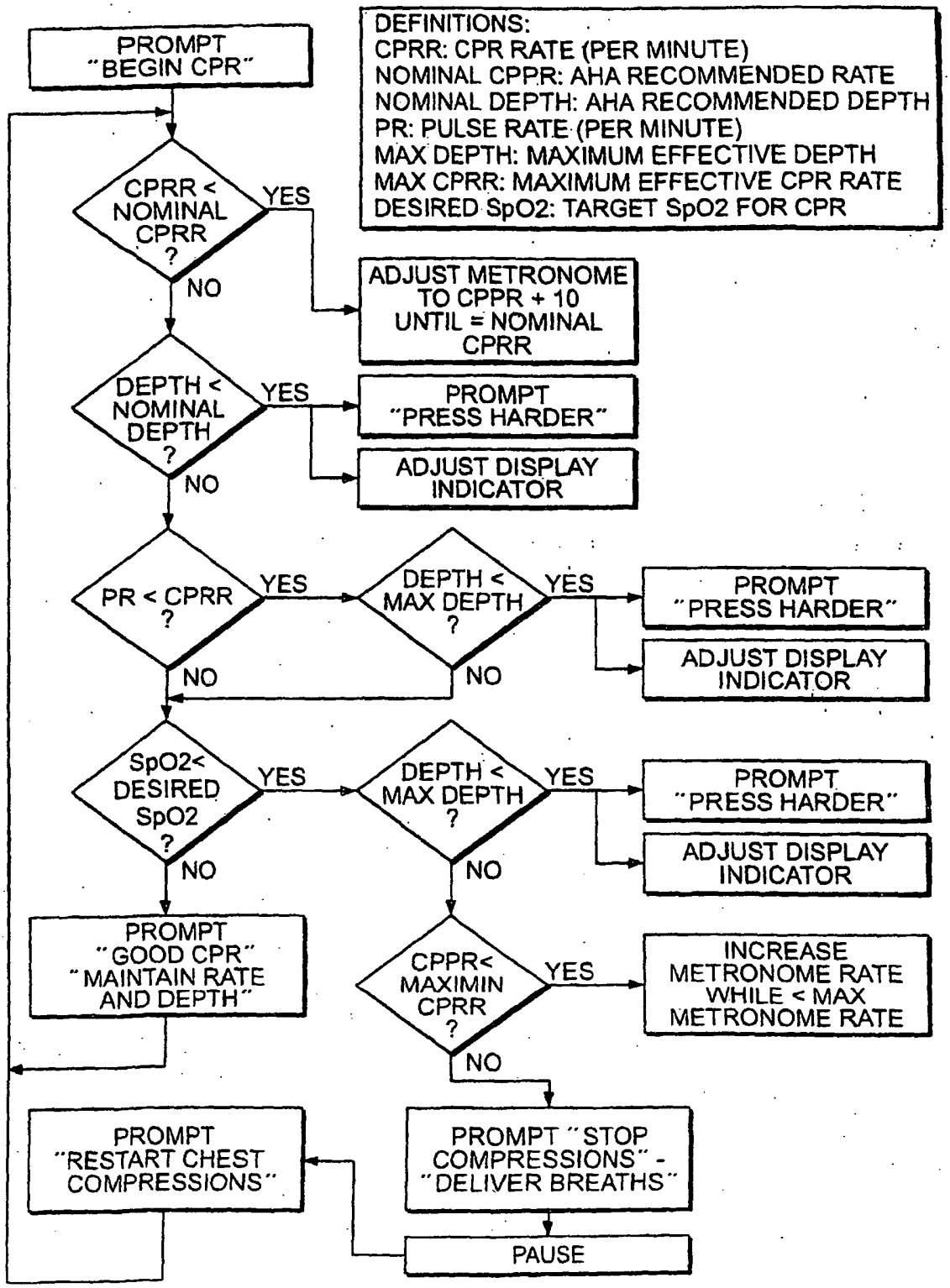
PROMPT "BEGIN CPR"
DEFINITIONS:
CPRR: CPR RATE (PER MINUTE)
NOMINAL CPPR: AHA RECOMMENDED RATE
NOMINAL DEPTH: AHA RECOMMENDED DEPTH
PR: PULSE RATE (PER MINUTE)
MAX DEPTH: MAXIMUM EFFECTIVE DEPTH
MAX CPRR: MAXIMUM EFFECTIVE CPR RATE
DESIRED SpO2: TARGET SpO2 FOR CPR
CPRR < NOMINAL CPRR ?
YES
NO
ADJUST METRONOME TO CPPR + 10 UNTIL = NOMINAL CPRR
DEPTH < NOMINAL DEPTH ?
YES
NO
PROMPT "PRESS HARDER"
ADJUST DISPLAY INDICATOR
PR < CPRR ?
YES
NO
DEPTH < MAX DEPTH ?
YES
NO
PROMPT "PRESS HARDER"
ADJUST DISPLAY INDICATOR
SpO2< DESIRED SpO2 ?
YES
NO
DEPTH < MAX DEPTH ?
YES
NO
PROMPT "PRESS HARDER"
ADJUST DISPLAY INDICATOR
PROMPT "GOOD CPR" "MAINTAIN RATE AND DEPTH"
CPPR< MAXIMIN CPRR ?
YES
NO
INCREASE METRONOME RATE WHILE < MAX METRONOME RATE
PROMPT "RESTART CHEST COMPRESSIONS"
PROMPT "STOP COMPRESSIONS" - "DELIVER BREATHS"
PAUSE

FIG. 3

专利名称(译)	具有来自脉搏和/或血氧测量的反馈的心肺复苏装置		
公开(公告)号	EP1491175B1	公开(公告)日	2006-08-30
申请号	EP2004253736	申请日	2004-06-23
[标]申请(专利权)人(译)	卓尔医学产品公司		
申请(专利权)人(译)	ZOLL医疗公司		
当前申请(专利权)人(译)	ZOLL医疗公司		
[标]发明人	BOUCHER DONALD R GEHEB FREDERICK		
发明人	BOUCHER, DONALD R. GEHEB, FREDERICK		
IPC分类号	A61H31/00 A61N1/39 G06F19/00 A61B5/00 A61B5/0402 A61B5/024 A61B5/0245 A61B5/11 A61B5/145 A62B9/00 A62B33/00		
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其他公开文献	EP1491175A1 EP1491175B2		
外部链接	Espacenet		

摘要(译)

一种辅助救助者对受害者进行心肺复苏的装置。该装置包括用于测量受害者脉搏率的脉冲传感器和用于测量血氧的SpO2传感器中的至少一个;用于处理传感器或传感器的输出并确定救助者应该执行的一个或多个动作以改善正在执行的CPR的电子设备;以及用于将一个或多个动作传达给救助者的提示装置。

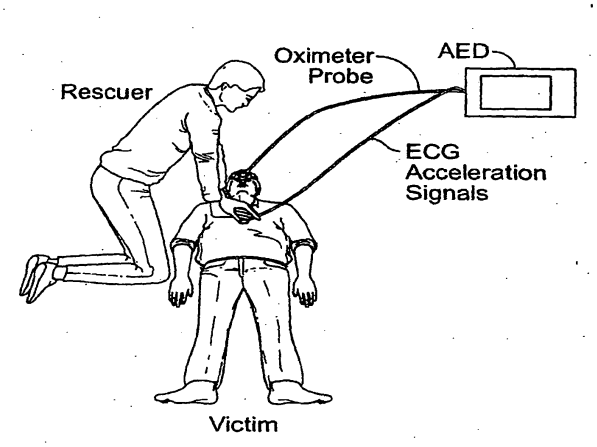

FIG. 1