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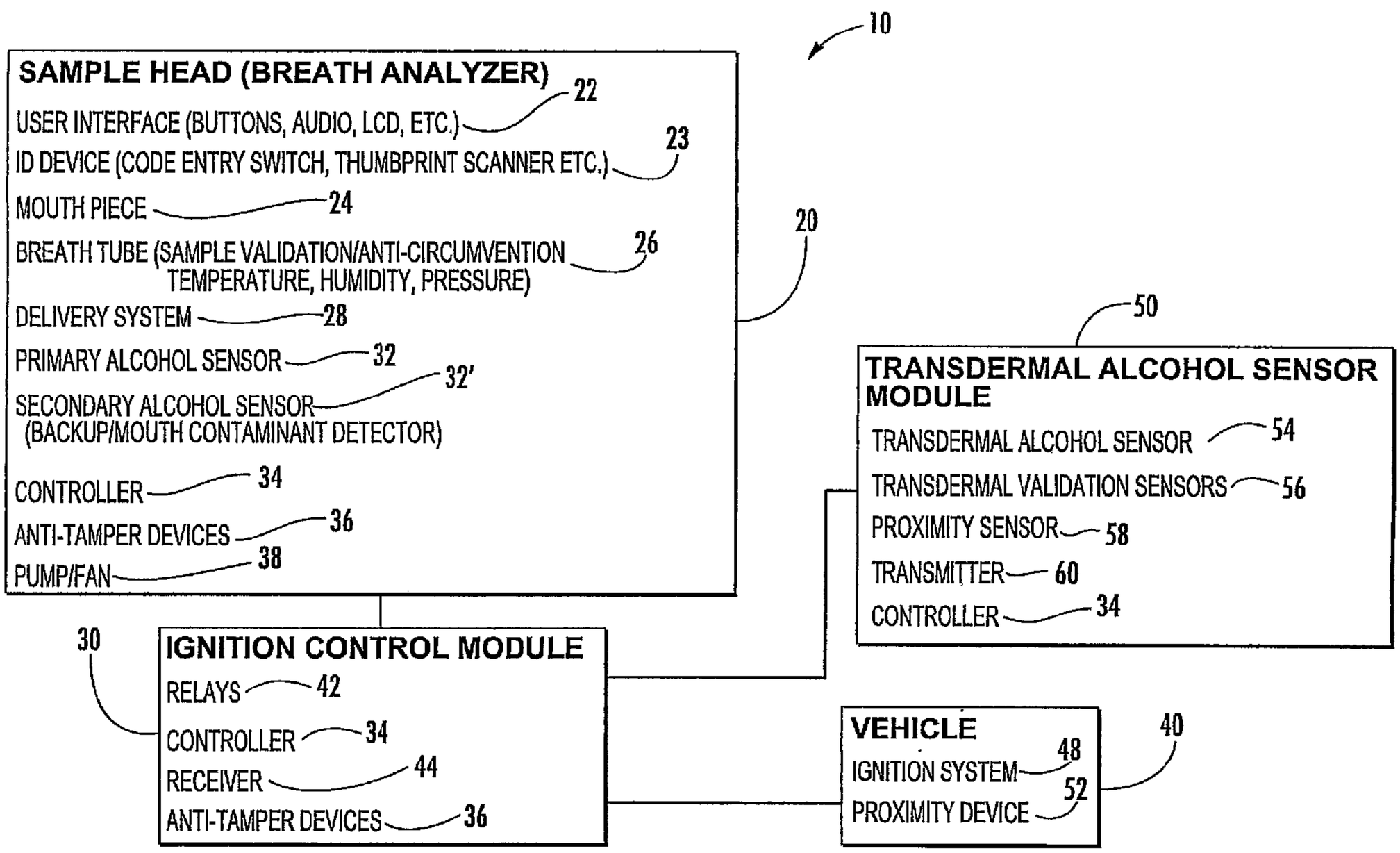

(57) Abrégé/Abstract:
A vehicle ignition interlock system includes a breath analyzer, a transdermal alcohol sensor configured to be worn by the vehicle operator, and a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle. The transdermal alcohol sensor is configured to be worn by the vehicle operator, and is configured to detect alcohol through the skin of the vehicle operator. The controller is configured to override one or more periodic breath analyzer retests if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor. The controller is configured to increase the frequency of periodic breath analyzer retests of the vehicle operator in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator. A proximity sensor detects proximity of the transdermal alcohol sensor relative to a vehicle operator area.

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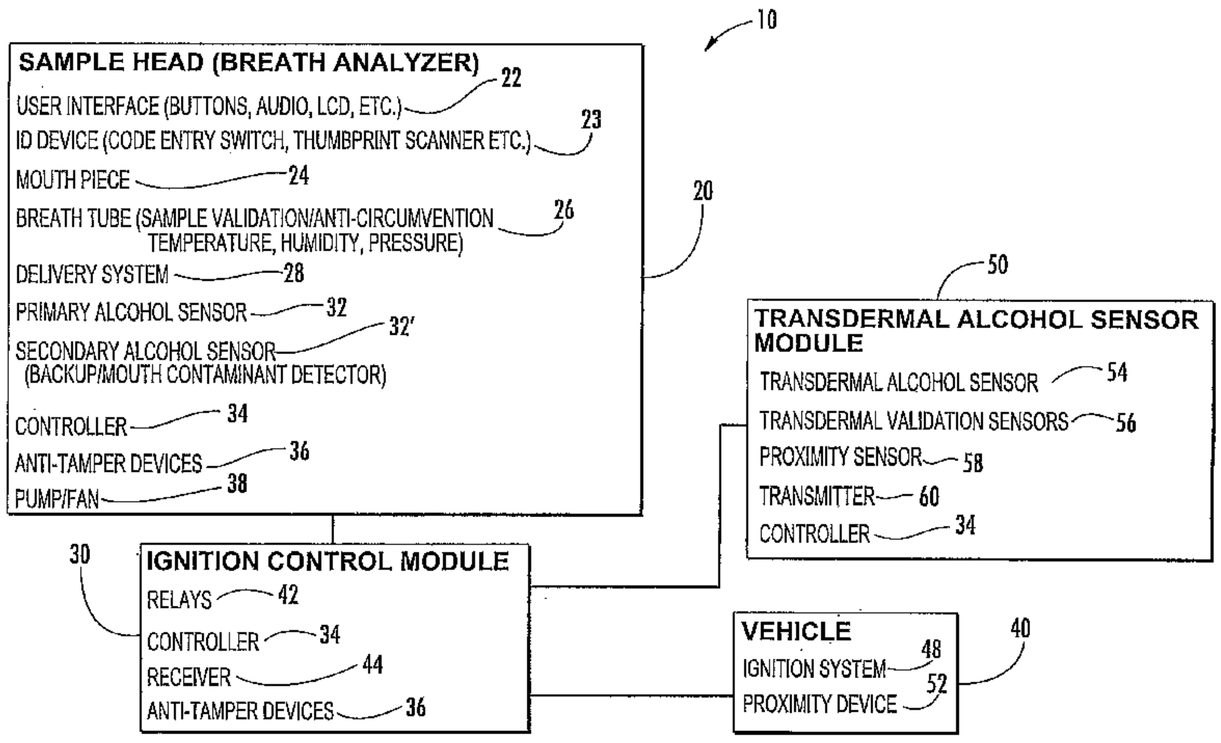
(54) Title: VEHICLE IGNITION INTERLOCK SYSTEMS HAVING TRANSDERMAL ALCOHOL SENSOR



(57) Abstract: A vehicle ignition interlock system includes a breath analyzer, a transdermal alcohol sensor configured to be worn by the vehicle operator, and a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle. The transdermal alcohol sensor is configured to be worn by the vehicle operator, and is configured to detect alcohol through the skin of the vehicle operator. The controller is configured to override one or more periodic breath analyzer retests if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor. The controller is configured to increase the frequency of periodic breath analyzer retests of the vehicle operator in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator. A proximity sensor detects proximity of the transdermal alcohol sensor relative to a vehicle operator area.

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VEHICLE IGNITION INTERLOCK SYSTEMS HAVING TRANSDERMAL ALCOHOL SENSOR

FIELD OF THE INVENTION

The present invention relates generally to sobriety testing devices and, more particularly, to vehicle ignition interlock systems.

BACKGROUND OF THE INVENTION

Vehicle operation by persons under the influence of alcohol is a well known safety problem in the United States and throughout the world. Thousands of deaths per year in the United States are attributable to drivers operating vehicles under the influence of alcohol. To address this problem, most states have established laws that prohibit operation of a vehicle by an individual with a blood alcohol content (BAC) greater than a preset value (*e.g.*, 0.08% BAC). In addition, "ignition interlock" systems have been developed which are directly connected to a vehicle's ignition system and are designed to prevent vehicle operation by inebriated individuals. Many states require the installation of ignition interlock systems in the vehicles of individuals convicted of driving under the influence of alcohol, particularly repeat offenders.

Conventional ignition interlock systems include a breath analyzer which measures the alcohol content of the breath of an individual. It is well known that the alcohol content of gas present in the alveoli of the lungs has an alcohol content directly proportional to that of the bloodstream of an individual. Blood alcohol content, thus, can be accurately determined by measuring breath alcohol content with a breath analyzer.

Typically, in order to start a vehicle equipped with an ignition interlock system, the driver must first blow into the breath analyzer. If the

driver's breath alcohol exceeds a preset limit, the vehicle's ignition is disabled and the vehicle is rendered inoperable. If the driver's breath alcohol is below the preset limit, ignition is permitted and the vehicle may be started. If a driver successfully passes an initial breath test and is allowed to start a vehicle, some ignition interlock systems will require one or more retests (typically random) of the driver after vehicle ignition. These retests may occur as the driver is operating the vehicle (referred to as "rolling retests") or the driver may be required to stop the vehicle prior to taking the retest. If the driver either refuses to take a retest or if the driver's breath alcohol exceeds a preset limit, vehicle operation may be disabled or may become disabled within a preset period of time. Exemplary ignition interlock devices that utilize breath analyzers are described in, for example, U.S. Patent Nos.: 3,780,311; 3,824,537; 3,831,707; and 4,592,443.

Operation of conventional ignition interlock systems is unsupervised. This lack of supervision has led to various attempts to bypass the breath analyzer such as by using air or other gases from balloons, bicycle pumps, gas station air hoses, and other sources. As a result, conventional ignition interlock systems may include breath temperature and humidity detection sensors to deter the use of non-human breath samples.

The lack of supervision has also led to attempts by vehicle operators to circumvent ignition interlock devices by using breath samples of non-driving individuals. To deter a person other than a vehicle operator from taking a breath test in order to start a vehicle, conventional ignition interlock systems have utilized various ways for confirming the identity of the person providing the breath sample. For example, the use of retina scans, voice identification, and face recognition have all been utilized. See, for example, U.S. Patent Application Publication Nos.: 2002/0089660, 2002/0084130 and 2002/0117287. Unfortunately, many of these systems are complicated and expensive.

Accordingly, there exists a need for a cost effective and reliable ignition interlock system that is capable of discriminating, without human supervision, between a vehicle operator and other persons in order to prevent circumvention of the ignition interlock system.

SUMMARY OF THE INVENTION

In view of the above discussion, a vehicle ignition interlock system, according to embodiments of the present invention, includes a breath analyzer located within a vehicle, a transdermal alcohol sensor configured to be worn by the vehicle operator, and a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle. The breath analyzer is configured to detect the breath alcohol level of an operator of the vehicle. The transdermal alcohol sensor is configured to detect alcohol through the skin of the vehicle operator. The controller compares detected breath alcohol levels of the vehicle operator with a threshold value, and is configured to prevent vehicle ignition (*i.e.*, prevent the vehicle from being started) if a breath alcohol level detected by the breath analyzer is greater than or equal to a threshold value. Preferably, the controller and transdermal alcohol sensor are connected and communicate with each other wirelessly.

The controller is configured to require the vehicle operator to periodically take breath analyzer "retests" after vehicle ignition in order to allow vehicle operation to continue. According to embodiments of the present invention, the controller will override the requirement for one or more periodic retests if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor. In addition, the controller is configured to increase the frequency of periodic retests of the vehicle operator in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator. According to other embodiments of the present invention, the controller may be configured to trigger a retest of the vehicle operator if alcohol is detected through the skin of the operator by the transdermal alcohol sensor.

According to embodiments of the present invention, the ignition interlock system includes a proximity sensor that detects the proximity of the transdermal alcohol sensor relative to the vehicle operator area (*i.e.*, to the driver's seat). For example, the proximity sensor may detect proximity to a magnetic field that is generated by a magnet located in the vehicle operator area (*e.g.*, on or adjacent to the steering column, the driver's seat, etc.).

The transdermal alcohol sensor may be secured to the skin of

the vehicle operator in any number of various ways. For example, the transdermal alcohol sensor may be attached to a bracelet or other device that is configured to be worn by the vehicle operator. According to embodiments of the present invention, other sensors that measure skin temperature and/or skin conductivity of an individual wearing the transdermal alcohol sensor may be associated with the transdermal alcohol sensor. Additional sensors may include pressure sensors that ensure that a transdermal alcohol sensor device is worn correctly by an individual.

According to embodiments of the present invention, an operator identification device (*e.g.*, a fingerprint identification device, hum-tone device, voice print device, face recognition device, PIN device, etc.) is operably connected to the controller and is configured to verify the identity of the vehicle operator via the operator identification device.

According to other embodiments of the present invention, the ignition interlock system includes a user selectable option that allows an individual to perform a breath alcohol test via the breath analyzer without enabling the vehicle ignition system. As such, the individual can use the ignition interlock system as a "personal", stand-alone breath analyzer.

According to other embodiments of the present invention, the vehicle ignition interlock includes a user interface that is operably connected to the controller and that is configured to display operational messages. The controller may also provide audible operational messages and prompts via the user interface, including voice messages in one or more languages.

According to an aspect of the present invention, there is provided a vehicle ignition interlock system, comprising:

a breath analyzer located within a vehicle, wherein the breath analyzer is configured to detect breath alcohol levels of an operator of the vehicle;

a transdermal alcohol sensor configured to be worn by the

vehicle operator, wherein the transdermal alcohol sensor is configured to detect alcohol through the skin of the vehicle operator; and

a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle, wherein the controller is configured to compare detected breath alcohol levels of the vehicle operator with a threshold value, wherein the controller is configured to prevent vehicle ignition if a breath alcohol level detected by the breath analyzer is greater than or equal to the threshold value, wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, and wherein the controller can override one or more required periodic breath alcohol tests of the vehicle operator via the breath analyzer if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor.

According to another aspect of the present invention, there is provided a vehicle ignition interlock system, comprising:

a breath analyzer located within a vehicle, wherein the breath analyzer is configured to detect breath alcohol levels of an operator of the vehicle;

an apparatus configured to be worn by the vehicle operator, wherein the apparatus comprises a transdermal alcohol sensor that is configured to detect alcohol through the skin of the vehicle operator, and a proximity sensor that detects proximity of the transdermal alcohol sensor relative to a vehicle operator area; and

a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle, wherein the controller is configured to compare detected breath alcohol levels of the vehicle operator with a threshold value, wherein the controller is configured to prevent vehicle ignition if a breath alcohol level detected by the breath analyzer is greater than or equal to the threshold value, and wherein the controller is configured to require periodic breath alcohol tests of the vehicle

operator via the breath analyzer, and wherein the controller can override one or more required periodic breath alcohol tests of the vehicle operator via the breath analyzer if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor.

According to another aspect of the present invention, there is provided a vehicle ignition interlock system, comprising:

a breath analyzer located within a vehicle, wherein the breath analyzer is configured to detect breath alcohol levels of an operator of the vehicle;

an apparatus configured to be worn by the vehicle operator, wherein the apparatus comprises a transdermal alcohol sensor that is configured to detect alcohol through the skin of the vehicle operator, and a proximity sensor that detects proximity of the transdermal alcohol sensor relative to a vehicle operator area;

a wireless transmitter operably connected to the transdermal alcohol sensor; and

a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle, wherein the controller is operably connected to the transdermal alcohol sensor via the wireless transmitter, wherein the controller is configured to compare detected breath alcohol levels of the vehicle operator with a threshold value, wherein the controller is configured to prevent vehicle ignition if a breath alcohol level detected by the breath analyzer is greater than or equal to the threshold value, and wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, wherein the controller can override one or more required periodic breath alcohol tests of the vehicle operator via the breath analyzer if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor, and wherein the controller is configured to increase the frequency of the periodic breath

alcohol tests of the vehicle operator via the breath analyzer in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram that illustrates an ignition interlock system, according to embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention now is described more fully hereinafter with reference to the accompanying drawing, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that

this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

It will be understood that when an element is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present. It will be understood that when an element is referred to as being "connected" or "attached" to another element, it can be directly connected or attached to the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly connected" or "directly attached" to another element, there are no intervening elements present. The terms "upwardly", "downwardly", "vertical", "horizontal" and the like are used herein for the purpose of explanation only.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. The terminology used in the description of the invention herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used in the description of the invention and the appended claims, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. All publications, patent applications, patents, and other references mentioned herein are incorporated herein by reference in their entirety. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

Referring now to **Fig. 1**, a vehicle ignition interlock system **10**, according to embodiments of the present invention, is illustrated. The illustrated system **10** includes a sample head **20** that serves the function of a breath analyzer that is configured to measure breath alcohol levels of an operator of a vehicle **40**. The terms "sample head" and "breath analyzer" are synonymous as used herein and are intended to be interchangeable. Exemplary sample head devices and their operation are described in U.S. Patent Nos.: 4,093,945; 4,902,628; and 4,901,058.

The sample head **20** is operably attached to an ignition control module **30**. The ignition control module **30** may be operably attached to

various components of a vehicle's ignition and electronics system **48**, which may include, but is not limited to, the battery, vehicle starter switch, tachometer, starter solenoid, etc. The ignition control module **30** may be operably connected to various vehicle systems/components, without limitation, to prevent starting and operation of the vehicle if the vehicle operator fails a breath alcohol test, as would be understood by those skilled in the art. The ignition control module **30** includes a controller **34**, which preferably includes a processor and/or other suitable programmable or non-programmable circuitry, including suitable software. The controller **34** may also include other devices as appropriate to control various devices described herein. The controller **34** may be one or more processors or circuitry designed to implement the various functions described herein. Moreover, the functions of the controller **34** may be performed by circuitry or processor(s) located within the various components of the ignition interlock system **10** described herein.

The sample head **20** is located within a vehicle **40** and is typically in a convenient location for use by an operator of the vehicle. Preferably, the sample head **20** is a handheld apparatus that can be easily handled by a vehicle operator prior to and during vehicle operation. According to embodiments of the present invention, the sample head **20** includes a user interface **22** that is operably connected to the controller **34** and that is configured to display and/or perform operational messages in any of a number of formats. This includes messages in one or more languages on a text display (*e.g.*, Liquid Crystal Display) and/or audible operational messages and prompts, including voice messages in one or more languages. At various times, instructions and prompts can be provided to the vehicle operator via the sample head **20** regarding when the next breath alcohol content retest is required, system status, etc. This can make vehicle operation safer, as the vehicle operator does not always need to actually look at the user interface **22** while driving. The user interface **22** may also include one or more push-button switches that the operator can depress to respond to various conditions or requests from the system **10**, including the need to enter operator identification information (*e.g.*, an entry code number or a thumbprint scan)

According to embodiments of the present invention, the sample

head **20** includes a mouthpiece **24**, which is used by the vehicle operator to blow a breath sample (*e.g.*, a "deep lung" breath sample) into one or more alcohol sensors **32** in the sample head **20**. The mouthpiece **24** communicates with the alcohol sensor(s) **32** via a breath tube **26** and a delivery system **28** (solenoid, syringe, etc.) that delivers a portion of a breath sample to the alcohol sensor(s) **32** for analysis. A deep lung breath sample is an expiratory sample of alveolar air (*i.e.*, air from the alveolar region of the lungs) which is known to have an alcohol concentration proportional to blood alcohol concentration of an individual. According to embodiments of the present invention, the sample head **20** may also include various features in the breath tube **26** that are configured to thwart circumvention by a vehicle operator, such as breath temperature sensors, breath humidity sensors, pressure sensors, etc., as would be understood by those skilled in the art.

Exemplary types of alcohol sensors **32** that can be used in accordance with embodiments of the present invention include, but are not limited to, electro-chemical fuel cells, infrared sensors, and metal oxide semiconductor sensors (*e.g.*, a Taguchi sensor, available from Figaro USA, Inc., Glenview, IL). Fuel cell technology, infrared technology and metal oxide semiconductor technology for use in detecting breath alcohol is well known in the art, and need not be described further herein.

The controller **34** is configured to compare detected breath alcohol levels of a vehicle operator with a threshold value, and to prevent vehicle ignition (*e.g.*, by opening a circuit in the vehicle ignition system, etc.) if a breath alcohol level of the vehicle operator, as measured by the sample head **20**, is greater than or equal to the threshold value (*e.g.*, 0.08% breath alcohol content, etc.). The term "prevent vehicle ignition" is intended to mean preventing a vehicle from being started, according to embodiments of the present invention. How a vehicle is prevented from being started may be accomplished in any of various ways known to those skilled in the art, and all of such ways are intended to be included within the scope of the present invention.

The ignition control module **30** contains relays **42** that are operably attached to a vehicle's ignition system **48**. The relays **42** are actuated by the controller **34** to open or close a circuit in the vehicle ignition

system **48**. As would be understood by those skilled in the art, the circuit enables the ignition system **48** to start the engine of the vehicle **40**.

If vehicle ignition is allowed (*i.e.*, the breath alcohol level of the vehicle operator is below the threshold value) the controller **34** periodically requires the vehicle operator to take a breath alcohol content retest in order to allow vehicle operation to continue. The retesting periodicity preferably is random, but can also be regular. A retest may be a "running" retest wherein the vehicle operator can continue to drive the vehicle **40**, or have the vehicle **40** "stand" while running, and blow a breath sample into the sample head **20**. A retest may also be an "engine off" test where the operator stops the vehicle **40** and turns off the engine prior to blowing a sample into the sample head **20**.

According to embodiments of the present invention, both the sample head **20** and the control module **30** have the capability to detect and log data into memory that may include system performance and conditions, conditions and results related to breath alcohol tests, functions of the vehicle, and possible evidence of system tampering or circumvention as detected by various anti-tamper devices (sensors) **36** in the system **10**.

According to embodiments of the present invention, the vehicle ignition interlock system **10** includes a transdermal alcohol sensor module **50** that is configured to be worn by a vehicle operator. The transdermal alcohol sensor module **50** is operably connected to (*i.e.*, communicates with) the controller **34** and is configured to keep a transdermal alcohol sensor **54** in continuous contact with the skin of a vehicle operator. The transdermal alcohol sensor **54** is configured to detect alcohol through the skin of the vehicle operator. Exemplary transdermal alcohol sensors **54** are available from Giner, Inc., Newton, MA. According to embodiments of the present invention, the ignition interlock system is designed to keep working if the transdermal alcohol sensor module **50** fails to operate.

According to embodiments of the present invention, the controller **34** will override the requirement for one or more periodic retests if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor module **50**. Because running retests can be a distraction to the driver of a vehicle, this aspect of the present invention is advantageous in that the need for running retests can be eliminated. In addition, the controller **34**

may be configured to increase the frequency of periodic retests of the vehicle operator in response to the transdermal alcohol sensor module **50** detecting alcohol through the skin of the operator. According to other embodiments of the present invention, the controller **34** may be configured to trigger a retest of the vehicle operator if alcohol is detected through the skin of the operator by the transdermal alcohol sensor **54**.

The transdermal alcohol sensor module **50** may be connected to the controller **34** via a hard-wire connection. Alternatively, the transdermal alcohol sensor module **50** may be connected to the controller **34** wirelessly. For example, a wireless transmitter **60** in the transdermal alcohol sensor module **50** may communicate wirelessly to a receiver **44** in the ignition control module **30**.

According to embodiments of the present invention, the transdermal alcohol sensor module **50** may be housed within or on a bracelet (or other device) that is configured to be worn by an individual. The bracelet (or other device) is configured to maintain the transdermal alcohol sensor **54** in contact with the skin of the individual and may be worn, for example, around the wrist, arm, leg, torso, neck, etc. of the individual. In addition, the transdermal alcohol sensor **54** may be attached to the skin of an individual in various other ways. For example, the transdermal alcohol sensor **54** may be adhesively attached to the skin of an individual. Embodiments of the present invention are not limited to the use of a bracelet. Various types of devices that can position the transdermal alcohol sensor **54** next to the skin of an individual may be utilized, without limitation.

According to embodiments of the present invention, one or more sensors **56** may be provided with the bracelet (or other device) that verify that the bracelet (or other device) is indeed being worn by a person (*e.g.*, strap pressure sensors, skin temperature sensors, skin conductivity sensors, etc.). These sensors **56** are designed to thwart circumvention of the transdermal alcohol sensor module **50** by placing the bracelet on objects, animals, etc. According to embodiments of the present invention, a proximity sensor **58** may be provided that detects proximity of the transdermal alcohol sensor module **50** relative to a vehicle operator area (*e.g.*, relative to the driver seat area, etc.). For example, a proximity device (*e.g.*, magnet) **52** may be located

on the steering column (or other area in close proximity to the driver's seat) of a vehicle and the proximity sensor **58** may be configured to detect proximity to the magnetic field generated by the magnet **52**. Alternatively, the transdermal alcohol sensor module **50** may contain a magnet **52** and a proximity sensor **58** may be located on the steering column or other area in close proximity to the driver's seat. The proximity sensor **58** is designed to thwart passengers within a vehicle from wearing the transdermal alcohol sensor module **50** in lieu of the vehicle operator. Various types of proximity sensors **58** can be used. For example, according to embodiments of the present invention, a proximity sensor **58** may be an RFID chip that is configured to communicate with an RFID reader positioned near the driver seat area of the vehicle **40**.

According to embodiments of the present invention, an operator identification device **23** (*e.g.*, a fingerprint identification device, hum-tone device, voice print device, face recognition device, PIN entry device, etc.) is operably connected to the controller **34** and is configured to verify the identity of the vehicle operator via the operator identification device **23**. The operator identification device **23** is configured to ensure that the vehicle operator is the one taking the breath alcohol tests and operating the vehicle **40**. According to other embodiments of the present invention, the operator identification device **23** may be an input device that is configured to receive input (*e.g.*, a PIN code) from a user. Failure to verify the identity of the vehicle operator can prevent the vehicle **40** from being started and operated. Some number of retry attempts may be allowed, as would be understood by those skilled in the art. Moreover, failure to verify the identity of the vehicle operator may result in a lockout period that prevents further attempts from being made, as would be understood by those skilled in the art.

According to embodiments of the present invention, the vehicle ignition interlock system **10** may also include a user selectable menu option that instructs the controller **34** to disable the vehicle ignition system and to allow an individual to perform a "personal inquiry" breath alcohol content test via the sample head **20**. Accordingly, an individual can utilize the ignition interlock system **10** as a personal, stand-alone breathalyzer; however, the vehicle cannot be started or operated in this mode.

The foregoing is illustrative of the present invention and is not to

be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

THAT WHICH IS CLAIMED IS:

1. A vehicle ignition interlock system, comprising:

a breath analyzer located within a vehicle, wherein the breath analyzer is configured to detect breath alcohol levels of an operator of the vehicle;

a transdermal alcohol sensor configured to be worn by the vehicle operator, wherein the transdermal alcohol sensor is configured to detect alcohol through the skin of the vehicle operator; and

a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle, wherein the controller is configured to compare detected breath alcohol levels of the vehicle operator with a threshold value, wherein the controller is configured to prevent vehicle ignition if a breath alcohol level detected by the breath analyzer is greater than or equal to the threshold value, wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, and wherein the controller can override one or more required periodic breath alcohol tests of the vehicle operator via the breath analyzer if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor.

2. The vehicle ignition interlock system of Claim 1, wherein the controller is configured to trigger a breath alcohol test of the vehicle operator via the breath analyzer if alcohol is detected through the skin of the operator by the transdermal alcohol sensor.

3. The vehicle ignition interlock system of Claim 1, further comprising a proximity sensor that detects proximity of the transdermal alcohol sensor relative to a vehicle operator area.

4. The vehicle ignition interlock system of Claim 3, wherein the proximity sensor detects nearness to a magnetic field generated by a

magnet located in the vehicle operator area.

5. The vehicle ignition interlock system of Claim 1, wherein the transdermal alcohol sensor is attached to a bracelet configured to be worn by the vehicle operator.

6. The vehicle ignition interlock system of Claim 1, further comprising a wireless transmitter operably connected to the transdermal alcohol sensor, and wherein the controller is operably connected to the transdermal alcohol sensor via the wireless transmitter.

7. The vehicle ignition interlock system of Claim 1, wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, and wherein the controller is configured to increase the frequency of the periodic breath alcohol tests of the vehicle operator via the breath analyzer in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator.

8. The vehicle ignition interlock system of Claim 1, further comprising a sensor associated with the transdermal alcohol sensor that measures skin temperature and/or skin conductivity of an individual wearing the transdermal alcohol sensor.

9. The vehicle ignition interlock system of Claim 5, further comprising a sensor associated with the transdermal alcohol sensor that measures pressure of the bracelet on an individual wearing the transdermal alcohol sensor.

10. The vehicle ignition interlock system of Claim 1, further comprising an operator identification device operably connected to the controller, wherein the controller is configured to verify the identity of the vehicle operator via the operator identification device.

11. The vehicle ignition interlock system of Claim 10, wherein the operator identification device comprises a fingerprint identification device.

12. The vehicle ignition interlock system of Claim 1, further comprising a user interface operably connected to the controller, wherein the controller displays operational messages via the user interface.

13. The vehicle ignition interlock system of Claim 1, further comprising a user interface operably connected to the controller, wherein the controller provides audible operational messages and prompts via the user interface.

14. The vehicle ignition interlock system of Claim 13, wherein the controller provides voice messages in one or more languages via the user interface.

15. The vehicle ignition interlock system of Claim 1, further comprising a user selectable option that allows an individual to perform a breath alcohol test via the breath analyzer without enabling the vehicle ignition system.

16. A vehicle ignition interlock system, comprising:

a breath analyzer located within a vehicle, wherein the breath analyzer is configured to detect breath alcohol levels of an operator of the vehicle;

an apparatus configured to be worn by the vehicle operator, wherein the apparatus comprises a transdermal alcohol sensor that is configured to detect alcohol through the skin of the vehicle operator, and a proximity sensor that detects proximity of the transdermal alcohol sensor relative to a vehicle operator area; and

a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle, wherein the controller is configured to compare detected breath alcohol levels of the

vehicle operator with a threshold value, wherein the controller is configured to prevent vehicle ignition if a breath alcohol level detected by the breath analyzer is greater than or equal to the threshold value, and wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, and wherein the controller can override one or more required periodic breath alcohol tests of the vehicle operator via the breath analyzer if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor.

17. The vehicle ignition interlock system of Claim 16, wherein the controller is configured to trigger a breath alcohol test of the vehicle operator via the breath analyzer if alcohol is detected through the skin of the operator by the transdermal alcohol sensor.

18. The vehicle ignition interlock system of Claim 16, wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, and wherein the controller is configured to increase the frequency of the periodic breath alcohol tests of the vehicle operator via the breath analyzer in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator.

19. The vehicle ignition interlock system of Claim 16, wherein the proximity sensor detects nearness to a magnetic field generated by a magnet located in the vehicle operator area.

20. The vehicle ignition interlock system of Claim 16, wherein the apparatus comprises a bracelet configured to be worn by the vehicle operator.

21. The vehicle ignition interlock system of Claim 16, wherein the apparatus further comprises a wireless transmitter operably connected to the transdermal alcohol sensor, and wherein the controller is operably connected to the transdermal alcohol sensor via the wireless transmitter.

22. The vehicle ignition interlock system of Claim 16, wherein the apparatus further comprises a sensor associated with the transdermal alcohol sensor that measures skin temperature and/or skin conductivity of an individual wearing the apparatus.

23. The vehicle ignition interlock system of Claim 16, further comprising a sensor associated with the transdermal alcohol sensor that measures pressure of the apparatus on an individual wearing the apparatus.

24. The vehicle ignition interlock system of Claim 16, further comprising an operator identification device operably connected to the controller, wherein the controller is configured to verify the identity of the vehicle operator via the operator identification device.

25. The vehicle ignition interlock system of Claim 24, wherein the operator identification device comprises a fingerprint identification device.

26. The vehicle ignition interlock system of Claim 16, further comprising a user interface operably connected to the controller, wherein the controller displays operational messages via the user interface.

27. The vehicle ignition interlock system of Claim 16, further comprising a user interface operably connected to the controller, wherein the controller provides audible operational messages and prompts via the user interface.

28. The vehicle ignition interlock system of Claim 27, wherein the controller provides voice messages in one or more languages via the user interface.

29. The vehicle ignition interlock system of Claim 16, further comprising a user selectable option that allows an individual to perform a

breath alcohol test via the breath analyzer without enabling the vehicle ignition system.

30. A vehicle ignition interlock system, comprising:

a breath analyzer located within a vehicle, wherein the breath analyzer is configured to detect breath alcohol levels of an operator of the vehicle;

an apparatus configured to be worn by the vehicle operator, wherein the apparatus comprises a transdermal alcohol sensor that is configured to detect alcohol through the skin of the vehicle operator, and a proximity sensor that detects proximity of the transdermal alcohol sensor relative to a vehicle operator area;

a wireless transmitter operably connected to the transdermal alcohol sensor; and

a controller operably connected to the breath analyzer, to the transdermal alcohol sensor, and to an ignition system of the vehicle, wherein the controller is operably connected to the transdermal alcohol sensor via the wireless transmitter, wherein the controller is configured to compare detected breath alcohol levels of the vehicle operator with a threshold value, wherein the controller is configured to prevent vehicle ignition if a breath alcohol level detected by the breath analyzer is greater than or equal to the threshold value, and wherein the controller is configured to require periodic breath alcohol tests of the vehicle operator via the breath analyzer, wherein the controller can override one or more required periodic breath alcohol tests of the vehicle operator via the breath analyzer if alcohol is not detected through the skin of the operator by the transdermal alcohol sensor, and wherein the controller is configured to increase the frequency of the periodic breath alcohol tests of the vehicle operator via the breath analyzer in response to the transdermal alcohol sensor detecting alcohol through the skin of the operator.

31. The vehicle ignition interlock system of Claim 30, wherein the controller is configured to trigger a breath alcohol test of the vehicle operator via the breath analyzer if alcohol is detected through the skin of the

operator by the transdermal alcohol sensor.

32. The vehicle ignition interlock system of Claim 30, wherein the proximity sensor detects nearness to a magnetic field generated by a magnet located in the vehicle operator area.

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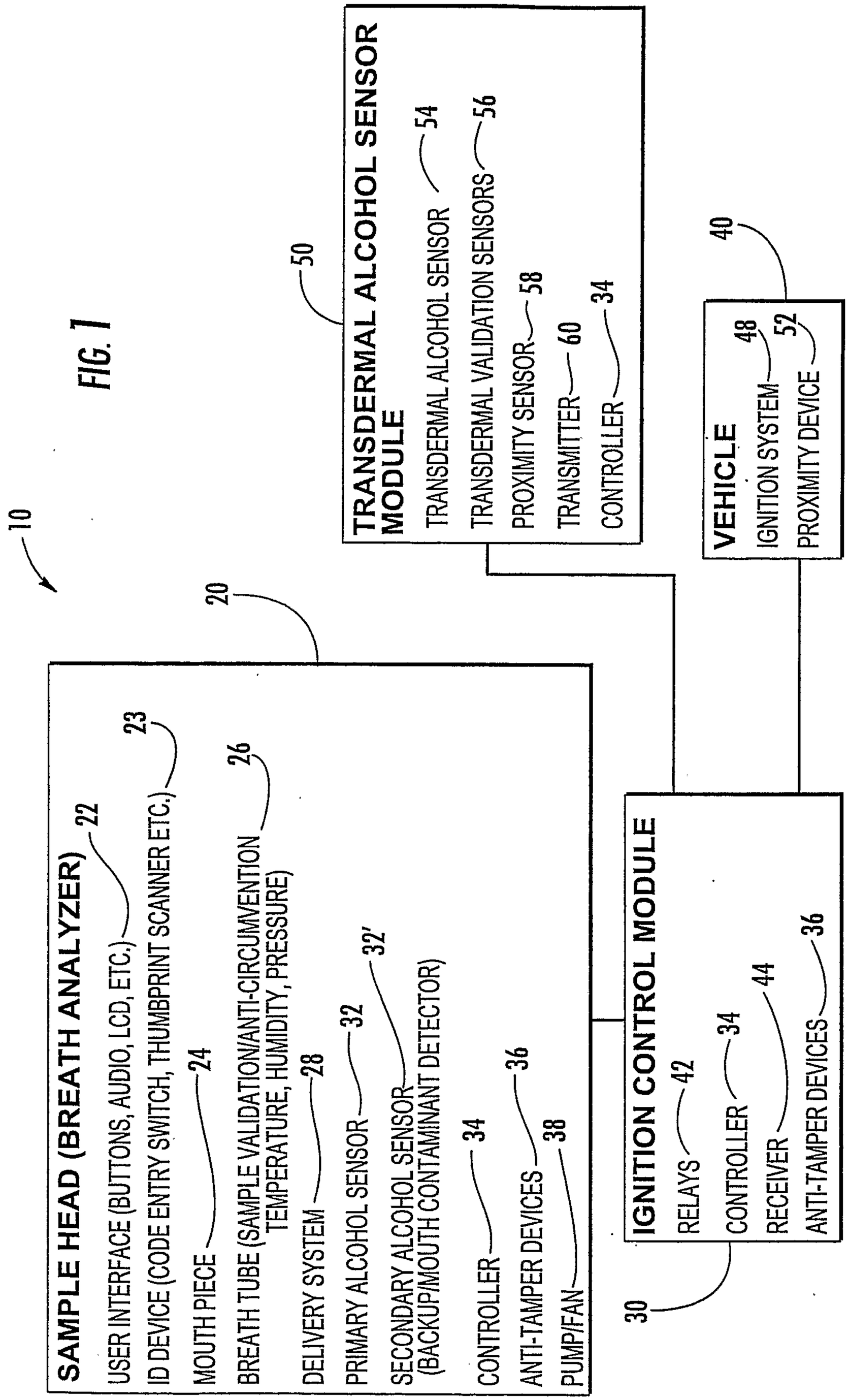
FIG. 1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SAMPLE HEAD (BREATH ANALYZER)
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PROXIMITY SENSOR 58
TRANSMITTER 60
CONTROLLER 34
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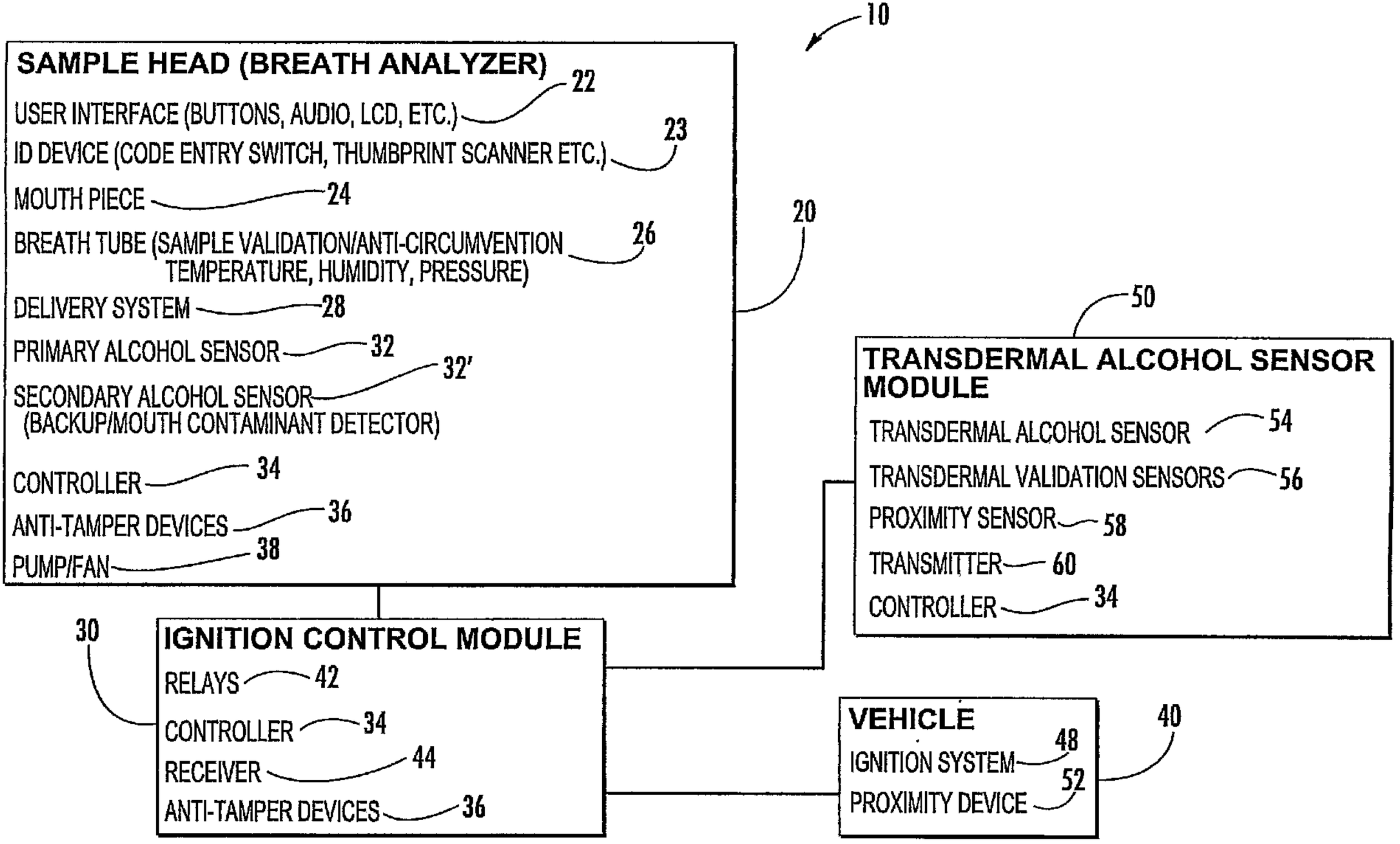
VEHICLE
IGNITION SYSTEM 48
PROXIMITY DEVICE 52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