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Inose et al.

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[54] **INTOXICATED DRIVER CAPABILITY TESTER**

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[52] **U.S. Cl.** ..... **73/27 R**

[51] **Int. Cl.** **G01n 31/00**

[58] **Field of Search** ..... 73/27 R, 421.5 R, 432 R; 180/99; 340/53, 279; 128/2 C

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[57] **ABSTRACT**

An intoxicated driver capability tester comprising a bridge circuit for producing an unbalanced output by detecting alcohol, a NOT circuit for producing an output 1 when said unbalanced output is more than a reference value, a display device for random numbers which is activated by one output of the NOT circuit, and a NAND gate for receiving the other output of the NOT circuit as one input thereof and receiving the output of the display device for random numbers as the other input thereof.

8 Claims, 4 Drawing Figures

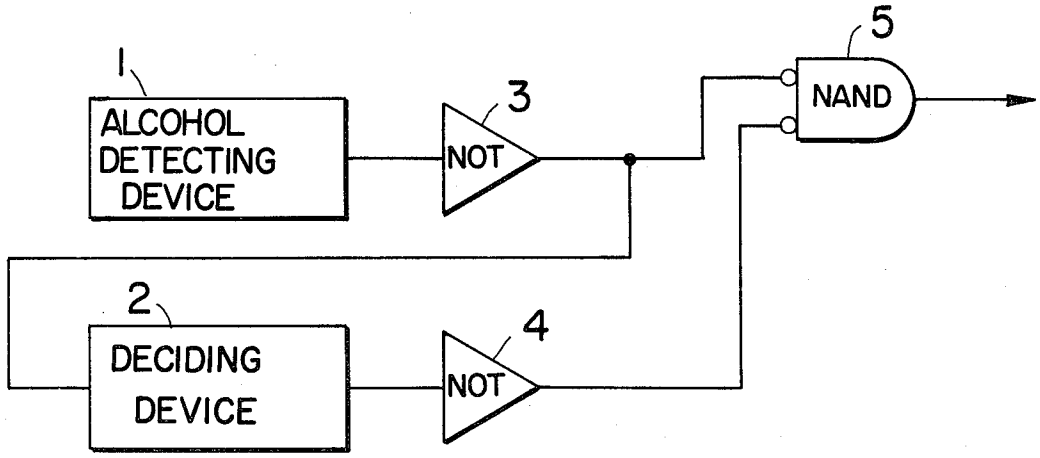


FIG. 1

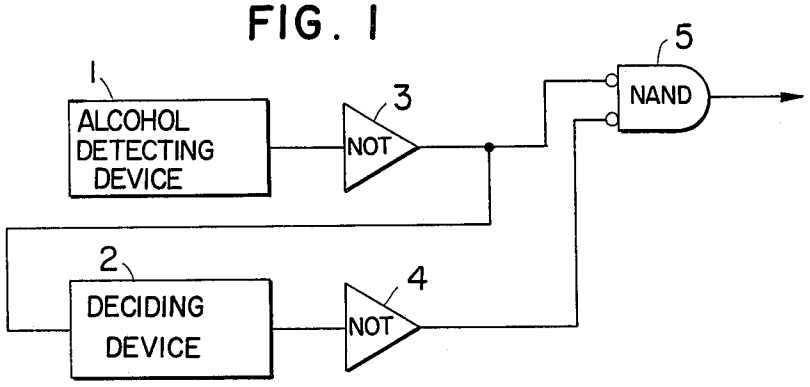


FIG. 2

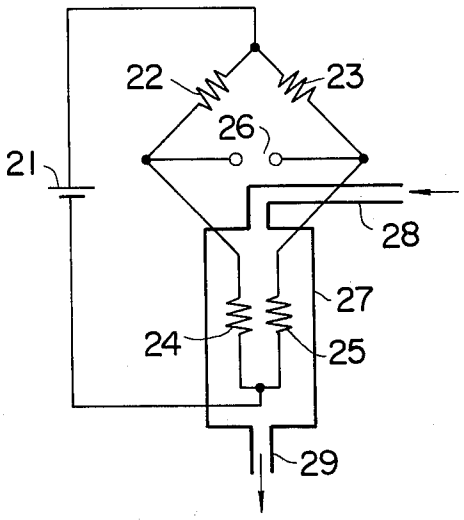


FIG. 3

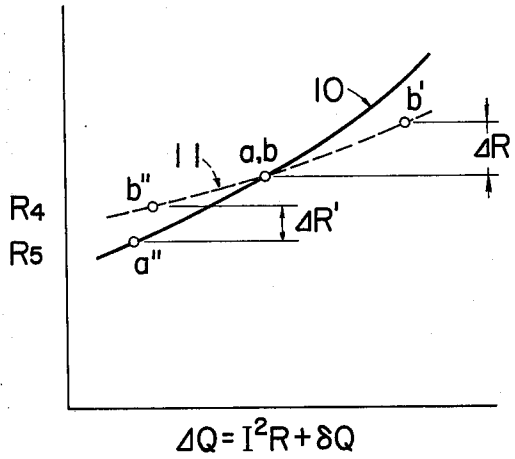
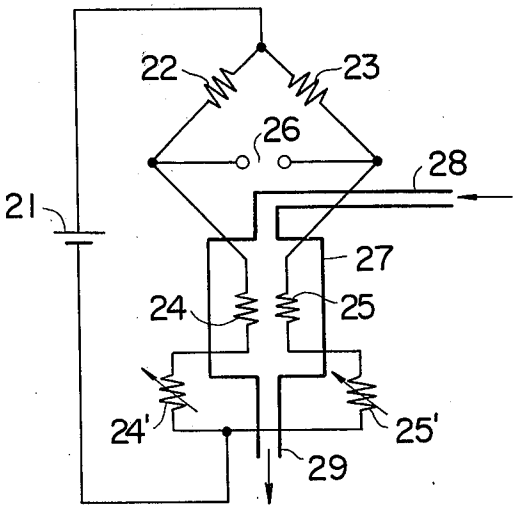


FIG. 4



INTOXICATED DRIVER CAPABILITY TESTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an intoxicated driver capability tester and particularly to a device detecting the degree of intoxication and deciding the adaptability for automobile driving.

2. Description of the Prior Art

Many traffic accidents arise in intoxicated driving. For preventing them, it is necessary to decide whether a driver is too intoxicated to safely drive an automobile or not. One example of such well-known deciding device includes a device wherein the driver is shown random numbers for a while and after the random numbers are removed, the driver pushes buttons of said device depending on his memory so as to input the same random numbers, and the driver's capability for driving is decided from the speed and accuracy of his push-button-operation, and then when it is decided that the driver is not adaptable for driving the device functions to prevent the engine from being started for a predetermined time interval. This device has defects in that the driver must carry out the above test every time before driving even if he has not taken any alcohol or even when he has an urgent business and the test is very troublesome. Further, it is possible that the driver is in a hurry so that he could not operate correctly the device, resulting in failure to start the engine.

SUMMARY OF THE INVENTION

An object of this invention is to provide an intoxicated driver capability tester to decide rapidly and reliably whether an intoxicated driver has the capability of driving or not.

In order to accomplish such object, the intoxicated driver capability tester according to the invention comprises in combination a detecting device to detect the amount of alcohol in a driver's body and a device to decide the capability of driver, whereby in case that the amount of alcohol in a driver's body is detected to be less than a predetermined value, the tester permits the engine to be started without deciding the capability of the driver for driving.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram showing the construction of an embodiment according to this invention.

FIGS. 2 and 4 show respective embodiments of alcohol detecting devices according to this invention.

FIG. 3 is a diagram showing the operating characteristics of the devices shown in FIGS. 2 and 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a block diagram showing the construction of an embodiment, in which numeral 1 designates a detecting device to detect the amount of alcohol in a driver's body and to produce an output signal 1 (high level) in case that the amount of alcohol is less than a predetermined value, and 0 (low level) in case that it is larger than the predetermined value.

Numeral 2 designates a deciding device of capability for driving which may be of a type of the conventional display device for random numbers. The deciding device 2 is activated by an output 0 of the detecting device 1, that is, when the amount of alcohol is larger than a predetermined value, and produces an output 1 when it is decided that the driver is capable to drive the vehicle and an output 0 when it is decided the driving is not to be permitted. Numerals 3 and 4 designate NOT circuits and numeral 5 designates a NAND circuit. The circuits 3, 4 and 5 constitute a circuit of logical sum.

FIG. 2 shows a circuit construction of an alcohol-detecting device being employed in the invention, which utilizes the fact that the temperature of a temperature-sensitive element connected in a bridge circuit changes its temperature depending or the amount of alcohol. Numeral 21 designates a power source for the bridge circuit, numerals 22, 23, 24 and 25 designate resistance elements composing an electrical bridge, numeral 26 designates an output terminal, numeral 27 designates a main tube for expiration to be measured, numeral 28 designates an inlet tube, numeral 29 designates an outlet tube. The resistance elements 24, 25 are both exposed to the expiration. The resistance elements 24 and 25 have characteristics such that their resistances vary by application of alcohol, and the characteristics of them are different for alcohol but not for other fluids.

For example, the temperature-sensitive elements 24 and 25 are made of resistance wires having a temperature coefficient, and one of them, for example the wire 25 is coated a chemical catalyzer such as a platinum black which reacts oxidation with a specific material so that it is able to measure the amount of the material from the difference in temperature due to heating by chemical reaction. This measurement operation is described with reference to FIG. 3. An amount of heat transmission ΔQ is given in the abscissa and the ordinate shows resistance values R_4 and R_5 of the elements 24 and 25. ΔQ is the sum of a heat quality I^2R in self-heating by a bridge current and a heat quantity δQ produced by chemical reaction and/or transmitted by thermal conduction, thermal radiation, thermal convection and heat transmission. The resistances of 24 and 25 are held at a resistance value corresponding to the temperature determined by the balancing of I^2R and δQ. A curve 10 shows a characteristic of the resistance 24 in FIG. 2 and a curve 11 shows that of the resistance 25. At first, the bridge circuit is balanced at the points of a and b. The values R_4 and R_5 of the resistances 24 and 25 are determined depending on the impedance values of the branches 22 and 23 of the bridge circuit. When an alcohol flows in the tube 27 through the inlet tube 28, the catalyzer activates chemical reaction, the temperature value of the resistance element 25 is changed and consequently, the resistance value of the element 25 is shifted to b' from b and then there exists a difference ΔR between the resistances of the elements 24 and 25. The balancing state of the bridge is changed and the variation is given as an output at the output terminal 26.

A comparator (not shown) receives that variation as one input and a voltage corresponding to a predetermined amount of alcohol as the other input. By comparing both inputs the comparator produces an output 0 in case the variation is over a predetermined standard value and produces 1 when it is less than the standard value.

In that case, an amount of alcohol to be detected is able to increase or decrease by changing the standard value.

The resistance values of **24** and **25** are possible to change from *a* and *b* to *a''* and *b''* by fluids, other than alcohol, contained in the expiration of a driver or by the change of composition of the fluid, thereby producing an undesired difference $\Delta R'$, resulting in producing an output of the sum of ΔR and $\Delta R'$ at the output terminal **26.** Thus, the device indicates a different value from the correct value ΔR.

The value of $\Delta R'$ appears as an error by the disagreement of the characteristics curves **10** and **11** of the temperature-sensitive elements **24** and **25** as shown in FIG. **3.**

Accordingly, adjusting resistances are provided at the branches of the bridge circuits in series or parallel with the temperature-sensitive elements **24** and **25,** in order to make the characteristics **10** and **11** of the elements **24** and **25** substantially identical. Numerals **24'** and **25'** designate variable resistors provided in series with the temperature-sensitive elements at the respective branches of the bridge circuit. Other numeral numbers indicate the same elements as those in FIG. **2.** Since the variable resisters **24'** and **25'** are connected in series with the temperature-sensitive elements **24** and **25,** the resistances of the branches provided with the elements **24** and **25** are changeable. Accordingly, the characteristic curves **10** and **11** described in FIG. **3** are respectively changeable. As the expiration without alcohol component is entered into the device through the inlet tube **28,** the variable resisters **24'** and **25'** are adjusted so as to make the point *a''* be in agreement with the point *b''* in FIG. **3** thereby making the characteristic curves **10** and **11** substantially identical. After thus being adjusted, the resistance values of the variable resisters **24'** and **25'** are fixed. Then, the bridge circuit is in a condition that the error $\Delta R'$ is eliminated.

The operation of an embodiment employing the alcohol-detecting device as above mentioned is described hereunder. In case that the alcohol contained in driver's expiration is less than a predetermined standard value, the alcohol-detecting device **1** produces an output 1 which is applied to the NOT circuit **3,** and the NOT circuit produces an output 0 which is applied to the NAND circuit **5** as an input and which is applied to the deciding device **2** of capability for driving as a control signal. When the output of the NOT circuit **3** is 0, the operation of the deciding device is not started. Since the input 0 is applied to the NAND circuit **5,** the output 1 is produced from the NAND circuit **5,** and the display device (not shown) displays the state that the driver is capable of driving.

Next, in case that the alcohol contained in driver's expiration is more than the predetermined standard value, the alcohol-detecting device **1** produces an output 0 which is applied to the NOT circuit **3,** and the NOT circuit **3** produces an output 1 which is applied to the NAND circuit **5** as an input and which is applied to the deciding device **2** of capability for driving as a control signal. When the output of the NOT circuit **3** is 1, the operation of the deciding device is started and the driver's capability is decided by means of the display of random numbers. If it decides that the driver is capable of driving, an output 1 is produced from the deciding device **2** and the output 1 is put in the NOT circuit **4,** then an output 0 is produced from the NOT circuit **4** and an output 1 is produced from the NAND gate **5** and then the display device indicates the state that the driver is capable of driving. However, if the driver's capability is denied as a result of the test by means of the display of random numbers, an output 0 is produced from the deciding device **2** and the output is put in the NOT circuit **4** and thereby an output 1 is produced from the NOT circuit **4** and is put in the NAND circuit **5** as another input. Thus, the NAND circuit is supplied with an input 1 at each of the input terminals, and hence an output 0 is given from the NAND circuit **5,** and the state that the driving is impossible is displayed. The output 0 of the NAND circuit **5** may be utilized to operate a relay (not shown) thereby cutting off the cell motor of an engine from a power source or making the engine key inoperative to start the engine.

As above mentioned, in case that the driver's alcohol is less than a predetermined standard value, the state that driving is possible is immediately decided, and in case that the driver's alcohol is more than the standard value the driving capability is further tested. Thus, the degree of intoxication is rapidly determined and the dangerous drive by an intoxicated driver is prevented.

We claim:

1. An intoxicated driver capability tester comprising:

means for detecting alcohol in a driver's body which generates a first output signal when the amount of alcohol in the driver's body is less than a predetermined reference value and which generates a second output signal when the amount of alcohol in the driver's body is greater than the predetermined reference value;

first signal generating means for generating a third output signal when the first output signal is applied from said alcohol detecting means and for generating a fourth output signal when the second output signal is applied from said alcohol detecting means;

means for deciding a driver's capability for driving, said deciding means being responsive to the fourth output signal from said first signal generating means for initiating an operation to be effected by the driver to determine the driver's capability for driving, said deciding means being responsive to the operation effected by the driver for generating a fifth output signal when the driver is in a state capable of driving and for generating a sixth output signal when the driver is not in a state capable of driving;

second signal generating means for generating a seventh output signal when the fifth output signal is applied from said deciding means and for generating an eighth output signal when the sixth output signal is applied from said deciding means; and

third signal generating means having one input for receiving the output signals from said first signal generating means and another input for receiving the output signals from said second signal generating means, said third signal generating means generating a ninth output signal indicative of a state capable of driving in response to said third output signal being applied to the one input thereof, generating a tenth output signal indicative of a state capable of driving in response to said seventh output signal being applied to the another input thereof, and generating an eleventh output signal indicative of a state not capable of driving in response to the fourth output signal being applied to the one input thereof and the eighth output signal being applied to the another input thereof.

2. An intoxicated driver capability tester according to claim 1; wherein each of said first and second signal generating means includes a NOT circuit, and said third signal generating means includes a NAND circuit.

3. An intoxicated driver capability tester according to claim 2, wherein said alcohol detecting means comprises a bridge circuit, at least one branch of which includes an impedance element whose impedance is adaptable to change by application of alcohol, a power source connected to said bridge circuit, and comparator means for comparing an unbalance output of said bridge circuit with the predetermined reference value, said unbalance output of the bridge circuit being produced by the impedance variation of said impedance element by alcohol.

4. An intoxicated driver capability tester according to claim 3, wherein said impedance element includes a temperature compensation impedance element.

5. An intoxicated driver capability tester according to claim 1, wherein said alcohol detecting means comprises a bridge circuit, at least one branch of which includes an impedance element whose impedance is adaptable to change by application of alcohol, a power source connected to said bridge circuit, and comparator means for comparing an unbalance output of said bridge circuit with the predetermined reference value, said unbalance output of the bridge circuit being produced by the impedance variation of said impedance element by alcohol.

6. An intoxicated driver capability tester according to claim 5, wherein said impedance element includes a temperature compensation impedance element.

7. An intoxicated river capability tester comprising:

means for detecting the alcohol content in a driver's body and for respectively providing first and second output signals indicative of the alcohol content being below and above a predetermined reference value;

means for deciding a driver's capability for driving, said deciding means being responsive to the second output signal from said alcohol detecting means for initiating an operation thereof to be effected by the driver to determine the driver's capability for driving, said deciding means being responsive to the operation effected by the driver for providing a third output signal indicative of the driver being in a state capable of driving and for providing a fourth output signal indicative of the driver not being in a state capable of driving; and

signal generating means having a first input for receiving the output signals from said alcohol detecting means and a second input for receiving the output signal from said deciding means, said signal generating means providing a fifth output signal indicative of a state capable of driving in response to the first output signal being applied to the one input thereof, providing a second output signal indicative of a state capable of driving in response to the third output signal being applied to the another input thereof, and providing a seventh output signal indicative of a state not capable of driving in response to the second output signal being applied to the one input thereof and the fourth output signal being applied to the another input thereof.

8. An intoxicated driver capability tester according to claim 7, wherein each of said alcohol detecting means and said deciding means includes NOT circuit means at the output stages thereof, and said signal generating means includes a NAND circuit.

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