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(54) Method for the evaluation of air comsumption for scuba divers

(57) Method for the evaluation of air consumption for scuba divers, such method being implemented by means of an integrated data processor, equipped with a display (1) to calculate the average air consumption of a scuba diver when diving and the remaining air time by setting the bottle capacity onto a suitable dial (2) of the display.

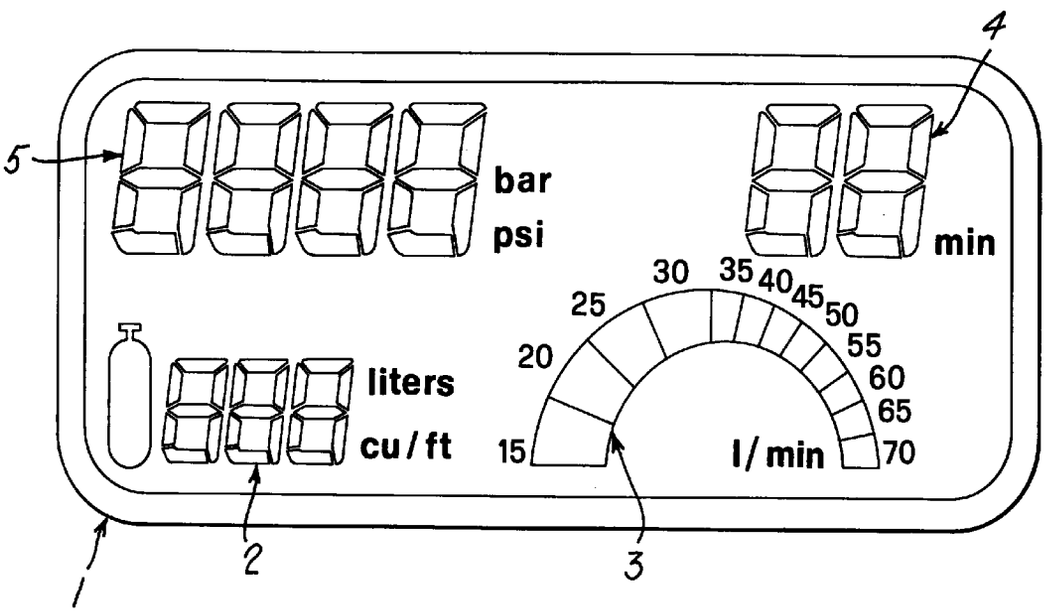


Fig.1

EP 0 919 462 A2

Description

[0001] The present invention relates to a method for the evaluation of air consumption of a scuba diver when diving by means of an integrated computer in which such method of evaluation is implemented.

[0002] People working in the field already know about the existence of integrated computers used by scuba divers while diving to get information about, for instance, air pressure in the bottle and other indications about the remaining air time, i.e. the duration time of the air contained in the bottles if the diver remains at a given depth and keeps on breathing according to the respiratory rhythm he/she has been keeping lately, said remaining time being viewed by means of a suitable display for the reading of the data processed by the integrated computer.

[0003] The way in which the computer gauges the remaining air time is linked to the pressure variation in the bottles in relation to the diving depth of the scuba diver. At a given diving depth h, the bottles will have a certain internal air pressure p_h. Supposing the diver remains at said depth h, there will be a progressive pressure decrease Δp in bar/minute in the bottles over a certain time t of decrease. The algorithm used by the computers to calculate the remaining air time will consider the diving depth h and the time t in which the decrease Δp has taken place as constant values, and then, such conditions persisting, on the basis of the remaining pressure value in the bottle at the time t, known by means of a relation of the type $p_t = p_h - \Delta p \cdot t$ (in bar), it will calculate the remaining air time t_r by means of the ratio of the remaining pressure pt to the pressure variation in time, i.e. $t_r = p_t/\Delta p$. Obviously, from such remaining time t_r we will have to subtract a certain safety time in order to prevent the air pressure in the bottle from falling completely to 0 and the bottle from being completely empty. Therefore, the time value appearing on the computer display won't be the calculated value t_r, but it will be reduced of a certain safety value, some minutes for instance. Obviously, the remaining air time, as was said before, is calculated by keeping as constants the variation of air pressure in the bottles, a function of the diving depth, and the diver's breathing rhythm; if, for example, the scuba diver went down to a greater depth, the remaining air time would decrease, while it would increase if he went up. This known system of calculation used by inte

[0004] grated computers does not have any relation with the bottle capacity, since the smaller the bottle the faster the air pressure in the bottle decreases. Therefore, such system only allows an approximate evaluation of the remaining air time, without permitting any evaluation of air consumption for the scuba diver. However, such evaluation of air consumption is very important since it allows the scuba diver not only to check whether he/she is breathing quietly or panting, but also, said consumption being known, to plan his/her future divings.

[0005] The present invention aims therefore at providing out a method to let the scuba diver have detailed information about such parameters as average air consumption and remaining air time during a diving, by means of an integrated computer of a known type, which evaluates such parameters using the method of the present invention and shows them on a suitable display connected to the integrated computer.

[0006] The present invention will be further explained by the following description referring to the only drawing enclosed, in which:

Fig. 1 is a view of the display connected to the integrated computer using the method described in the present invention.

[0007] The average air consumption of a scuba diver can be given, to the diver's convenience, in litres/minute "on surface", that is to say, at atmospheric pressure. Indicating as Q_s the air consumption "on surface" in l/min, and knowing that, from the surface downwards, pressure increases of about 1 bar every 10 m of diving depth, we can desume the effective air consumption Q_r as a function of depth. Now the computer can calculate the consumption Q_s in l/min by dividing the effective consumption Q_r by the pressure p_h related to the diving depth of the scuba diver. In order to calculate such air consumption value Q_s, the computer will obviously have to know the quantity of air the diver has at his/her disposal; therefore, designating as V_b the bottle volume in litres and as p_b the air pressure in bar within the bottles, the quantity V_a of air in the bottle, considering the volume occupied by air at atmospheric pressure under the same conditions, will correspond to $V_b \cdot p_b$. The scuba diver, therefore, will have to set the bottle capacity in litres on the dial 2 of the display 1 connected to the computer, and, according to the variations of pressure in the bottle due to the diving depth and to the breathing rhythm, he/she will be able to read the average air consumption in l/min "on surface" on the dial 3 of the display 1. Having thus calculated the average air consumption, the computer will now calculate, according to the method of the present invention, the quantity of available air and then, on the basis of such average consumption in l/min, it will show the air time in minutes on the dial 4.

[0008] According to an alternative embodiment of the present method, it is possible to set onto the dial 2 of the display the bottle capacity in cubic feet (cu/ft) and not in litres, thus providing the integrated computer with a datum on the theoretical quantity of air available for the diver at the maximum nominal pressure of the bottles. Therefore, the scuba diver will also have to set, besides said capacity in cu/ft onto the dial 2, the maximum nominal air pressure in the bottles onto the dial 5 of the display 1. The computer will process those data and will show, as in the previous embodiment, the average air

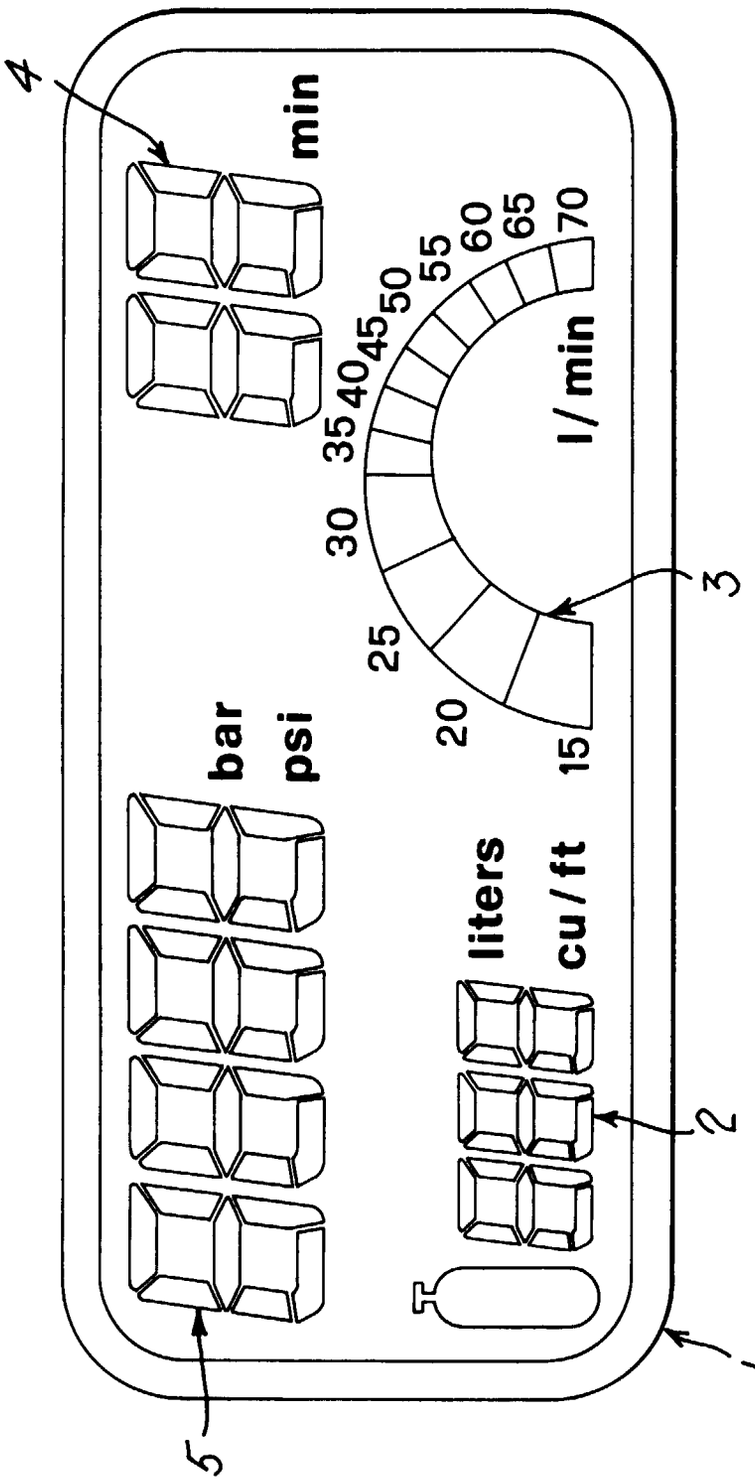
consumption in l/min and the remaining air time for the diver while diving.

Claims

1. Method for the evaluation of air consumption for scuba divers, characterised in that it is implemented in an integrated data processor, equipped with a display (1) to calculate said average air consumption of a scuba diver and the remaining air time by setting the bottle capacity onto a suitable dial (2) of said display (1).

2. Method according to claim 1, characterised in that said average air consumption and said air time are viewed onto two dials (3/4) of said display (1).

3. Method according to claim 1, characterised in that it impossible to calculate said average air consumption and said remaining air time by setting onto two dials (2/5) of said display (1) the theoretical quantity of air available in the bottle and the maximum nominal air pressure in the bottle.


4
min
bar
psi
liters
cu / ft
l / min
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30
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40
45
50
55
60
65
70
3
2
5
1

Fig. 1