VIAMED

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For the attention of Alexandra Tomkinson

From John Lamb

Quick-Ox Patent

The device was designed because of a need by recreational scuba divers to measure accurately, easily and quickly the oxygen concentration in a sub-aqua diving cylinder.
Nitrox and mixed gas diving requires accurate mixing and measurement.
Accuracy must be better than +/- 1%. With a preferable resolution of +/- 0.1%

The gas in the cylinder is approximately 200Bar to 300Bar.
The oxygen concentration can be anything from 0-100%

When the cylinder is opened the gas is emitted at high flow rates and the drop in pressure cause the escaping gas to drop in temperatures sometimes causing frost on the cylinder valve.

Effects of flow rate.
As most Oxygen sensors are partial pressure measuring devices the high flow rates meeting a resistance translate into pressure give a false high reading
The sensor will work with a flow rate between 100millitres per minute to 2 litres per minute.
This has normally been achieved by the use of a flow meter or flow reducer/restrictor DAN Handbook
As Oxygen has a partial pressure of .209 Bar at STP which the electronic measuring device translates to 20.9% the most accurate pressure to take a measurement is therefore also 1Bar.

Effects of Temperature
When the cylinder is opened the gas pressure is reducing from 200+ Bar to 1 Bar atmospheric. This causes a severe drop in temperature of the gas.
The sensors are very temperature sensitive(2.5% per degree Celsius change) so temperature compensation is required. This is usually fitted externally on the rear of the sensor.
A temperature gradient is therefore created whereby the sensor temperature compensation mechanism is fed information from room temperature whilst the sensor gas sensing membrane is experiencing low and dropping temperatures.
This exhibits itself as a varying baseline.

The objective was therefore to create a device which
Did not depend on the operator controlling an accurate flow rate
i.e enable the measurement to be taken at 1Bar.

The Device
The sensor needs to see a flowing gas to react quickly and have a short response time.
In ideal conditions the sensor response is 7 seconds for a 90% step.
In a non flowing gas the remaining 10% can take a very long time as the response time is an exponential curve..

The diver using the device needs to take a measurement quickly.
Ideally directly from the outlet valve of the cylinder.

Most devices that enable this also have the problem of a possible Venturi effect of drawing in room air during measurement and diluting the measured gas.

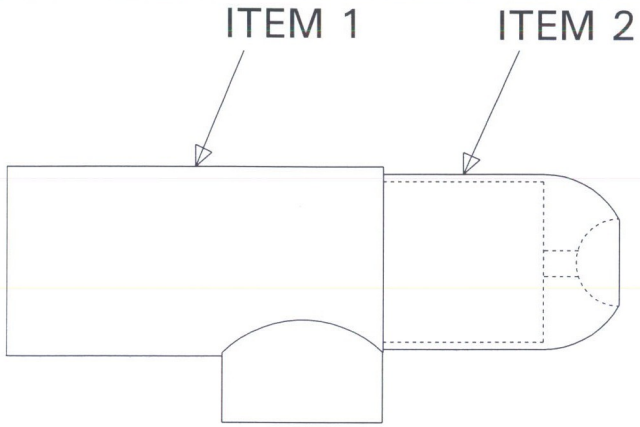
The device described fulfils all the above criteria and overcomes all the associated problems.

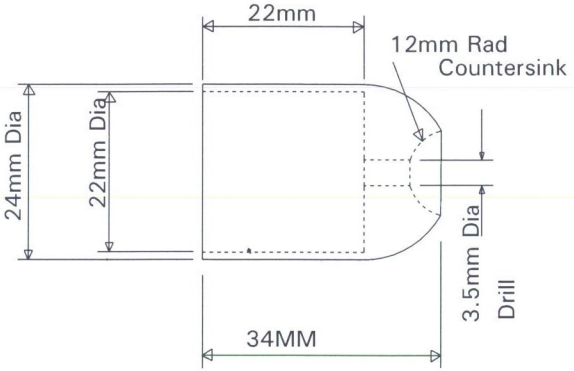
A Dome A is configured to fit flush against the O ring on a Scuba cylinder or it fits into the thread if a Scuba DIN fitting. This is not original idea and is already available.Existing domes suffer two problems.
The Venturi effect is possible with careless sampling and the high pressure gas is directed directly onto the sensor membrane.
The Dome has therefore been fitted with a concave inlet B and a small hole C at the end so that the gas builds up in the concave and forces the room air to out of the sampling gas stream
The hole size has been chosen to restrict the flow yet allow sufficient gas to enter the sensor and enable the fast response.
An existing medical Tee with two one-way valves D & E has been redesigned to match the length of the divertor F
The gas stream is funnelled by the concave on the dome through the hole D restricted by the one way valve D and diverted into the sensor via the flow divertor F.
Excess high pressure gas travels directly through the device and out of F into the atmosphere
When the measurement is reached the gas flow is turned off.
The gas is trapped at 1Bar in the sensor by the one way valves D & E.

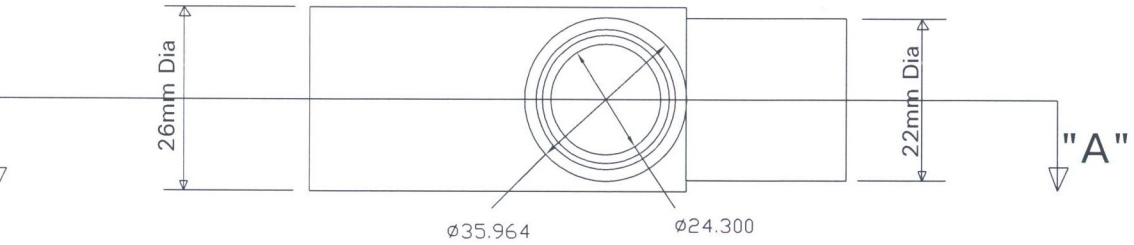
The one-way valves D & E also serve to stop air re-entering the sensor during the reading.

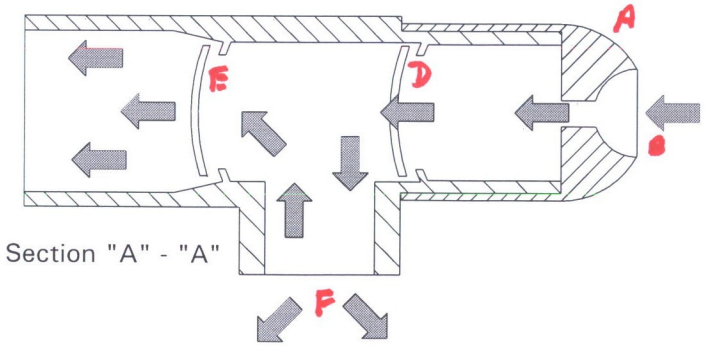
The novelty of this device is the combination of the modified medical Tee which has one way valves and the dome with a concave inlet to solve the problems of oxygen measurement from Scuba cylinders.
Excess flow rates are vented via one-way valve E
Concave inlet B and small hole C prevent Venturi suction yet allow a fast sensor response.
The one-way valves trap the gas at 1Bar allowing a reading with both flow rate and temperature stability.
The one-way valves D & E prevent dilution of the with air when the cylinder has been closed

A by product of this system is the gas flows across the sensor and not directly onto the sensor face as in existing Dome sensing system. This prevent high pressures which can damage the membrane of the sensor.
This device can be used by any level of diver and is not dependent on skill to achieve accuracy.









Section "A" - "A"

Material

ITEM 1	A-268 "T" Adapter	Polyethylene
ITEM 2	Pouch	PVC Nylon

				Material :	Title	Non-Return Tee Valve	Dim in mm
							Tol 0.2
Date	N°	Drawn	Approv	Part No.	Scale	Not To Scale	Drawn K. Rush
					Date	25/09/03	Dwg No.

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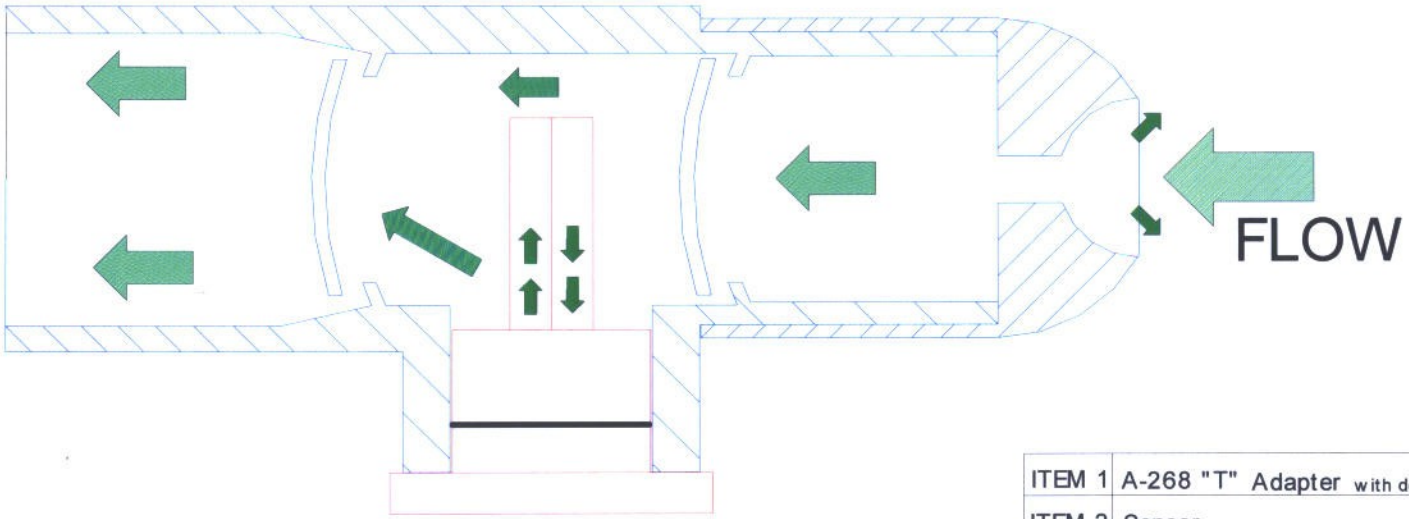
ITEM 1
TEE ADAPTOR



SENSOR
ITEM 2

ITEM 1	A-268 "T" Adapter with domed end
ITEM 2	Sensor

					Material :
REV	Date	N°	Drawn	Approv	Part No.

Title	Non-Return Tee Valve (with sensor)	Dim in	mm
		Tol	: 0.2
Scale	Not To Scale	Drawn	K. Rush
Date	11/11/03	Dwg No.	P0010-06

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