EBERHARD KARLS
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Mobile Gas Measurement System

Technology Description

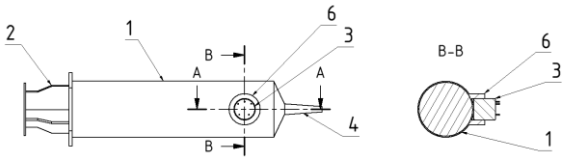

Figure 1: *The simplest model of the gas measurement system for illustration of the principle, with a measuring chamber (1), a plunger (2), an inlet port (4) and only one exchangeable gas sensor (3), which is inserted into a sensor holder (6).*

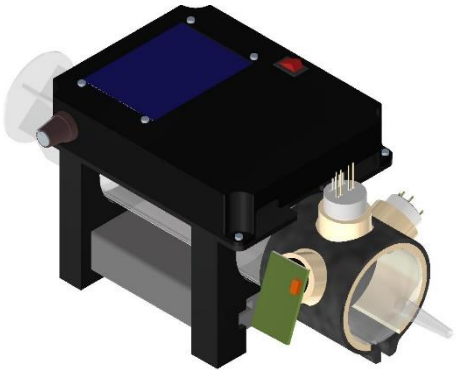

Figure 2: *3D-model of the gas measurement system with three sensors, a device for data logging with a display, a power supply, a rotary potentiometer and a main switch.*

Quantitative gas determination is required for various purposes. Conventional gas measurement systems are often bulky, stationary devices with built-in gas sensors capable of detecting only specific gases. They typically utilize electrical pumps, resulting in larger sample sizes. They are often not suitable for fast mobile simultaneous measurements of different gases.

Here we present a compact, portable device ideally suited for the quantitative detection of gas concentrations in a gas mixture in real-time, requiring small gas sample volumes of less than **100ml**. This innovative feature of the system is achieved through the use of a piston syringe design, combined with minimizing dead volume.

The mobile gas measuring system comprises a measuring chamber with a barrel, a plunger movable therein, an inlet port, through which samples are taken, and at least one gas sensor, which is fixed at the outer wall of the measuring chamber and is in contact with its inside space via an opening (Fig. 1 and 2).

The device can advantageously use commercially available cylindrical gas sensors, which can be attached to the outer wall and be exchanged for others in a very short time to suit the specific measurements as required.

Innovation

Up to now: Bulky stationary devices with built-in gas sensors for the detection of only certain gases

Now: Compact portable and cheap device for the detection of different gases in real time

Market Potential / IP Status

We are looking for an industrial partner interested in licensing, production, and marketing of the mobile gas measurement system (MGMS 100).

Patent filed with the DPMA on 2023/11/02
Application Number: 10 2023 004 381.8
Further patent applications are being planned

Applications

Thanks to its flexibility, compact size and low price, the gas measuring system enables versatile applications in various areas:

- ❑ Chemical or processing industries
- ❑ Biogas plants
- ❑ Medicine
- ❑ Educational institutions
- ❑ Security and monitoring systems
- ❑ etc.

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PROOF OF CONCEPT

Prototype with Three Exchangeable Sensors

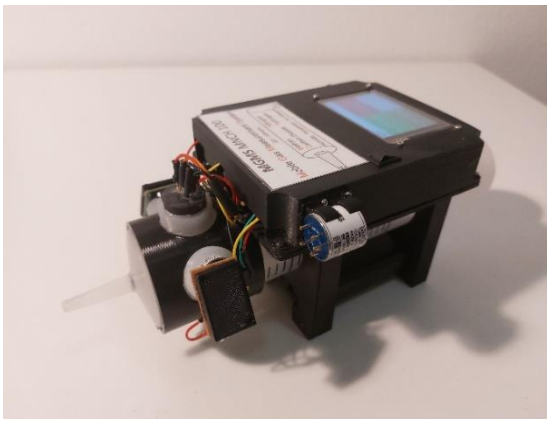

Figure 3: *A first prototype of the gas measurement system with three sensors, a device for data logging with a display, a power supply, a rotary potentiometer and a main switch.*

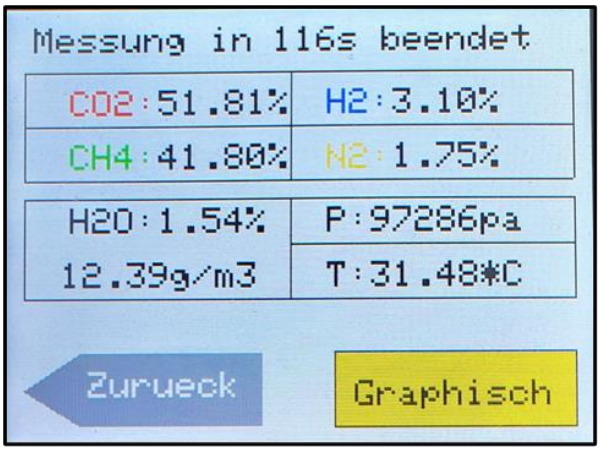

Figure 4: *The output of the sensor data for the volume concentrations of carbon dioxide, methane, hydrogen and nitrogen via a touch display.*

You can view the gas measurement system in action in this video:

We have already developed a first prototype, which, in addition to the unit for sampling and three different removable sensors, also contains electronic components (Fig. 3). These include device for data logging, temperature and pressure sensors, power supply, 3-inch-touchscreen display, gas sensors and memory card. The device can determine the volume concentrations of different gases in a gas mixture within the shortest time (3 minutes per single measurement without the need for preparation time) and achieves a precision of **2.5%** by volume.

Two NDIR sensors are used to measure carbon dioxide and methane, as well as a thermal conductivity sensor to determine hydrogen and nitrogen concentrations. Reading of the measured values and calculating of the volume concentrations of the particular gases are performed automatically by a microcontroller. With a removable micro-SD card, the measured values can be easily transferred to a PC and also be output directly via the display (Fig. 4).

Figure 5 illustrates the progression of Biogas over a 45-day period. These findings were derived from daily measurements of gas samples, a process taking only 3 minutes per sample using this system. Additionally, long-term measurements can be autonomously conducted by using an external micro pump. The power supply is ensured in autonomous mode by a 10000 mAh battery for over 25 hrs.

Since the system uses common commercial components such as sensors and syringes, manufacturing costs are very low. By utilizing only the methane sensor (Biogas production monitoring), the system can be built for a material cost of less than 200 Euro.

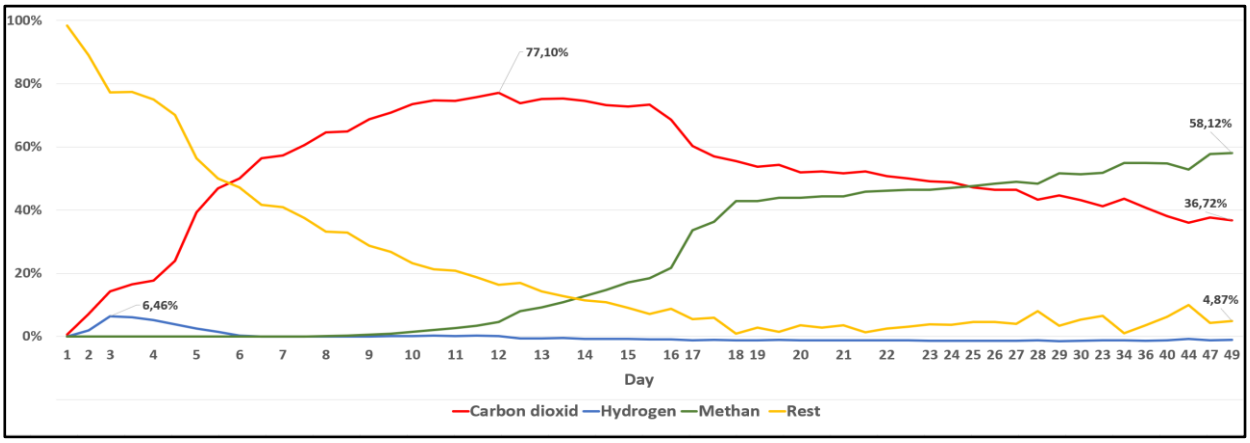

Figure 5: *An example of a long-term measurement to record the changes in gas concentrations during the production of biogas.*