

(12) **United States Patent**  
**Yoshimura**

(10) **Patent No.:** **US 9,410,872 B2**  
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **EXHAUST GAS FLOWMETER AND EXHAUST GAS ANALYZING SYSTEM**

USPC ..... 55/385.1, 385.3, DIG. 34; 96/417, 420, 96/422; 73/23.31, 114.69, 114.71, 114.76  
See application file for complete search history.

(71) Applicant: **HORIBA, Ltd.**, Kyoto (JP)  
(72) Inventor: **Tomoshi Yoshimura**, Kyoto (JP)  
(73) Assignee: **Horiba, Ltd.**, Kyoto (JP)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,968,452 A 10/1999 Silvis  
6,470,732 B1\* 10/2002 Breton ..... F01N 13/008  
73/114.69

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 161 days.

(Continued)

FOREIGN PATENT DOCUMENTS

(21) Appl. No.: **14/278,298**

EP 2339156 A2 6/2011  
JP 62-005151 A 7/1985  
JP 2004117259 A 4/2004

(22) Filed: **May 15, 2014**

(65) **Prior Publication Data**

US 2014/0338540 A1 Nov. 20, 2014

OTHER PUBLICATIONS

(30) **Foreign Application Priority Data**

May 16, 2013 (JP) ..... 2013-104434

Wiers, Ward W., et al. Carbon Dioxide (CO<sub>2</sub>) Tracer Technique for Model Mass Exhaust Emission Measurement, SAE Technical Paper 720126, Feb. 1, 1972, XP002729129, New York, pp. 1-14.

*Primary Examiner* — Duane Smith

*Assistant Examiner* — Minh-Chau Pham

(74) *Attorney, Agent, or Firm* — Brooks Kushman P.C.

(51) **Int. Cl.**

**G01F 9/00** (2006.01)  
**G01N 1/22** (2006.01)  
**G01N 21/3504** (2014.01)  
**G01F 1/704** (2006.01)  
**G01N 21/3554** (2014.01)  
**G01M 15/10** (2006.01)  
**G01N 21/61** (2006.01)

(57) **ABSTRACT**

The present invention is adapted to be provided with: a first sampling line for sampling raw exhaust gas; a first concentration measuring part that measures the concentration of the predetermined target component contained in the raw exhaust gas; a second sampling line for sampling diluted exhaust gas; a second concentration measuring part that measures the concentration of the target component contained in the diluted exhaust gas; and an arithmetic unit that, with use of first measured concentration, second measured concentration, and a diluted exhaust gas flow rate, calculates a raw exhaust gas flow rate, wherein in a state where the first sampling line and the first concentration measuring part are heated, the first concentration measuring part measures the concentration of the target component contained in the raw exhaust gas.

(52) **U.S. Cl.**

CPC ..... **G01N 1/2252** (2013.01); **G01F 1/704** (2013.01); **G01F 9/00** (2013.01); **G01M 15/108** (2013.01); **G01N 21/3504** (2013.01); **G01N 21/3554** (2013.01); **F01N 2560/07** (2013.01); **G01N 21/61** (2013.01); **G01N 2001/2255** (2013.01)

(58) **Field of Classification Search**

CPC ..... F01N 13/008; G01F 1/46; G01F 9/001; G01M 15/102; G01M 15/106

**4 Claims, 2 Drawing Sheets**

