

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
24 August 2023 (24.08.2023)



(10) International Publication Number
WO 2023/155966 A1

(51) International Patent Classification:

B60P 3/22 (2006.01) **G06Q 10/00** (2012.01)
B63B 17/00 (2006.01) **H04L 67/00** (2022.01)
B67D 7/00 (2010.01) **G01D 1/00** (2006.01)
F17C 13/00 (2006.01) **G01F 15/063** (2022.01)
F17D 3/18 (2006.01) **G01F 15/06** (2022.01)

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(21) International Application Number:

PCT/EP2022/025052

(22) International Filing Date:

16 February 2022 (16.02.2022)

(25) Filing Language:

English

(26) Publication Language:

English

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(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, IT, JM, JO, JP, KE, KG, KH,
KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA,

(54) Title: INTELLIGENT SYSTEM FOR REAL-TIME MEASUREMENTS AND ANALYSIS OF FUEL OILS, FOR QUANTI-
TATIVE AND QUALITATIVE ASSESSMENT AND ACCEPTANCE

(57) Abstract: 1. The System allows for the acquisition, monitoring, presentation, analysis and storage of numerous parameters, noti-
fications and alarms, in real time, during the refueling process of ships (or any means of transport) or the fuel cargo loading-unloading
process. The System consists of (at least) the following parts: a. A Portable Device (powered by a rechargeable battery or by an external
DC or AC source), which is installed in line with the fuel flow and: (1) Provides measurements of numerous parameters related to the
quantitative delivery-acceptance of the fuel: ■ Operating and standard (normalized to any desired temperature) fuel volume rate (m3 /
h). ■ Operating and standard (normalized to any desired temperature) fuel mass rate (tn / h). ■ Operating and standard (normalized to
any desired temperature) total fuel volume (m3). ■ Operating and standard (normalized to any desired temperature) total fuel mass (tn).
(2) Identifies the category/type of the fuel (e.g. RMG 380, RMG 180, Gasoil, etc.). (3) Detects possible adulteration of the fuel with air
bubbles (providing alarms when the detected level exceeds a desired limit). (4) Performs instant/real-time chemical analysis of the fuel
and measures: ■ Fuel kinematic and dynamic viscosity (cSt). ■ Fuel operating and standard (normalized to any desired temperature)
density (kg/m3) and API degree. ■ Fuel temperature (°C). ■ Fuel humidity (% water content (P%/0)). ■ % content of various chemical
elements, such as S, Al, Si, Ca, V, P, Zn, Na, etc. (all chemical elements of the "Periodic Table" can be detected, according to the
needs of the application). (5) Detects the location of the bunkering site (WGS84 coordinates), exploiting all available Global Navigation
Satellite Systems. (6) Provides notifications and alarms in case any of the measured fuel parameters exceed specific limits/thresholds, as
defined in international/national standards in force. (7) Provides geo-fencing notifications and alarms. (8) Transmits all aforementioned
data: ■ To a Cloud Application & Data Base, via the cellular network or satellite communications or radio links for communication with
a local router/gateway. ■ To a Mobile Application, via short-range radio links available on Mobile Phones. (9) Its limits/thresholds,
sampling rate, various configuration parameters and Firmware (FW) can be remotely updated: ■ From a Cloud Application, via the
cellular network or satellite communications or radio links for communication with a local router/gateway. ■ From a Mobile Applica-
tion, via short-range radio links available on Mobile Phones. (10) Stores all above mentioned data. b. A Cloud Application & Data Base,
which support: (1) All functions of the Portable Device, as described in paragraph 1a. (2) Data analytics and statistics. (3) Storage and
processing of historic data. (3) User management. c. A Mobile Application developed to support the functions of the Portable Device,
as described in paragraph 1.a. This Application is used on a Mobile Phone in the vicinity of the Portable Device. The Radio Access
Technology (RAT) between the mobile phone and the Portable Device can short-range radio links available on Mobile Phones. 2. The
System: a. Ensures the delivery - acceptance of the correct quantity (volume and mass) of fuel. b. Ensures the delivery - acceptance
of the proper quality of fuel, according international/national standards in force. c. Ensures optimal management of a ship's refueling
or fuel cargo loading-unloading process and minimization (or even elimination) of the economic losses for all stakeholders, due to
adulterated fuels or fuels of bad quality.

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MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,
RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM,
ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*
