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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 July 2020 (30.07.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/151991 A1

(51) International Patent Classification:
F25J 1/00 (2006.01)

(21) International Application Number:
PCT/EP2020/050749

(22) International Filing Date:
14 January 2020 (14.01.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2019-008163 22 January 2019 (22.01.2019) JP

(71) Applicant: **L'AIR LIQUIDE SOCIETE ANONYME POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE** [FR/FR]; 75, Quai d'Orsay, 75007 PARIS (FR).

(72) Inventors: **TOMITA, Shinji**; c/o Air Liquide Global E&C Solutions Japan Ltd., 7-1-15, Goko-dori, Chuo-ku, Hyogo Prefecture, KOBE, Hyogo 651-0087 (JP). **HIROSE, Kenji**; c/o Air Liquide Global E&C Solutions Japan Ltd., 7-1-15, Goko-dori, Chuo-ku, Hyogo Prefecture, 651-0087, KOBE, Hyogo 651-0087 (JP). **UTSUNOMIYA, Hirofumi**; c/o Air Liquide Global E&C Solutions Japan Ltd., 7-1-15, Goko-dori, Chuo-ku, Hyogo Prefecture, KOBE, Hyogo 651-0087 (JP).

(74) Agent: **DE BEAUFORT, François-Xavier**; L'AIR LIQUIDE S.A., Département de la propriété intellectuelle, 75 Quai d'Orsay, 75321 PARIS Cedex 07 (FR).

(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,

(54) Title: GAS LIQUEFACTION METHOD AND GAS LIQUEFACTION DEVICE

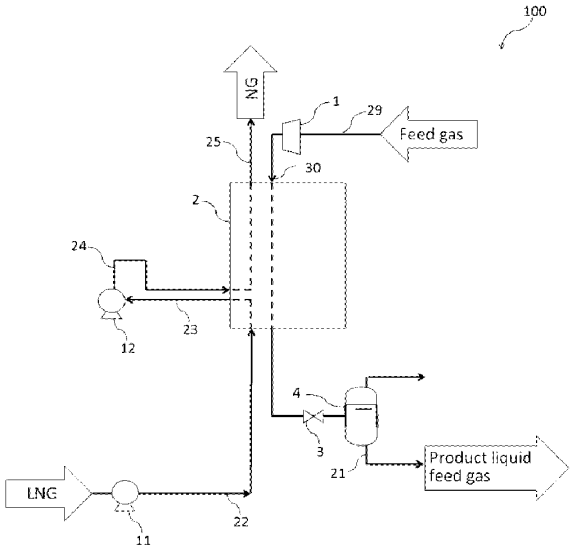

Figure 1

(57) Abstract: To provide a gas liquefaction device and a gas liquefaction method employing said gas liquefaction device, capable of supplying high-pressure natural gas in a device which liquefies a feed gas with a high efficiency by utilizing the coldness of liquefied natural gas. This gas liquefaction device comprises a main heat exchanger (2) which cools feed gas that has been compressed by a first compressor (1), a first pressure reducing valve (3) which decompresses and cools the feed gas, a gas-liquid separator (4) which subjects the feed gas that has been discharged from the first pressure reducing valve (3) to gas-liquid separation, a first pump (11) which pressurises the liquefied natural gas to a first pressure, and a second pump (12) which pressurises the liquefied natural gas to a second pressure higher than the first pressure, wherein, in the main heat exchanger (2), heat is exchanged between the feed gas on the one hand, and the liquefied natural gas pressurised by the first pump (11) and the liquefied natural gas pressurised by the second

[Continued on next page]

WO 2020/151991 A1

HR, HU, ID, IL, IN, IR, IS, JO, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, 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:

— *of inventorship (Rule 4.17(iv))*

Published:

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

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*