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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 September 2025 (18.09.2025)

WIPO | PCT

(10) International Publication Number
WO 2025/190917 A1

(51) International Patent Classification:
F25J 1/00 (2006.01) *F25J 1/02* (2006.01)

(21) International Application Number:
PCT/EP2025/056566

(22) International Filing Date:
11 March 2025 (11.03.2025)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
202441018982 15 March 2024 (15.03.2024) IN
24172904.5 29 April 2024 (29.04.2024) EP

(71) Applicant *(for all designated States except US)*: **SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.** [NL/NL]; Carel van Bylandtlaan 30, 2596 HR The Hague (NL).

(71) Applicant *(for US only)*: **SHELL USA, INC.** [US/US]; P.O. BOX 576, Houston, Texas 77001-0576 (US).

(72) Inventors: **CLARE, Robert James**; Hill Park Court, Springfield Drive Leatherhead, Surrey KT22 7NL (GB). **MALLIKONDLA, Vasudha**; Plot No 7, Bengaluru Hardware Park, Devanahalli Industrial Park. Mahadeva Kodigahalli, Karnataka, Bangalore North 562149 (IN). **MACNAIR, Chris**; Shell Centre 2 York Road Waterloo, London SE1 7NA (GB). **WIJNANS, Sanne**; Grasweg 31, 1031HW Amsterdam (NL). **VAN DE VENNE, Joost Pieter**; Grasweg 31, 1031HW Amsterdam (NL).

(74) Agent: **SHELL LEGAL SERVICES IP**; PO BOX 384, 2501 CJ The Hague (NL).

(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, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, 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, UY, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, 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,

(54) Title: A PROCESS FOR HANDLING A HYDROGEN BOG STREAM

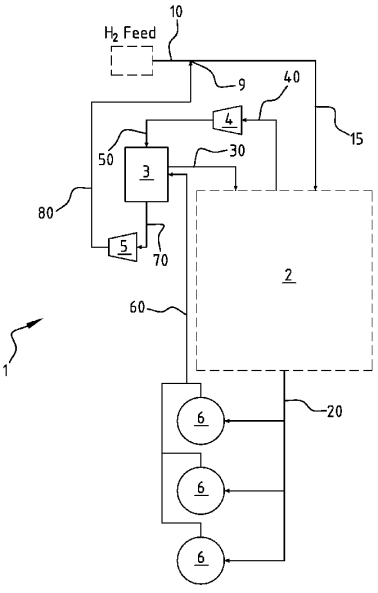


FIG. 2

(57) Abstract: The present invention provides a process for handling a hydrogen BOG (boil-off gas) stream, the process at least comprising the steps of: (a) providing a hydrogen feed stream (10) to be liquefied; (b) cooling the hydrogen feed stream (10) provided in step (a) in a liquefaction unit (2) comprising a precooling cold box (21) and a liquefaction cold box (22), using at least a first refrigerant (30) thereby obtaining an at least partly liquefied hydrogen stream (20), wherein the first refrigerant (40) is, after leaving the liquefaction unit (2), compressed in a compressor (4) to obtain a compressed first refrigerant (50) and cooled in an external heat exchanger (3) before being returned to the liquefaction unit (2); (c) providing a hydrogen BOG stream (60); (d) heating the hydrogen BOG stream (60) provided in step (c) in the external heat exchanger (3) against the compressed first refrigerant (50), thereby obtaining a heated hydrogen BOG stream (70); (e) compressing the heated hydrogen BOG stream (70), thereby obtaining a compressed heated hydrogen BOG stream (80); (f) combining the compressed heated hydrogen BOG stream (80) obtained in step (e) with the hydrogen feed stream (10) provided in step (a); and wherein the first refrigerant (30,40,50) is in a closed refrigerant loop comprising the external heat exchanger (3), the compressor (4) and the liquefaction unit (2).

WO 2025/190917 A1

[Continued on next page]

LU, LV, MC, ME, 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))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*