



(51) International Patent Classification:

H01L 31/18 (2006.01) H01L 31/042 (2014.01)
B09B 3/00 (2022.01) B09B 5/00 (2006.01)
H02S 30/00 (2014.01)

(21) International Application Number:

PCT/SG2024/050323

(22) International Filing Date:

16 May 2024 (16.05.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10202301373S 16 May 2023 (16.05.2023) SG

(71) Applicant: SINGAPORE POLYTECHNIC [SG/SG];
500 Dover Road, Singapore 139651 (SG).

(72) Inventors: LI, Xiaodong; c/o Advanced Materials Technology Centre, Singapore Polytechnic, 500 Dover Road, Singapore 139651 (SG). THONG, Ya Xuan; c/o Advanced Materials Technology Centre, Singapore Polytechnic, 500 Dover Road, Singapore 139651 (SG). LU, Yanru; c/o Advanced Materials Technology Centre, Singapore Polytechnic,

500 Dover Road, Singapore 139651 (SG). YIN, Xi Jiang; c/o Advanced Materials Technology Centre, Singapore Polytechnic, 500 Dover Road, Singapore 139651 (SG).

(74) Agent: DAVIES COLLISON CAVE ASIA PTE. LTD; 10 Collyer Quay, #07-01 Ocean Financial Centre, Singapore 049315 (SG).

(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, 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,

(54) Title: APPARATUSES AND METHODS FOR RECOVERING RECYCLABLE COMPONENTS OF PHOTOVOLTAIC MODULES

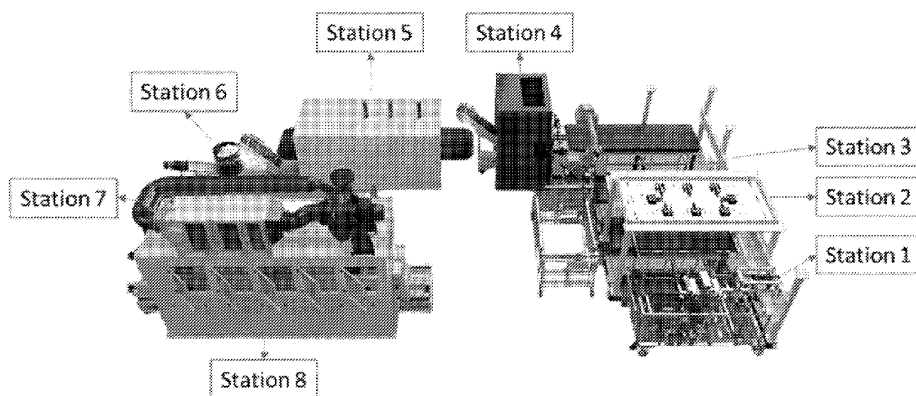


Figure 1

(57) Abstract: Disclosed herein are apparatuses and methods for systematic recovery of recyclable components from photovoltaic (PV) modules. The apparatuses are operable to receive a PV module on one end of one of the conveyor elements; load the PV module onto the frame removal station by the loading station; separate a frame from the PV module by the frame removal station to recover the frame; separate a junction box, a back support and one or more glass panels from the frameless PV module by the PV module dismantling station to obtain encapsulated solar cell units; heat the encapsulated solar cell units in the furnace station to remove the encapsulant; separate metallic bus bars and/or glass cullets from solar cell units by the component separation station to obtain solar cells; and etch the solar cells by the etching station to recover aluminium, silver and silicon wafers.

[Continued on next page]

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, 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:

— *of inventorship (Rule 4.17(iv))*

Published:

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