

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
28 March 2019 (28.03.2019)



(10) International Publication Number
WO 2019/060876 A2

(51) International Patent Classification:

B01D 61/02 (2006.01) **B01D 61/08** (2006.01)
B01D 61/06 (2006.01) **B01D 61/12** (2006.01)

(21) International Application Number:

PCT/US2018/052576

(22) International Filing Date:

25 September 2018 (25.09.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/562,694 25 September 2017 (25.09.2017) US
16/138,291 21 September 2018 (21.09.2018) US

(71) Applicant: **FLUID EQUIPMENT DEVELOPMENT
COMPANY, LLC** [US/US]; 800 Ternes Drive, Monroe,
Michigan 48162 (US).

(72) Inventor: **OKLEJAS, Eli, Jr.**; 4750 Burke Road, Newport,
Michigan 48166 (US).

(74) Agent: **MIERZWA, Kevin G.**; HARNESS, DICKEY &
PIERCE, P.L.C., P. O. Box 828, Bloomfield Hills, Michigan
48303 (US).

(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, JO, JP, 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, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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).

(54) Title: METHOD AND SYSTEM FOR OPERATING A HIGH RECOVERY SEPARATION PROCESS

(57) Abstract: A reverse osmosis system and method includes a pump pressurizing a feed stream, a first and second membrane array that generates permeate and brine streams. A first energy recovery device uses first energy from the second brine stream to pressurize the first brine stream. A first and second auxiliary and bypass valves are associated with the first and second energy recovery device. A second energy recovery device uses second energy from the second brine stream to increase a second pressure of the feed stream. A first flowmeter generates a first flow signal for the first permeate stream. A second flowmeter generates a second flow signal for the second permeate stream. A third flowmeter generates a third flow signal for the second brine stream. A motor drives the first energy recovery device. A controller controls the in response to the flow signals.



WO 2019/060876 A2