

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
02 January 2025 (02.01.2025)



(10) International Publication Number
WO 2025/006647 A2

(51) International Patent Classification:
Not classified

(21) International Application Number:
PCT/US2024/035678

(22) International Filing Date:
26 June 2024 (26.06.2024)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/523,942 29 June 2023 (29.06.2023) US

(71) Applicants: **KABUSHIKI KAISHA YASKAWA DENKI** [JP/JP]; 2-1, Kurosaki-Shiroishi, Yahatanishi-ku, Kitakyushu-shi, Fukuoka, 806-0004 (JP). **YASKAWA AMERICA, INC.** [US/US]; 2121 Norman Drive South, Waukegan, IL 60085 (US).

(72) Inventor: **ROGERS, John Charles**; c/o Yaskawa America, Inc., 2121 Norman Drive, South, Waukegan, IL 60085 (US).

(74) Agent: **WARD, Christopher, D.**; Mori & Ward, LLP, 2000 Duke Street, Suite 300, Alexandria, VA 22314 (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, 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.

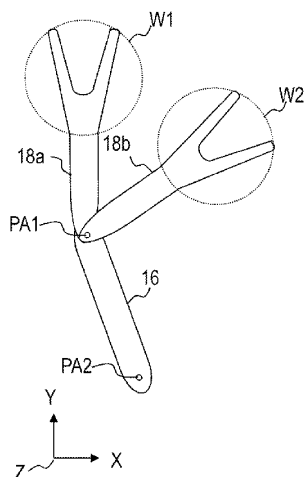
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, 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).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: APPARATUS AND METHOD FOR OPTIMIZING SWAP TIME

FIG. 1A



(57) Abstract: A robotic apparatus including an arm member configured to pivot about a first axis, a first end effector, a second end effector, a drive unit, and a control unit. The first and second end effectors are pivotably connected to the arm member about a second axis, and each have a surface to receive a workpiece. The drive unit drives the arm member to pivot about the first axis, and to drive the first and second end effectors to pivot about the second axis. The control unit controls the drive unit to move the arm member and the first and second end effectors to perform a swapping operation that includes the first and second end effectors swapping arc positions at opposite ends of an arc of constant radius of curvature such that the workpieces on the first and second end effectors each travel at equal and constant velocities along the arc.

WO 2025/006647 A2