

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 September 2006 (28.09.2006)

PCT

(10) International Publication Number
WO 2006/102089 A2

(51) International Patent Classification:
E04C 3/30 (2006.01)

(21) International Application Number:
PCT/US2006/009729

(22) International Filing Date: 16 March 2006 (16.03.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/663,392 17 March 2005 (17.03.2005) US

(71) Applicant (for all designated States except US): **INDUSTRIAL ORIGAMI, LLC** [US/US]; 487 Bryant Street, San Francisco, CA 94107 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **DURNEY, Max, W.** [US/US]; 2069 Hayes Street, San Francisco, CA 94117 (US).

(74) Agents: **BREZNER, David, J.** et al.; Dorsey & Whitney LLP, Suite 1000, 555 California Street, San Francisco, CA 94104-1513 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

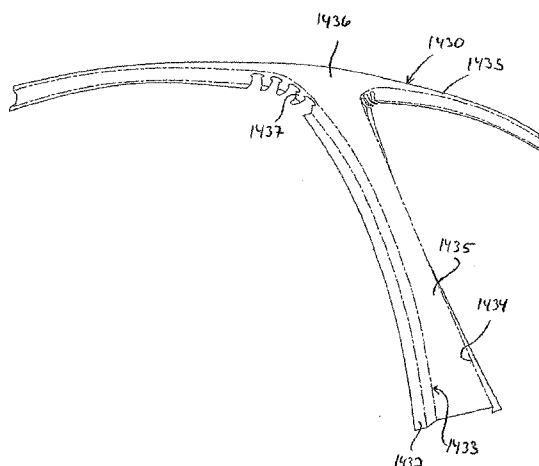
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PRECISION-FOLDED, HIGH STRENGTH, FATIGUE-RESISTANT STRUCTURES AND SHEET THEREFOR



(57) **Abstract:** Precision-folded, high strength, fatigue-resistant structures and a sheet therefore are disclosed. To form the structures, methods for precision bending of a sheet of material along a bend line and a sheet of material formed with bending strap-defining structures, such as slits or grooves, are disclosed. Methods include steps of designing and then separately forming longitudinally extending slits or grooves through the sheet of material in axially spaced relation to produce precise bending of the sheet when bent along the bend line. The bending straps have a configuration and orientation which increases their strength and fatigue resistance, and most preferably slits or arcs are used which causes edges to be engaged and supported on faces of the sheet material on opposite sides of the slits or arcs. The edge-to-face contact produces bending along a virtual fulcrum position in superimposed relation to the bend line. Several slit embodiments suitable for producing edge-to-face engagement support and precise bending are disclosed. With these teachings, forming numerous three-dimensional load-bearing structures from a two dimensional sheet are enabled. Examples of straight and curved beams, chassis, and exoskeletons are disclosed.



WO 2006/102089 A2