



(51) International Patent Classification:
G01N 21/65 (2006.01)

(21) International Application Number:

PCT/US2024/026934

(22) International Filing Date:

30 April 2024 (30.04.2024)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/463,187 01 May 2023 (01.05.2023) US

(71) Applicant: **AMGEN INC.** [US/US]; One Amgen Center Drive, Thousand Oaks, CA 91320-1799 (US).

(72) Inventors: **SOTO, Robert Joseph**; c/o Amgen Inc., One Amgen Center Drive, Mail Stop 28-5-A, Thousand Oaks,

CA 91320-1799 (US). **MERIAGE, David**; c/o Amgen Inc., One Amgen Center Drive, Mail Stop 28-5-A, Thousand Oaks, CA 91320-1799 (US).

(74) Agent: **PHELAN, Ryan N.**; MARSHALL, GERSTEIN & BORUN LLP, 233 S. Wacker Drive, 6300 Willis Tower, Chicago, IL 60606-6357 (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,

(54) Title: CONFIGURABLE HANDHELD BIOLOGICAL ANALYZERS FOR IDENTIFICATION OF BIOLOGICAL PRODUCTS BASED ON RAMAN SPECTROSCOPY USING ARTIFICIAL INTELLIGENCE

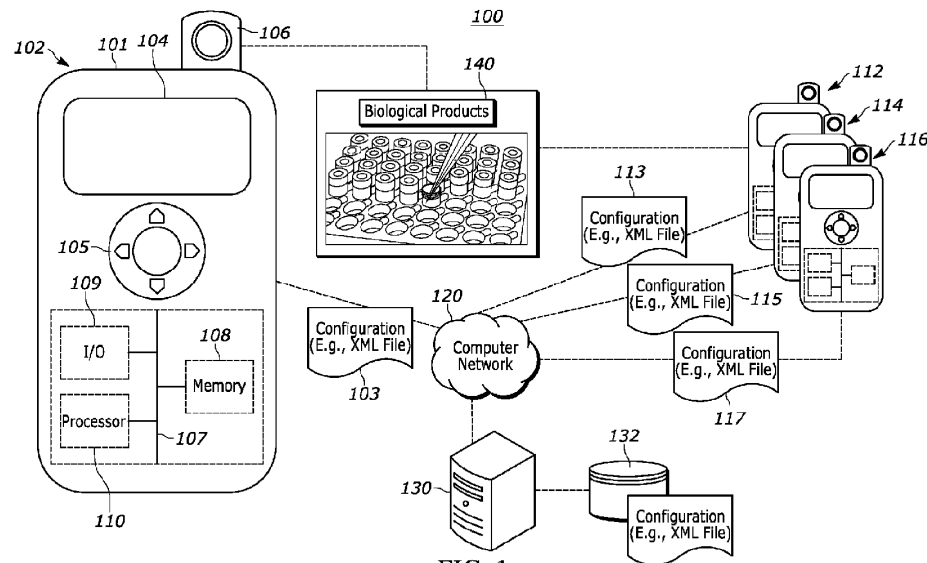


FIG. 1

(57) Abstract: Configurable handheld biological analyzers and related biological analytics methods are described for identification of biological products based on Raman spectroscopy using ensemble artificial intelligence (AI). A biological classification ensemble model configuration (103) is loaded into a computer memory (108) of a configurable handheld biological analyzer (102) having a processor (110) and a scanner (106). The biological ensemble classification model configuration includes a biological classification ensemble model having an unsupervised model and a supervised model. The processor is configured to receive a Raman-based spectra dataset defining a biological product sample as scanned by the scanner and to execute a spectral preprocessing algorithm of the biological ensemble classification model configuration to reduce a spectral variance of the Raman-based spectra dataset. The biological ensemble

[Continued on next page]

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:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

classification model identifies a biological product type based on the Raman-based spectra dataset.