



(51) International Patent Classification:

G02B 6/293 (2006.01) G02F 1/21 (2006.01)
G02B 26/08 (2006.01) H01S 5/04 (2006.01)

(21) International Application Number:

PCT/GB2024/051354

(22) International Filing Date:

24 May 2024 (24.05.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2307891.8 26 May 2023 (26.05.2023) GB

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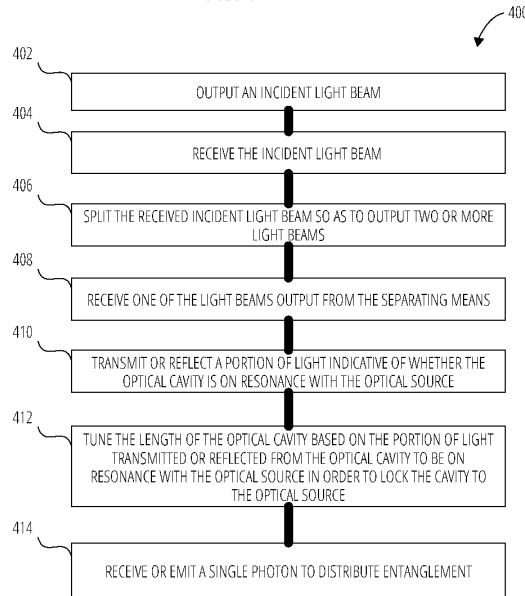
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, 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: APPARATUS, METHOD AND SYSTEM FOR SCALABLE OPTICAL CAVITY LOCKING

FIG. 4



(57) Abstract: According to aspects of the disclosure, an apparatus, system and method for stabilising the length of a plurality of optical cavities is provided. The apparatus comprises an optical light source configured to output an incident light beam. The apparatus also includes a separating means configured to receive the incident light beam output from the optical source and split the received incident light beam so as to output two or more light beams. The apparatus further includes a plurality of optical cavities, where each optical cavity of the plurality of optical cavities is configured to receive one of the light beams output from the separating means and transmit or reflect a portion of light indicative of whether the optical cavity is on resonance with the optical light source. Each optical cavity is also configured to contain a matter qubit within the optical cavity. Each matter qubit is configured to capture photons to distribute quantum entanglement, where a rate of entanglement is enhanced by the Purcell effect. Each optical cavity is further configured to be

[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))

connected to an actuator. The actuator is configured to tune the length of the optical cavity based on the portion of light transmitted or reflected from the optical cavity to be on resonance with the optical source in order to lock the optical cavity to the optical source. The matter qubit is the same for each optical cavity. The incident light beam is detuned by a ratio of two integers, a and b where a/b denotes a fixed fraction, from a transition wavelength of the matter qubit to ensure that, for each optical cavity, there is at least one point within a travel range of the actuator where a dual-resonance condition is met such that the optical cavity is simultaneously resonant with the matter qubit and the incident light beam.