

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
27 May 2022 (27.05.2022)



(10) International Publication Number
WO 2022/106328 A1

(51) International Patent Classification:
G06N 10/40 (2022.01) *H01L 27/18* (2006.01)
H05K 1/02 (2006.01)

(21) International Application Number:
PCT/EP2021/081623

(22) International Filing Date:
15 November 2021 (15.11.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
16/950,610 17 November 2020 (17.11.2020) US

(71) Applicant: **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, New York 10504 (US).

(71) Applicant (for MG only): **IBM DEUTSCHLAND GMBH** [DE/DE]; IBM-Allee 1, 71139 Ehningen (DE).

(72) Inventors: **TIMPANE, Trevor**; IBM CORPORATION, 3605 Highway 52 North, Rochester, Minnesota 55901-1407 (US). **BERGE, Layne**; IBM CORPORATION, 3605 Highway 52 North, Rochester, Minnesota 55901-1407 (US). **GUMANN, Patryk**; IBM Thomas J Watson Research Center, 1101 Kitchawan Road, P.O. Box 218, Yorktown Heights, New York 10598 (US). **HART, Sean**; IBM Thomas J Watson Research Center, 1101 Kitchawan Road, P.O. Box 218, Yorktown Heights, New York 10598 (US). **LARSEN, Curtis Eugene**; IBM CORPORATION, 3605 Highway 52 North, Rochester, Minnesota 55901-1407 (US). **GOOD, Michael**; IBM CORPORATION, 3605 Highway 52 North, Rochester, Minnesota 55901-1407 (US).

(74) Agent: **LAUX, Felix**; IBM Deutschland GmbH, Patentwesen und Urheberrecht, IBM-Allee 1, 71139 Ehningen (DE).

(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,

(54) Title: GROUND CONDUCTOR DISCONTINUITIES FOR THERMAL ISOLATION OF QUBIT CIRCUITS

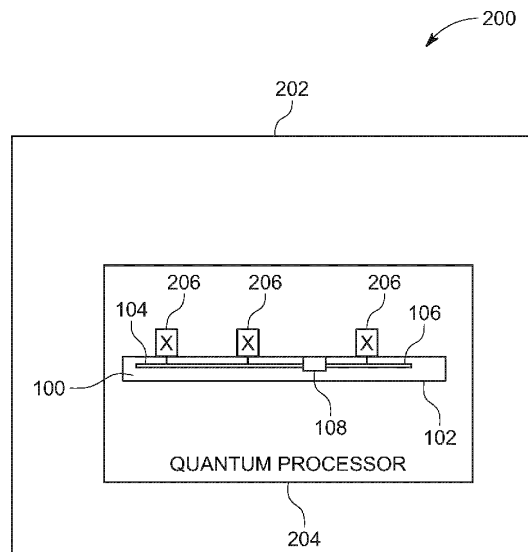


FIG. 4

(57) Abstract: A quantum mechanical circuit (100) includes a first electrical conductor (104) and a second electrical conductor (106) provided on a substrate (102) and spaced apart to provide a gap (112) therebetween, and a third electrical conductor (108) to electrically connect the first and second electrical conductors. The third electrical conductor has a thermal conductivity substantially lower than a thermal conductivity of the first and second electrical conductors, to provide for thermal isolation. Qubits (206) of a superconducting quantum processor (204) are provided on the substrate and are electrically connected to ground via at least one of the first or second electrical conductors.

[Continued on next page]



WO 2022/106328 A1

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, IT, 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, 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, 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).

Published:

- with international search report (Art. 21(3))
- in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE