

Title (en)
CRYOGEN FREE COOLING APPARATUS AND METHOD

Title (de)
VORRICHTUNG UND VERFAHREN ZUR KRYOGENFREIEN KÜHLUNG

Title (fr)
APPAREIL ET PROCÉDÉ DE REFROIDISSEMENT EXEMPTS DE CRYOGÈNE

Publication
EP 3620732 B1 20220216 (EN)

Application
EP 19187223 A 20100315

Priority

- GB 0904500 A 20090316
- EP 10710389 A 20100315
- GB 2010000454 W 20100315

Abstract (en)
[origin: WO2010106309A2] A cryogen free cooling apparatus comprises at least one heat radiation shield (54) surrounding a working region (20) and located in a vacuum chamber (4). A cryogen free cooling system has a cooling stage coupled to the heat radiation shield (54). Aligned apertures (56,58) are provided in the heat radiation shield and vacuum chamber walls. Sample loading apparatus has a sample holding device (2) attached to one or more elongate probes (3) for inserting the sample holding device through the aligned apertures (56,58) to the working region (20); and a thermal connector enables the sample holding device to be releasably coupled for heat conduction via said connector to a cold body or cold bodies within the vacuum chamber so as to pre-cool a sample on or in the sample holding device.

IPC 8 full level
F25D 19/00 (2006.01)

CPC (source: EP US)
F25B 9/14 (2013.01 - EP); **F25B 9/145** (2013.01 - EP); **F25D 19/00** (2013.01 - EP US)

Citation (opposition)
Opponent : Bluefors Oy

- WO 2010002245 A2 20100107 - FROSSATI GIORGIO [NL]
- US 5611207 A 19970318 - HESS JOHN [US]
- JP 2008014878 A 20080124 - UNIV KYUSHU
- JP 2001304709 A 20011031 - TAIYO TOYO SANSEI CO LTD
- WO 2007101305 A1 20070913 - CAMBRIDGE MAGNETIC REFRIGERATION [GB], et al
- JP 2001255252 A 20010921 - JEOL LTD
- JP 4163447 B2 20081008
- J.E.RIX ET AL.: "Automated sample exchange and tracking system for neutron research at cryogenic temperatures", REVIEW OF SCIENTIFIC INSTRUMENTS, vol. 78, 2007, XP012103606, DOI: 10.1063/1.2426878
- "The Art of Cryogenics Low-Temperature Experimental Techniques", 1 January 2008, ELSEVIER, ISBN: 978-0-08-044479-6, article ANONYMOUS: "Dilution Refrigerators", pages: 158 - 160, XP093131681
- UHLIG KURT: "Concept of a Powerful Cryogen-Free Dilution Refrigerator with Separate 1K Stage", CRYOCOOLER 16; PROCEEDINGS OF THE 16TH INTERNATIONAL CRYOCOOLER CONFERENCE, HELD MAY 17-20, 2010 IN ATLANTA, GEORGIA, INTERNATIONAL CRYOCOOLER CONFERENCE, INC., BOULDER, CO, USA, 1 January 2011 (2011-01-01) - 20 May 2010 (2010-05-20), Boulder, CO, USA, pages 509 - 513, XP093142130
- UHLIG, K.: "³He/⁴He dilution refrigerator with pulse-tube refrigerator precooling", CRYOGENICS, ELSEVIER, KIDDLINGTON, GB, vol. 42, no. 2, 1 February 2002 (2002-02-01), GB, pages 73 - 77, XP004346863, ISSN: 0011-2275, DOI: 10.1016/S0011-2275(02)00002-4
- BAUM H.-P., Y. J. QIAN, M.-F. XU, A. SCHENSTROM, M. LEVY, BIMAL K. SARMA: "Top-Loading Dilution Refrigerator for High Frequency Measurements", JAPANESE JOURNAL OF APPLIED PHYSICS, PHYSICAL SOCIETY OF JAPAN AND THE JAPAN SOCIETY OF APPLIED PHYSICS, vol. 26, no. S3-2, 1 January 1987 (1987-01-01) - 26 August 1987 (1987-08-26), pages 1731 - 1732, XP093142136, ISSN: 1347-4065, DOI: 10.7567/JJAPS.26S3.1731
- "Dissertation ", 1 January 1994, STANFORD UNIVERSITY, article TIGNER BENJAMIN: "A one millikelvin top-loading dilution refrigerator and demagnetization cryostat ; and , The electric field dependence of the dielectric constant in amorphous materials at ultra-low temperatures ", pages: 1 - 172, XP093131766

Cited by
WO2021229149A1

Designated contracting state (EPC)
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

DOCDB simple family (publication)
WO 2010106309 A2 20100923; WO 2010106309 A3 20110519; WO 2010106309 A8 20111013; EP 2409096 A2 20120125; EP 2409096 B1 20190821; EP 2409096 B2 20240619; EP 3620732 A1 20200311; EP 3620732 B1 20220216; EP 4027081 A2 20220713; EP 4027081 A3 20220831; EP 4027081 B1 20221221; EP 4148353 A1 20230315; EP 4148353 B1 20240522; EP 4148353 C0 20240522; ES 2909009 T3 20220504; ES 2935698 T3 20230309; FI 2409096 T4 20240620; FI 4027081 T3 20230113; FI 4148353 T1 20230329; GB 0904500 D0 20090429; JP 2012520987 A 20120910; US 2012102975 A1 20120503

DOCDB simple family (application)
GB 2010000454 W 20100315; EP 10710389 A 20100315; EP 19187223 A 20100315; EP 22154522 A 20100315; EP 22205298 A 20100315; ES 19187223 T 20100315; ES 22154522 T 20100315; FI 10710389 T 20100315; FI 22154522 T 20100315; FI 22205298 T 20100315; GB 0904500 A 20090316; JP 2012500303 A 20100315; US 201013257032 A 20100315