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Datasheet for the decision of 21 September 2023

Case Number: T 0873/22 - 3.2.03

Application Number: 10710389.7

Publication Number: 2409096

IPC: F25D19/00

Language of the proceedings: EN

Title of invention:
CRYOGEN FREE COOLING APPARATUS AND METHOD

Patent Proprietor:
Oxford Instruments Nanotechnology Tools Limited

Opponent:
Bluefors Oy

Headword:

Relevant legal provisions:
EPC Art. 100(b), 100(c), 83, 123(2), 54(2), 56, 13(2)
RPBA 2020 Art. 12(6)

Keyword:
Sufficiency of disclosure - (yes)
Amendments - added subject-matter main request (yes)
Amendment to case - complexity of amendment (high number of auxiliary requests)
Novelty - main request A(d) (no)
Inventive step - auxiliary request (yes)

Decisions cited:
T 2700/18, T 0500/20

Catchword:

Europäisches Patentamt
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Beschwerdekammern

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Chambres de recours

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Case Number: T 0873/22 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 21 September 2023

Appellant: (Patent Proprietor)	Oxford Instruments Nanotechnology Tools Limited Tubney Woods Abingdon Oxon OX13 5QX (GB)
Representative:	Gill Jennings & Every LLP The Broadgate Tower 20 Primrose Street London EC2A 2ES (GB)
Appellant: (Opponent)	Bluefors Oy Arinatie 10 00370 Helsinki (FI)
Representative:	Papula Oy P.O. Box 981 00101 Helsinki (FI)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 22 February 2022 concerning maintenance of the European Patent No. 2409096 in amended form.**

Composition of the Board:

Chairman	C. Herberhold
Members:	B. Goers
	D. Prietzel-Funk

Summary of Facts and Submissions

I. European patent No. 2 409 096 relates to a cryogen-free cooling apparatus comprising a sample loading apparatus having one or more elongate probes and a sample holding device and a method of loading a sample into the working region of a cryogen-free cooling apparatus.

II. With the impugned decision, the opposition division concluded that the patent as amended on the basis of auxiliary request 1 complied with the requirements of the EPC.

III. This decision was appealed by both the patent proprietor and the opponent, which in the following are referred to as such for the sake of simplicity.

IV. In oral proceedings before the Board, the final requests were as follows.

The patent proprietor requested that the decision under appeal be set aside and the patent be maintained as granted or that the patent be maintained in amended form on the basis of any of the auxiliary requests as displayed in matrixes A and B filed with the statement setting out the grounds of appeal (see pages 12 and 13) and further auxiliary requests filed with letter dated 18 November 2022 (see pages 16 to 18).

The appellant requested that the decision under appeal be set aside and that the patent be revoked.

V. The following evidence is relevant for this decision.

D11: WO 2007/101305 A1

D13: J. E. Rix et al., "Automated sample exchange and tracking system for neutron research at cryogenic temperatures", Review of Scientific Instruments, vol. 78, 2007

D17: H. Kambara, T. Matsui, Y. Niimi and Hiroshi Fukuyama, "Construction of a versatile ultralow temperature scanning tunneling microscope", Review of Scientific Instruments 78, 2007

D18: Tomohiro Matsui, Hiroshi Kambara and Hiroshi Fukuyama, "Development of a new LILT Scanning Tunneling Microscope at University of Tokyo, Journal of Low Temperature Physics, vol. 121, Nos. 5/6, 2000

D19: Hiroshi Kambara, Tomohiro Matsui and Hiroshi Fukuyam, "Construction of an ultralow temperature scanning tunneling microscope", KOTBA 2 41 (2) 75-148, 2006, No. 480, Solid State Physics, vol. 41 2006

D19a: English translation of D19

VI. Wording of the claim requests as far as it is relevant for the decision

(a) Independent claims 1 and 14 and dependent claims 7 and 8 of the **main request** (patent as granted) read as follows (feature numbering added in "[]"):

Claim 1:

"[1.1] *A cryogen free cooling apparatus comprising: a vacuum chamber (4); a first heat radiation shield (54) surrounding a working region (20) and located in the vacuum chamber (4); a cryofree cooling system,*
[1.2] *for example a mechanical cooler such as a GM cooler, Stirling cooler or pulse tube device,*
[1.3] *having a cooling stage coupled to the first heat radiation shield (54);*

[1.4] *a cold body (12) formed by a surface linked to a cold plate coupled to a cooling stage of the cooling system;*
[1.5] *a cold mounting body (15) located at the working region (20) and held at a lower temperature than the cold body (12);*
[1.6] *aligned apertures (52, 56) in the first heat radiation shield (54) and vacuum chamber wall; sample loading apparatus having one or more elongate probes (3) and*
a sample holding device (2) attached to the one or more elongate probes, the one or more elongate probes for inserting the sample holding device through the aligned apertures (52, 56) to the working region (20);
and a thermal connector (18),
[1.7] *whereby the sample holding device (2) is configured to be connected to the cold mounting body (15) via the connector,*
[1.8] *and whereby the elongate probe or each of the elongate probes (3) is releasably coupled to the sample holding device for releasing the sample holding device when the sample holding device is connected to the cold mounting body;*
[1.9] *characterised in that the sample holding device(2) is releasably coupled for heat conduction via said connector (18) to the cold body (12) so as to pre-cool a sample (1) on or in the sample holding device*
[1.10] *before the sample holding device is connected to the cold mounting body (15).*"

Claim 7:

"*Apparatus according to any of the preceding claims, wherein the one or more elongate probes (3) comprise two or more elongate probes, each coupled to the sample holding device.*"

Claim 8:

"*Apparatus according to claim 7, wherein each probe is rotatable about its axis relative to the sample holding device (2), and wherein the or each probe is preferably screw threaded (18) at one end to define the thermal connector, the connector cooperating with a screw thread (19) on cold body to achieve a thermal connection therebetween.*"

Claim 14:

"*A method of loading a sample (1) into the working region (20) of cryogen free cooling apparatus according claims 5 and 13, the method comprising:*
placing a sample (1) in or on the sample holding device (2);
securing the vacuum vessel (6) of the sample loading apparatus to the vacuum chamber (4) and aligned with the aperture (52) of the vacuum chamber;
evacuating the vacuum vessel (6);
opening the aperture (52) of the vacuum chamber (4) and operating the or each elongate probe (3) to insert the sample holding device (2) through the opened aperture so that the sample holding device is thermally coupled to the cold body;
allowing the sample (1) in or on the sample holding device (2) to be cooled as a result of heat conduction to the cold body;
disconnecting the sample holding device (2) from the cold body; and
operating the or each elongate probe (3) to insert the sample holding device (2) into the working region (20)."

(b) Main request A(d)

Claim 1 of main request A(d) corresponds to claim 1 of the main request with the following additional feature group [1.11] inserted between features [1.8] and [1.9].

"...[1.11] *whereby a first operation of the one or more elongate probes causes the sample holding device to be connected to the cold mounting body, and a second, subsequent operation enables the one or more elongate probes to be released from the sample holding device and retracted;...*"

Claim 14 of main request A(d) includes the features of claims 1, 5, 13 and 14 of the main request and in addition feature [1.11']

"*A method of loading a sample (1) into the working region (20) of cryogen free cooling apparatus, the cryogen free cooling apparatus comprising:*
a vacuum chamber (4); a first heat radiation shield (54) surrounding a working region (20) and located in the vacuum chamber (4); a cryofree cooling system, for example a mechanical cooler such as a GM cooler, Stirling cooler or pulse tube device, having a cooling stage coupled to the first heat radiation shield (54); a cold body (12) formed by a surface linked to a cold plate coupled to a cooling stage of the cooling system; a cold mounting body (15) located at the working region (20) and held at a lower temperature than the cold body (12);aligned apertures (52, 56) in the first heat radiation shield (54) and vacuum chamber wall, wherein the aligned aperture (52) in the vacuum chamber wall includes a closure system (5) such as a vacuum valve;
sample loading apparatus having one or more elongate probes (3) and a sample holding device (2) attached to the one or more elongate probes, the one or more

elongate probes for inserting the sample holding device through the aligned apertures (52, 56) to the working region (20),
wherein the sample loading apparatus further includes a vacuum vessel (6) in which the sample holding device (2) and elongate probe or probes (3) are movably mounted, the vacuum vessel being connectable to the aperture (52) of the vacuum chamber wall;
and a thermal connector (18),
whereby the sample holding device (2) is configured to be connected to the cold mounting body (15) via the connector,
and whereby the elongate probe or each of the elongate probes (3) is releasably coupled to the sample holding device for releasing the sample holding device when the sample holding device is connected to the cold mounting body;
wherein the sample holding device (2) is releasably coupled for heat conduction via said connector (18) to the cold body (12) so as to pre-cool a sample (1) on or in the sample holding device before the sample holding device is connected to the cold mounting body (15);
the method comprising:
placing a sample (1) in or on the sample holding device (2);
securing the vacuum vessel (6) of the sample loading apparatus to the vacuum chamber (4) and aligned with the aperture (52) of the vacuum chamber;
evacuating the vacuum vessel (6);
opening the aperture (52) of the vacuum chamber (4) and operating the or each elongate probe (3) to insert the sample holding device (2) through the opened aperture so that the sample holding device is thermally coupled to the cold body;

allowing the sample (1) in or on the sample holding device (2) to be cooled as a result of heat conduction to the cold body;
disconnecting the sample holding device (2) from the cold body;
operating the or each elongate probe (3) to insert the sample holding device (2) into the working region (20);
[1.11'] ***connecting the sample holding device (2) to the cold mounting body (15) via the connector; and releasing and retracting 5 the elongate probe or each of the elongate probes (3) from the sample holding device when the sample holding device is connected to the cold mounting body."***

(c) Auxiliary request 1 A(d)

Auxiliary request 1 A(d) corresponds to main request A(d) with the following amendment made to feature group [1.9] of claim 1. A corresponding amendment is also made to claim 14.

"... [1.9'] *the sample holding device (2) is releasably ~~coupled~~* ***connected*** *for heat conduction via said connector (18) to the cold body (12) so as to pre-cool a sample (1) on or in the sample holding device...*"

VII. The patent proprietor's arguments relevant to the present decision can be summarised as follows.

(a) Main request - Article 100 (b) EPC
The invention defined in claims 1 and 8 was sufficiently disclosed.

(b) Main request - Article 100 (c) EPC
The features of the claims were not disclosed in combination with a second heat radiation shield in the

application as filed. The retraction function of the probes was not disclosed as obligatory and was furthermore implicit in the releasable coupling. The omission of these features did thus not result in an unallowable intermediate generalisation.

(c) Admittance - Main request A(d) and auxiliary request 1 A(d)

The requests had to be admitted. They were a proper reaction to the reasons of the appealed decision and did not introduce new aspects not dealt with in the opposition proceedings. Even if there was arguably a large number of requests, these had been provided in a well-structured way with a clear walk-through.

(d) Main request A(d) - Novelty

The subject-matter of claim 1 was novel over D13 since in D13 the first heat radiation shield was not disclosed as being located in the vacuum chamber and the vacuum chamber had no aperture aligned with the other aperture. Also, the sample holding device was not coupled for heat conduction to the cold body but just held in proximity.

(e) Auxiliary request 1 A(d) - Article 83 EPC

The actuation of the release and retraction functions by use of the probes as actuators sufficiently enabled the skilled person to carry out the invention.

(f) Auxiliary request 1 A(d) - Admittance of new Article 123(2) EPC objection

The new argument supporting an objection of unallowable intermediate generalisation against claim 14 (retraction and release was only disclosed to be caused by the probes) could and should have been submitted in

the opposition proceedings and should not to be admitted.

(g) Auxiliary request 1 A(d) - Novelty
Claim 1 was novel over D13 as amended feature [1.9'] required a physical contact between the cold body and the sample holding device which was not disclosed in D11.

(h) Auxiliary request 1 A(d) - Inventive step
The submission of documents D17 to D19a and the substantiation of the inventive step objections starting from D13 in combination with common general knowledge, D11 and D17 to D19 only in oral proceedings was late, and none of these submissions should be admitted.
In addition, the subject-matter of claims 1 and 14 involved an inventive step starting from D13 as the closest prior art. None of the documents D11, D17, D18 and D19 disclosed that the same thermal connector is used for connecting the sample holding device with both the cold body for pre-cooling and the cold mounting body. This was not common general knowledge either.

VIII. The opponent's arguments relevant to the present decision can be summarised as follows.

(a) Main request - Article 100 (b) EPC
The conflicting definitions of the thermal connector and the probes in claims 1 and 8 meant that the patent did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

(b) Main request - Article 100 (c) EPC
The subject-matter of claim 1 extended beyond the content of the application as filed. A second heat radiation shield and a release and retraction function of the probes were omitted. This created an unallowable intermediate generalisation.

(c) Admittance - Main request A(d) and auxiliary request 1 A(d)
The requests should not be admitted. The number of auxiliary requests filed was too high and not convergent. This rendered the case too complex, this being "clearly contrary to procedural efficiency, approaching abuse". Furthermore, the requests diverged from those in the opposition proceedings and did not constitute a proper reaction to a surprising development in the opposition proceedings. Also, the request for the change of the order of requests only at oral proceedings was too late to be admitted.

(d) Main request A(d) - Novelty
Claim 1 of main request A(d) was not novel over the disclosure of D13. The term "coupling" with respect to the pre-cooling at the cold body did not require physical contact with the cold body and the sample holding device.

(e) Auxiliary request 1 A(d) - Article 83 EPC
Contrary to the requirements of Article 83 EPC, the patent had no enabling disclosure for actuators of the release and retraction function at the cold body.

(f) Auxiliary request 1 A(d) - Admittance of new Article 123(2) EPC objection
The argument that in claim 14 the releasing and retracting step was not disclosed to be caused by an

operation of the probes and that resulted in an unallowable intermediate generalisation had to be admitted into the appeal proceedings.

(g) Auxiliary request 1 A(d) - Novelty
The subject-matter of claim 1 was not novel over D13. The new wording of feature [1.9] did not restrict the scope compared to main request A(d).

(h) Auxiliary request 1 A(d) - Inventive step
The subject-matter of claims 1 and 14 was not inventive starting from D13 and considering either common general knowledge or D11, D17, D18 or D19.

Reasons for the Decision

1. Main request - Article 100 (b) EPC

The invention defined in claims 1 and 8 of the main request is disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

1.1 The opponent raised the following objections of lack of sufficiency of disclosure against the invention defined in claims 1 and 8 of the patent as granted.

- The definition of the thermal connector in claim 1 gave rise to a lack of sufficiency of disclosure since embodiments in which different thermal connectors were used for coupling with the cold body and the cold mounting body (e.g. springs at the cold bodies) were in conflict with the claim wording.
- The definition of the separate features "one or more elongate probes" and the "thermal connector" in claim 1 was in contradiction with claim 8 in which the thermal connector was defined as being a part of the elongated probe.

1.2 Claim 1 - Definition of the thermal connector

The Board agrees with the opponent that the term "thermal connector" also encompasses connector entities with more than a single component (such as multiple screws or springs). This understanding applies to all components involved in the coupling or connection

function with each of the cold body or the cold mounting body.

The thermal connector (entity) addressed in features [1.7] and [1.9] is defined in claim 1 as being the same ("said connector"). Accordingly, this one thermal connector has to establish both the:

- thermal coupling with the cold body
- connection with the cold mounting body.

This implies that the thermal connector - be it embodied by springs or screws - is movable from the pre-cooling position at the cold body to the final position at the cold mounting body. These embodiments are considered to be sufficiently disclosed (see e.g. Figures 4 and 6).

For the same reason, the embodiments suggested by the opponent in which different connectors (be it different types or different entities of the connector) are used for coupling with the cold body and connection to the cold mounting body (such as springs fixed to each cold body) are not encompassed by the subject-matter claimed. The fact that these embodiments are not described in the patent can thus also not constitute a lack of sufficient disclosure.

1.3 Claim 8 - Contradiction in the definition of the "elongate probe"

1.3.1 The opponent correctly noted that the definitions of the terms "elongate probe" and "thermal connector" as applied in claims 1 and 8 are inconsistent.

1.3.2 In claim 1 as granted, the elongate probe and the thermal connector are defined as separate items, both with different functions:

elongate probe:
- for inserting the sample holding device through the aligned apertures to the working region ([1.6])
- releasably coupled to the sample holding device for releasing the sample holding device ([1.8])

thermal connector:
- connecting the sample holding device to the cold mounting body ([1.7])
- releasably coupling the sample holding device to the cold body for heat conduction ([1.9])

These functional definitions of claim 1 encompass the two different main embodiments of the thermal connector disclosed in the patent: the screw threads (Figure 4) and the springs (Figure 6). While for the screw thread embodiment the screws (18) are disclosed to be actuated by direct interaction with the probes, this is not the case for the springs. However, for both embodiments, the thermal connector remains at the sample holding device when this is thermally connected or coupled to a cold body or the cold mounting body while the elongate probe is releasable thereof as required by feature [1.8].

1.3.3 Contrary to this, claim 8 defines that the thermal connector forms part of the elongated probe ("each probe is preferably screw threaded at one end to define the thermal connector"). This is in conflict with the functions defined in claim 1 as described above.

In view of this obvious inconsistency in the granted claims, the skilled person needs to consult the description to come to a common interpretation of the subject-matter of claims 1 and 8.

1.3.4 In the description, the term "probe" is not used to describe the screw thread embodiment of Figure 4. Instead, the description distinguishes between a "rod assembly 3" (corresponding to the elongated probe according to claim 1) and the "screw thread 18" (corresponding to the thermal connector according to claim 1). Claim 8 therefore has to be construed accordingly. Paragraphs [0028] to [0030] of the patent describe how the thermal connector (screw thread) is connected to a cold body (here addressed by the term "plate 12") or cold mounting body (here: "cold body 15"). It is further described that from the cold mounting body, the elongate probe (here: "rod assembly") is released and partly or fully retracted. The "coupling" of the probes to the sample holding device (claim 7) is therefore indirect in this embodiment, i.e. via the thermal connector.

1.3.5 To conclude, the contradiction between the wording of claim 1 and claim 8 as granted is a clarity issue which, however, cannot be objected to in opposition appeal proceedings as it is already present in the patent as granted (See G 3/14, catchword). When properly construed in light of the whole patent specification, no lack of sufficiency of disclosure arises.

1.4 These conclusions apply *mutatis mutandis* also for claims 1 and 8 of main request A(d) and auxiliary request 1 A(d).

2. Main request - Article 100 (c) EPC

In the appealed decision the opposition division came to the conclusion that the subject-matter of the claims extended beyond the content of the application as filed for the following reasons.

(a) Including feature [1.5] (the relative temperature difference between the cold body and the cold mounting body) in claim 1 while at the same time **omitting a second heat radiation shield** results in an unallowable intermediate generalisation.
(b) The release function for the elongate probes was only disclosed in **combination with a function to retract** the probes after being released from the sample holding device. The omission of this retraction function constitutes an unallowable intermediate generalisation.

This decision is challenged by the patent proprietor.

In this section, references are to the application documents as filed. The conclusions below also apply to auxiliary request 1 A(d) discussed below.

2.1 a) Omission of the second heat radiation shield

The omission of the second heat radiation shield does not extend the subject-matter beyond that of the application as filed.

2.1.1 Granted claim 1 combines the features of originally filed claims 1 (features [1.1], [1.3], [1.6], [1.9]), claim 2 (feature [1.4]) and claim 19 (feature [1.2]). Furthermore, it encompasses **a part** of claim 17 ("probe releasably coupled", feature [1.8]), while the first

and second operation steps defined in claim 17 are omitted.

In addition, granted claim 1 encompasses features [1.5], [1.7] and [1.10] not defined in the originally filed claims.

The opponent's argument that these additional features, in particular feature [1.5], were only originally disclosed in combination with a second heat radiation shield is not persuasive.

2.1.2 The general part of the description discloses that in a "a cryogen free cooling apparatus [which] comprises at least one heat radiation shield" the sample holding device "*can 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*" (page 2, lines 14 to 24), as required by features [1.7] and [1.10].

However, as argued by the opponent, the only explicit disclosure in the application as filed in support of feature [1.5] is found on page 7 (lines 5 to 17: "cold mounting body held at the lowest temperature"). This passage of the description relates to a "first embodiment" shown in Figures 1 to 5.

While in this embodiment a plurality of heat radiation shields are described, only one heat radiation sheet is disclosed as mandatory (see page 8, lines 13 to 15) in line with the general statement above.

2.1.3 It is apparent from the patent disclosure as a whole that the working region (i.e. at the cold mounting body) is in general operated at a temperature below

that of the first cold body (which is only optionally the first heat radiation shield, see page 3, lines 17 to 20). The heat radiation shield in a cryogenic system inevitably has a higher temperature than the target temperature because its function is to shield the lower temperature components. Nothing else is reflected by feature [1.5] in claim 1.

The statement on page 3, lines 20 to 25, according to which the cold body "is held at the coldest temperature", is a "further possibility" which does not apply to the subject-matter of claim 1 (see features [1.9] and [1.10]). Instead, it describes an additional embodiment not in accordance with the invention defined in claim 1 in which the cold body corresponds to the cold mounting body and wherein the pre-cooling is done using a thermal connection of variable strength in the target regions.

2.1.4 The cooling system as originally disclosed is not limited to systems operating below 1 K ("sub 4 K cooler"), which would require an additional heat shield (and a dilution refrigerator). As also noted in the appealed decision, claim 1 does not specify absolute temperatures or temperature differences, let alone the temperature at the cold mounting plate. Also, the temperature of the sample when supplied to the cold body for pre-cooling is not restricted in the application as filed. It can be at room temperature but also in a pre-cooled state, as argued by the patent proprietor. Depending on the (undefined) operation temperatures, "different shielding requirements exist" (see also page 3, lines 26 to 29).

In other words, the second heat radiation shield is not explicitly or implicitly disclosed as a technical necessity in view of the further features of claim 1.

2.1.5 This is further supported the following statements in the description (emphasis added):

- page 2, lines 14 to 24: "at least one heat radiation shield surrounding a working region"
- page 4, lines 11 to 13: "a second shield (if provided) will be held at a temperature of less than 6K or even less than 4.2K"
- page 8, lines 13 to 17: "The carrier is then optionally connected in a similar manner to a or a plurality of optional additional radiation shields, such as the shield 10 (forming additional cold bodies)"

2.1.6 Thus, the skilled person understands from the original disclosure that pre-cooling at a cold body's temperature different to and higher than the cold mounting body's temperature is not inextricably linked to the provision of a second heat radiation shield, and this is not disclosed in the application as filed either.

2.1.7 The opponent's argument making reference to the D13 is not relevant for the question of extension of subject-matter, which has to be established on the basis of the originally filed application documents.

2.2 b) Omission of the release and retracting function and step

The omission of the release and retraction function in claim 1 and the corresponding steps in claim 14 extends

the subject-matter beyond that of the application as filed.

2.2.1 Feature [1.8] in question ("probe releasably coupled") is, *inter alia*, based on the **first part** of claim 17 as originally filed, while the second part of claim 17, the functional feature defining the suitability for a first connecting and a second release and retraction step, was omitted from claim 1. The patent proprietor's argument that the retraction was implied by the releasable coupling defined in the claim is not convincing. A probe can, by suitable connection means, release the connection without being retracted.

2.2.2 Moreover, contrary to the view of the patent proprietor, a release function for the probes without a retraction function is not disclosed in the whole application as filed either. Even if for the embodiment of Figure 4 it is disclosed that the sample could optionally remain connected to the probe (page 9, lines 9 to 17), this does not disclose a release step without a retraction. In this case, the probe is neither released nor retracted.

3. Admittance of main request A(d) and auxiliary request 1 A(d)

3.1 Main request A(d) and auxiliary request A(d) were submitted with the patent proprietor's statement setting out the grounds of appeal.

Both requests differ from all requests submitted and maintained during the opposition proceedings and are, therefore, amendments under Article 12(4) RPBA 2020. The Board thus has discretion as to their admittance.

3.2 The opponent challenged the admittance of both main request A(d) and auxiliary request 1 A(d). The arguments were twofold.

First, the opponent challenged the admittance of all auxiliary requests submitted with the statement setting out the grounds of appeal as:

- the number of auxiliary requests filed was too high and not convergent, this rendering the case too complex, which was "clearly contrary to procedural efficiency, approaching abuse”
- the requests diverged from those in the opposition proceedings and did not constitute a proper reaction to a surprising development in the opposition proceedings

Second, the opponent objected to the change of the order of requests during oral proceedings before the Board to deal with the "d" requests first, contrary to the initially requested order ("a" requests before "b", "c" and "d").

However, the requests were admitted into the appeal proceedings for the following reasons.

3.3 With the statement setting out the grounds of appeal, the patent proprietor submitted two matrixes of claim requests, each with 12 rows and 5 columns (although not every place in the matrixes comprises a different request). These requests included also main request A(d) and auxiliary request 1 A(d).

Main request A(d) and auxiliary request 1 A(d) are both considered appropriate reactions to the conclusions in

the appealed decision. In addition, they do not introduce new aspects into the appeal proceedings not submitted in the opposition proceedings.

3.3.1 Main request A(d) corresponds to auxiliary request 1 in the appealed decision (patent as maintained), with the sole difference that the second heat radiation shield is omitted.

Whether this feature had to be included in claim 1 under the requirements of Article 123(2) EPC was discussed in the appealed decision.

Therefore, main request A(d) is an appropriate reaction to the reasons in the decision under appeal.

3.3.2 Auxiliary request 1 A(d) corresponds to main request A(d) with the sole further restriction to a "connection" of the connector with the cold body (instead of a "coupling"). The same restriction was part of a request in opposition proceedings (see auxiliary request 1A(d) as submitted with the letter dated 9 September 2021), which is identical to current auxiliary request 1 A(d) apart from an amendment in claim 14 ("and retracting"). Auxiliary request 1 A(d) is furthermore convergent with main request A(d).

3.3.3 As to the fact that main request A(d) and auxiliary request 1 A(d) have been filed together with a high number of partly divergent requests with the statement of grounds of appeal, this is also not as such a reason not to admit them.

First, already during the opposition proceedings, the patent proprietor submitted two lines of requests A and

B without and with the restriction to a second heat radiation shield.

Second, a high number of partially non-convergent claim requests as in the case at hand is not per se inadmissible, and their individual admittance has to be decided on a case-by-case basis. For multiple objections of added subject-matter, a strict convergence of the requests is not always a reasonable strategy. Parallel lines of claim requests enable, for example, dealing with a large number of objections, as in the current case with parallel lines A and B and a to d respectively. A matrix structure of requests - as used in the case at hand - which after the discussion of added matter reduces to a single path with only a reduced number of requests to be considered for novelty and inventive step - may well be an appropriate way for patent proprietors to structure their fallback positions.

No general rule exists for dealing with admittance when a high number of requests is filed. However, a high number of claim requests requires more efforts from the request drafter on the documentation and the reasoning for such strategy. This is to be seen in context with Article 12(4) RPBA 2020, which requires to "clearly identify[ing] each amendment and provid[ing] reasons for submitting it in the appeal proceedings, also indicating the basis for the amendment in the application as filed and providing reasons why the amendment overcomes the objections raised". Ultimately, the case must remain manageable for the parties and the Board.

In the case at hand, these requirement are met given the following information provided by the opponent:

- a structured overview of the claim requests provided by the patent proprietor
- a flow diagram which establishes an order in which the patent proprietor's request are to be treated

From this information, it was apparent that even if none of the requests were found allowable, only a limited number of objections and requests would need to be considered.

The situation in the case at hand is not comparable to that in T 2700/18 cited by the opponent, where the admittance of such a high number of requests was denied. Unlike in the current case, the requests in that case were not submitted at an early stage of the appeal proceedings but in response to the Board's written opinion under Article 13(2) RPBA 2020.

3.4 The change of the order of the requests during oral proceedings before the Board is an amendment of the patent proprietor's appeal case under Article 13(2) RPBA 2020.

With respect to feature [1.11] (release and retraction), version (d) of the A requests relies on the wording of the patent as maintained, contrary to versions (a) to (c).

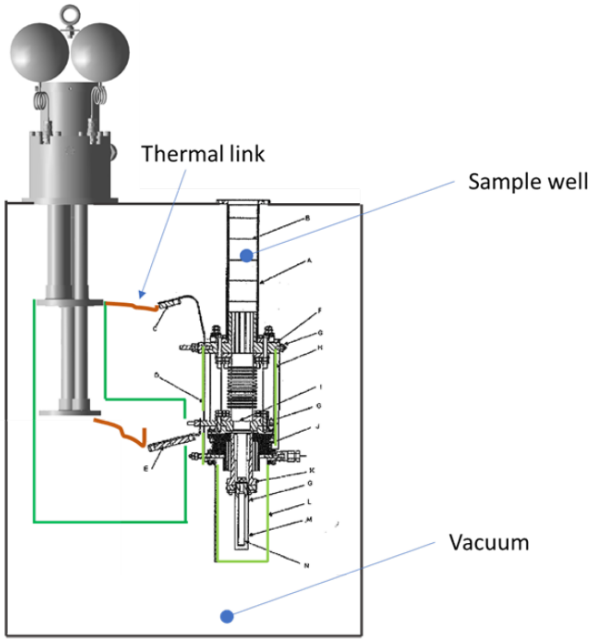
This amendment is a direct reaction to the Board's preliminary negative opinion on the (a) to (c) requests in the communication under Article 15(1) RPBA 2020. Reacting to the Board's communication by changing the order of the requests was thus an appropriate reaction

contributing to procedural efficiency which in the case at hand is accepted as exceptional circumstances.

4. Main request 1 A(d) - Lack of novelty of the subject-matter of claim 1 in view of the disclosure of D13

The subject-matter of claim 1 of main request 1 A(d) is not novel over the disclosure of D13.

4.1 D13 discloses a cryogenic cooling system with, *inter alia*, a first cold body (first stage cooling ring, Figure 1a, "F") and a cold mounting body (landing pad, Figure 1a, "K") held at a lower temperature (see the temperature curves in Figures 5a and 5b). The system is cooled by a closed cycle refrigerator ("CCR"), thus constituting a cryogen-free cooling system (connectors, "C" and "E"). It is further undisputed that the complete sample well as shown in Figure 1 of D13 is inserted into a vacuum chamber (see D13, page 2, right column, middle of second paragraph: "... the sample well was ... installed into a vacuum chamber"). This is also illustrated by the figure in patent proprietor's statement setting out the grounds of appeal (page 5, reproduced below).



A first heat radiation shield (see Figure 1a, reference D/F) and second heat radiation shield (I/ M) are provided to surround the working region. The working region of the sample well is filled in operation with low pressure helium gas (D13, page 1: "Filling the sample well and the sample can with low pressure helium is essential to provide heat transfer and to achieve useful cooling rates"). In operation, the cold mounting body ("landing pad") is at a lower temperature than the first stage cooling ring ("cold body") (see Figures 5a and 5b).

The system further comprises an elongated probe ("actuator rod") for linearly loading a sample holding device ("sample can") comprising a sample into the working region of the sample well through aligned apertures in the heat shields. Pre-cooling is achieved by holding the sample can "adjacent" to the first stage cooling ring (page 2, right column, last paragraph).

The sample can is pre-cooled by placing it adjacent to the first cooling ring. The sample is then pre-cooled by heat transfer from the sample to the cooling ring via the helium gas in the sample well. Subsequently, the sample can is "placed" on a cold mounting plate in the working region ("landing pad"). The probe is then released from the sample holding device (by rotation) and retracted.

4.2 The patent proprietor argued that D13 had the following differenes compared to the features of claim 1:

- the first heat radiation shield was not located in the vacuum chamber (feature [1.1])
- the vacuum chamber had no aperture aligned with the other aperture and suitable for a probe to be inserted though the apertures (feature [1.6])
- the sample holding device ("sample can") was not coupled for heat conduction to the cold body ("first stage cooling ring") (feature [1.9])

This is not persuasive.

4.3 Contrary to the patent proprietor's view, also features [1.1] and [1.6] are disclosed by the device displayed in Figure 1a of D13. While the embodiments of the patent are operated under vacuum in the working region, claim 1 is not so limited. The vacuum chamber surrounds the whole sample well and accordingly also the first heat radiation shield, independent of the fact that the working region is filled with helium gas. Therefore, the whole sample well, including the first heat radiation shield, is located in the vacuum chamber as required by feature [1.1].

4.4 The top opening in the sample well is surrounded by an aperture in the vacuum chamber in which the sample well is received. This aperture is necessarily aligned with the apertures in the sample well as required by feature [1.6]. When the probe passes though the aperture in the first heat radiation shield it thus also passes this aperture in the vacuum chamber. As far as the patent proprietor argued that the vacuum chamber has no aperture at all but instead a continuous wall delimiting the vacuum chamber from the sample well this is not convincing. The patent proprietor's understanding is based on the allegation of a requirement for a direct connection of the volumes of the working region and the vacuum chamber via the aperture. However, such a requirement is not included in features [1.1] and [1.6] and is not implied by the whole subject-matter of claim 1 either.

4.5 Claim 1 makes a distinction in describing how the sample holding device is brought into relation to either the cold body or the cold mounting body:

(a) the sample holding device (2) is releasably coupled for heat conduction via said connector (18) to the cold body (feature [1.9])
(b) the sample holding device is configured to be connected to the cold mounting body via the connector (features [1.7], [1.8] and [1.10])

In D13, the "connector" (i.e. the "thermal connector") is the lid of the sample can. Section II.A "Instrument concept and design" describes that the cold mounting plate ("landing pad") "has a cut-out that engages with the lid of the sample can" which is thus "placed directly on the landing pad", i.e. connected to the cold mounting body (see also Figure 1a). When the lid

of the sample can engages with the cut-out of the landing pad, the elongated probes ("actuator rods") are rotated to release the bayonet connection from the sample can and are retracted.

The definition (b) above is directed to such a mechanical connection of the surfaces of the cold mounting body and the sample holding device which is embodied in the patent with additional screws or clamps. This understanding is, *inter alia*, also supported by feature [1.11], since retraction of the probes is only possible if the sample holding device is in physical connection with the cold mounting body.

However, contrary to the view of the patent proprietor definition (a) above does not require a mechanical connection. It merely requires a "coupling for heat conduction", which may well be achieved by convective heat exchange via a heat exchange medium without physical contact of the cold body and the sample holding device.

D13 discloses such a coupling for heat conduction without a mechanical connection for the pre-cooling step. According to D13, the sample holding device is held adjacent to a cold body ("first cooling ring", see D13, section II.A). This step corresponds to the sample holding device being "releasably coupled to a cold body for heat conduction" as defined in feature [1.9]. The thermal coupling is achieved by convective heat exchange via the helium gas. The coupling is "releasable" as after thermal coupling the sample is inserted further down towards the landing pad, thus releasing the (thermal) coupling. The gas serves to exchange heat between the cold body and the complete sample holding device's outer surface, which includes

the "thermal connector" (i.e. the lid of the can). Therefore, the fact that the exact position of the lid of the sample relative to the ring is not disclosed in D13 is not relevant.

5. Auxiliary request 1 A(d)

5.1 Article 83 EPC

5.1.1 The opponent argued that according to paragraph [0019], last sentence, actuators for the release and retraction function could be put on the probe or the cold body. However, the patent did not describe an embodiment for actuators at the cold body.

This is not persuasive.

5.1.2 Indeed, it is directly apparent for a skilled person that some sort of actuation has to be envisaged to allow for the functions of releasing and retracting. This is an implicit requirement of claims 1 and 14 even though these claims do not explicitly reference an actuator.

However, the following embodiments are disclosed in the patent in which the probes serve as actuators, this being uncontested:

- the rotation of the probes for the screw thread embodiment
- the linear movement of the probes for the embodiment with the springs

These embodiments suffice to put into practice the broadly defined concept of actuation for release and

retraction. Furthermore, the opponent has not convincingly shown that embodiments of actuators at the cold plates would not be technically feasible. The mere absence of an embodiment is not sufficient evidence that the invention cannot be performed over the whole range claimed (cf. also T 500/20, Reasons 3.6).

5.1.3 Since it is already not convincing that the feature is not sufficiently disclosed, whether this objection was late filed and should not be admitted can be left undecided.

5.2 Auxiliary request A(d) - Admittance of new Article 123(2) EPC argument under Article 12(6) RPBA 2020

5.2.1 In the appealed decision, method claim 12 of auxiliary request 1 at that time (patent as maintained) was discussed with respect to Article 123(2) EPC. However, it was only discussed with respect to the opponent's argument that the inclusion of the "retraction" feature constituted an unallowable intermediate generalisation over more specific types of "retraction", such as full retraction, partial retraction and retraction with baffles staying in contact.

5.2.2 With the reply to the patent proprietor's appeal, the opponent submitted for the first time a new argument in support of the objection of an unallowable intermediate generalisation.

The opponent held that the insertion of the feature "connecting the sample holding device (2) to the cold mounting body (15) via the connector" into claim 14 constituted an unallowable intermediate generalisation. In this context, the step of:

operating the probe(s) to connect the sample holding device to the cold mounting body and to release the probe(s) from the sample holding device after connecting

as disclosed in original claim 17 was non-allowably omitted. Claims 22 and 24 did not constitute a suitable basis either as they did not disclose any connection step.

5.2.3 This new argument is an amendment under Article 12(4) RPBA 2020. The Board exercised its discretion and did not admit this argument into the appeal proceedings.

5.2.4 The argument could and should have been raised against the same feature of claim 12 of the patent as maintained during the opposition proceedings, in particular, since an objection of intermediate generalisation was already under discussion for this feature group (Article 12(6) RPBA 2020).

5.2.5 Furthermore, the argument is also *prima facie* not convincing since originally filed claim 24 discloses a method step of releasing ("detaching") the sample holding device from the elongate probe(s) following inserting and retracting ("withdrawing") the elongate probe(s) without specifying the probes as the actuator of this action.

5.3 Novelty of the subject-matter of claims 1 and 14 over the disclosure of D13

Compared with claim 1 of main request A(d), claims 1 and 14 of auxiliary request 1 A(d) include only a single further restriction in feature [1.9] and in the corresponding feature of claim 14. The amendment is

that the wording "releasably coupled for heat conduction" is replaced by "releasably **connected** for heat conduction" (feature [1.9']).

5.3.1 The verb "to connect" adds a further limitation of the subject-matter. As previously discussed (see point 4.5 above), amended feature [1.9'] has in the context of the other features of claims 1 and 14 to be construed as a direct physical connection of the thermal connector and the cold body in the pre-cooling stage. The same wording is used in features [1.7], [1.8] and [1.10] for the (physical) connection with the cold mounting body: "... *a thermal connector, whereby the sample holding device (2) is configured to be connected to the cold mounting body via the connector*".

5.3.2 The opponent's argument that the term "releasably" was not amended does not make a difference. It is true that the term "releasably" is broader and encompasses also the situation in D13 when the probe is removed from its pre-cooling position further downwards towards the cold mounting plate. However, in combination with the term "connected", the wording is now limited to the release of a physical connection. Therefore, in the context of the claim, the term "releasably" defines the suitability for physical de-connection of the thermal connector from the cold body.

5.3.3 A physical connection between the sample can lid or any other part of it and the first cooling ring during the pre-cooling step is not disclosed in D13 (which just discloses a convective thermal coupling). Therefore, the subject-matter of claims 1 and 14 is novel over the disclosure of D13.

5.4 Auxiliary request 1 A(d) - Inventive step

The opponent raised the following objections of lack of inventive step against the subject-matter of claims 1 and 14:

- D13 as the starting point in combination with the teaching of D11
- D13 as the starting point in combination with common general knowledge supported by D17, D18 and D19

However, the subject-matter of claims 1 and 14 involves an inventive step for the following reasons.

5.4.1 As explained above (in point 5.3), D13 does not disclose that the sample holding device is (physically) connected to the pre-cooling cold body, and it does not disclose that this is done with the same thermal connector used to (physically) connect the sample holding device to the cold mounting body.

5.4.2 The opponent suggested the reduction of the time needed for pre-cooling as the objective technical problem. It argued that this problem was solved by the distinguishing features by the improved thermal conductivity between the sample holding device and the cold body due to their direct physical contact.

The Board is not convinced that it was sufficiently shown in the patent that this effect is achieved by the features of claims 1 and 14. In the claims, both (physical) connections are not further characterized and encompass any kind of contact. It is not compulsory that the contact is enhanced by springs or screws. However, the heat transfer by direct physical contact in cryogenic systems does not only depend on the

materials and the size of the contact area but also on the "tightness" of the physical connection as described in paragraphs [0017] and [0018] of the patent and D11, page 2, lines 4 to 12, none of which is defined in claims 1 and 14.

Therefore, the objective technical problem is merely to provide an alternative pre-cooling system.

5.4.3 D13 in combination with common general knowledge

It is already counter-intuitive for the skilled person to modify the system of D13 - which relies on heat exchange gas for the pre-cooling - into a (direct) connection system. Contrary to the view of the opponent, D13 does not disclose attempts to operate the systems without the helium gas under vacuum conditions. While in D13 "a few runs" are mentioned "with the system evacuated to a pressure of 10^{-1} Pa" (see section III.B), these runs are conducted on another cooling system with no pre-cooling stage characterised as a "SMASH rig" (see Figure 3). Furthermore, the overall conclusion in D13 is that "filling the sample well ... with low pressure helium is essential to provide heat transfer and to achieve useful cooling rates" (section IV.C, last sentence).

But even if the skilled person considered a (physical) connection as an alternative in D13, the common general knowledge would not lead him to a system according to claim 1 and a method according to claim 14. This is because claims 1 and 14 require that the same thermal connector be used to establish the connection with the cold body and the cold mounting body. In contrast, the thermal connector disclosed in D13 is the lid of the sample can which rests in its final position in a cut-

out of the landing pad, i.e. a cut-out having a smaller diameter than the lid. It is not feasible to use the same connection principle also for the first cooling ring in D13 since the sample holding device needs to be moved further downwards from its pre-cooling position.

5.4.4 D13 in combination with the teaching of D11

D11 does not point the skilled person towards the solution either.

D11 teaches that a physical connection for heat transfer from the sample holding device if no heat transfer gas can be used, in particular if temperatures of less than 0.1 K are necessary, which requires operation under vacuum conditions (D11, page 1, lines 16 to 19). However, for the cooling system disclosed in D13, these conditions are not required. This cooling system is designed for the operation at "a few Kelvin" at the cold mounting plate (as a specific value, 4.1 K is mentioned) in which operation under vacuum conditions is not necessary. Therefore, the skilled person has, based on the teaching of D11, no incentive to modify the pre-cooling set-up in accordance with the teaching of D11.

But even if the skilled person considered implementing an alternative pre-cooling system under vacuum, D11 does not disclose all distinguishing features.

D11 discloses a cooling system in which the sample holding device is (physically) connected only to the cold mounting plate by radially engaging connectors. Pre-cooling is not addressed. Therefore, D11 instead discloses an alternative system for the connection of the sample holding device with the landing pad.

The only mention of cooling at different temperature levels in D11 is in the discussion of the prior art (page 2, lines 12 to 16), where, however, contrary to the requirements of claim 1 and 14, explicitly two different thermal connectors are disclosed.

The opponent further argued with reference to D11 (page 2, lines 12 to 16) that springs could also be used at the lid of the sample can in D13 as thermal connectors to (physically) connect to the cold body. However, such springs would not be suitable for also connecting to the recess in the landing pad without further modifications.

To conclude, at least the concept of using the **same** thermal connector for the connection with the pre-cooling ring and the sample well is not taught by D11.

5.4.5 D13 in combination with D17, D18 and D19

D17, D18 and D19 disclose similar cooling devices, none of which is of the cryogen-free type. As can be best seen in D17, Figure 1, the sample holding device is pre-cooled in a pre-cooling chamber. The exact process of pre-cooling is not disclosed in D17 to D19.

According to the opponent, the octagonal sample holding device is contacted with a "cold finger" which is identified as the structure at the left side of the pre-cooling chamber (see opponent's reply to the appeal, page 18: "fig. 1 of D17 and fig. 4 of D19 show how a moving cold finger can be brought in from the left to touch the octagonal carousel"). According to this interpretation, the cold finger moves towards the sample holding device to establish a (physical) contact

(which is considered a connection according to features [1.9]) and the cold finger is retracted after pre-cooling is accomplished. According to this interpretation the cold-finger is the "thermal connector" according to claims 1 and 14.

However, even if this interpretation is accepted, due to the design of the pre-cooling stage in D17 to D19, the thermal connector remains in the pre-cooling chamber and thus cannot also be the same thermal connector establishing a connection with the heat sink in the cold mounting plate ("STM head").

Therefore, none of the disclosures of D17 to D19 can render the distinguishing features obvious.

5.5 Since none of the opponent's objections under Article 56 EPC is successful, the admittance of documents D17 to D19 and the inventive step objections as well as allegedly late-filed arguments can be left undecided.

5.6 The amendments made to the description are undisputed.

Order

For these reasons it is decided that:

1. The decision under appeal is set side.

2. The case is remitted to the opposition division with the order to maintain the patent in amended form in the following version:

   - Claims 1 to 15 according to **auxiliary 1 A(d)** submitted with the patent proprietor's statement setting out the grounds of appeal

   - Description:
     - paragraphs 1 to 18, 20 to 29 and 31 to 43 of the patent specification
     - paragraphs 19 and 30 of the amended description submitted during the oral proceedings before the Board

   - Figures 1 to 7 of the patent specification

The Registrar: The Chairman:

C. Spira C. Herberhold

Decision electronically authenticated