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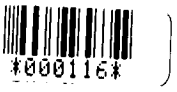
Veröffentlichung im Amtsblatt Ja/Nein
Publication in the Official Journal Yes/No
Publication au Journal Officiel Oui/No



Aktenzeichen:
Case Number: T 82/82
N° du recours :

ENTSCHEIDUNG / DECISION

vom / of / du 28 April 1983

Anmelder:
Applicant: AIR PRODUCTS AND CHEMICAL, INC.
Demandeur :

Stichwort:
Headword:
Référence :

EPÜ / EPC / CBE Articles 52(1), 56.
"Inventive Step"

Leitsatz / Headnote / Sommaire

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Case Number: T 82 / 82

DECISION

of the Technical Board of Appeal 3.2.1

of 28 April 1983

Appellant: AIR PRODUCTS AND CHEMICALS, INC. P.O. Box 538, Allentown, Pennsylvania 18105 (USA)

Representative: Raynor, John
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Decision under appeal: Decision of Examining Division 074 of the European Patent Office dated 1 March 1982 refusing European patent application No 80 300 610.5 pursuant to Article 97(1) EPC

Composition of the Board:

Chairman: G. Andersson

Member: M. Huttner

Member: P. Ford

Summary of Facts and Submissions

I. European patent application No. 80 300 610.5 filed on 29 February 1980 and published on 17 September 1980 under No. 0015 728, claiming priority from a prior application in the United States of America of 2 March 1979, was refused by decision of Examining Division 074 of the European Patent Office dated 1 March 1982. The decision was based on Claims 1 to 5 received on 11 September 1981.

II. The principal reason given for the refusal was that in view of the prior art disclosed by the IBM Technical Disclosure Bulletin, Vol. 18, No. 4, September 1975, pages 1226 to 1229, DE-A-2 423 301 and US-A-3 360 955, the subject-matter of Claim 1 did not involve an inventive step within the meaning of Article 56 EPC. A further reason given for the refusal was that claim 1 did not meet with the requirements of Rule 29(1) EPC as to the two-part form although such form would have been appropriate in order to avoid giving a misleading picture of the subject matter of claim 1 with regard to the relevant prior art. The claim was thus not allowable under Article 52(1) and Rule 29(1) EPC.

III. On 27 April 1982, the appellants lodged an appeal against the decision, the Statement of Grounds was received on 3 May 1982 together with the new Claims 1 to 3, and the appeal fee was duly paid. The appellants argued that a person skilled in the art could not deduce the subject-matter of the invention from anything disclosed in the state of the art.

IV. By a communication dated 1 December 1982 the appellants were advised that the claims, the description and the drawings contained a number of deficiencies.

V. Finally, on 19 February 1983, 15 March 1983 and 23 March 1983, the appellants submitted amendments to the description, (new pages 1, 1A, 1B and 1C together with pages 2, 6, 8 and 10 amended in manuscript), new Claims 1-3 and a new sheet 1/1 of the drawings with an amended figure. The appellant's requested a correction of page 1 and in the labelling of the figure on sheet 1/1 as "Fig. 1".

Claim 1 now reads as follows:

1. A cryostat of the type including a reservoir (14) for receiving and holding a supply of a liquid cryogen (15) and having a vacuum-jacket including a vacuum space, the vacuum-jacketed reservoir having a cover exposed to the ambient atmosphere and refrigeration means operating on a closed cycle and including means for recondensing cryogen boil-off from the reservoir, characterised in that the cryostat includes an access passage (24,34) extending across the vacuum jacket, the refrigeration means (42,43,44,46) being disposed within said access passage, in that the refrigeration means has at least two stages (42,43), each of the said at least two stages (42,43) being thermally connected to a respective heat station (64,66) disposed at the respective stages of the said refrigeration means within the access passage, in that first and second radiation shields (60,62) are disposed in the vacuum space of the vacuum-jacket and thermally connected but not mechanically secured to the said first and second heat stations (64, 66) respectively, such that the respective stages of the refrigeration means (42,43) are arranged to cool respective heat stations (64,66) and the said radiation shields (60,62) to minimise heat infiltration into the cryogenic liquid via the access passage and via the vacuum space respec-

tively, the means for recondensing cryogen boil-off from the reservoir including a heat exchanger having a Joule-Thompson valve, provided below the second stage of the refrigeration means and in that means (70,80,84) are provided to permit removal of the refrigeration means from the access passage on removal of the cover without opening the reservoir to the ambient atmosphere.

VI. The appellants requested that the impugned decision be set aside and the European patent be granted on the basis of the amended description and drawings and the presently effective Claims 1 to 3.

VII. For the original claims, description and drawings reference should be made to publication No. 0015 728.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 EPC and Rule 64 EPC and is, therefore, admissible.

2. The subject-matter of the Claims 1 to 3 and of the amended description, as well as the corrected sheet 1/3 of the drawings do not extend beyond the content of the application as originally filed. The amendments are, therefore, allowable under the terms of Article 123(2) EPC. The claims now also meet with the requirements of Rule 29(1) as to the two-part form.

3. The features of the first part of the Claim 1 are, in combination, part of the prior art as represented by the IBM Technical Disclosure Bulletin, Vol. 18, No. 4, September 1975, pages 1226 to 1229 (Rule 29(1)(a) EPC). In the Board's view no objection may be raised against the

preamble of Claim 1 acknowledging a cryostat disclosed in the publication referred to as the most pertinent prior art, for such cryostat is undoubtedly deemed to be closer to the subject-matter of the application in respect of the salient features than those disclosed in either US-A-3 360 955 or DE-A-2 423 301.

Likewise, the Board has no objection to the appellants' amendment of the characterising clause so as to include the access passage extending across the vacuum jacket, which feature was previously in the first part of the Claim 1 and further in that it now specifies the thermal connection of the radiation shields to the respective heat stations as not being mechanically secured, because this latter feature finds its support on page 5, lines 26 to 30 of the description.

4. According to the characterising portion, the subject-matter of Claim 1 differs from this prior art by a number of features, which may be broadly summarised as: a vacuum-jacketed reservoir having an access passage within which a two-stage refrigerator means is disposed, each of said stages being thermally connected to the respective heat stations, to which two radiation shields located within the vacuum space of the vacuum jacket are thermally connected but not mechanically secured; a heat exchanger having a Joule-Thompson valve below the second refrigerator stage for recondensing the boil-off, and means permitting the removal of the refrigerator from the access passage without opening the reservoir to the ambient atmosphere.

.../...

As the other citations mentioned in the search report reveal neither an access passage nor means permitting the removal of the refrigerator located therein without opening the reservoir to the ambient atmosphere, the subject-matter of Claim 1 proves to be novel (Article 54 EPC).

5. In the cryostat known from the IBM Technical Disclosure Bulletin access is required to the cryogenic liquid so that the device being cooled can be placed in the liquid. In order to obtain access, it is necessary to dismantle the refrigerator head completely and thus the cryostat has to be shut down. Thereby the cryogenic liquid becomes exposed to the atmosphere, which entails undesirable ingress of heat into the cryostat. There is likewise heat ingress during the normal operation through the walls forming the reservoir. This ingress creates undesirable boil-off of the cryogenic liquid. The appellants consider the excessive heat ingress as well as the complicated servicing of the known cryostat as disadvantageous.

6. The appellants have refrained from expressly stating the technical problem to be solved by the invention. However, the problem can be appreciated from the description and stated as follows: it resides firstly in the provision of means for the inhibition of heat infiltration to the inventory of the cryogenic liquid in the reservoir during operation and for the minimisation of boil-off during servicing of the refrigerator, secondly in the recondensing of the boil-off from the cryogenic liquid and thirdly in preventing exposure of the reservoir to the ambient atmosphere while removing the refrigeration means for servicing.

.../...

The above formulation of the problem has been communicated to the appellants and has not been repudiated by them.

7. The solution of the problem underlying the application is based on the idea of first reducing the ingress of heat by radiation passing through the vacuum jacket of the reservoir. As proposed in claim 1, this idea is realised by a plurality of cooled thermally conductive heat shields disposed in the vacuum space of the jacket which are coupled thermally with heat stations positioned in an access passage and thermally connected with the respective refrigerating stages. Secondly there is the idea of blocking thermal radiation to the cryogenic liquid via the access passage by providing thermally stratified spaces formed between the stations in which the proper temperatures of gas contained therein are established for creating the proper temperature gradient required. Thirdly for recondensing the boil-off from the cryogenic liquid, a Joule-Thompson valve is provided below the second stage of the refrigerator and finally there is the idea of preventing the exposure of the liquid to the atmosphere while the refrigerator is removed for servicing by means permitting the removal of the refrigerator from the access passage on removal of the cover without opening the reservoir to the ambient atmosphere.

8. It remains to be examined whether the subject-matter of Claim 1 involves an inventive step and the question now arises whether the publications cited would give the skilled person any indication as to how in the cryostat according to the IBM Technical Disclosure Bulletin the heat infiltration is to be reduced, the boil-off recondensed and exposure of the cryogenic liquid to the atmosphere prevented.

.../...

8.1 Although the object of the invention according to DE-A-2 423 301 is to provide a minimum-vibration environment for a sample being cooled in a liquid dewar, this citation, in its embodiment of Figure 5, nevertheless aims at reducing the heat radiation in the liquid of the dewar for the purpose of maintaining the liquid level therein, which in fact is achieved by the recondensation of vaporised liquid (cf. page 10, end of first paragraph). This undoubtedly corresponds to the purpose and function of the radiation shields of Claim 1. Furthermore, there are also heat stations disclosed in the form of cover plates to which the shields are mechanically connected (i.e. by solid conduction) and are thus thermally coupled to the respective refrigerator stages. However, there is definitely no access passage leading to the liquid reservoir within which the refrigeration means are disposed. Hence no precautionary measures had to be taken to prevent ingress of heat through an access passage. Consequently, no hint could have been obtained from this citation as to how to overcome the disadvantage of affecting the atmospheric integrity of the liquid reservoir when the refrigeration head of the device according to the IBM Bulletin comprising the internal parts and the cold finger was to be removed from the access opening in the cover. From this it must be inferred that, in view of DE-A-2 423 301, the employment of means for preventing exposure of the reservoir to the ambient atmosphere while removing the refrigeration means from an access passage are not to be considered as obvious to a person skilled in the art.

.../...

8.2 US-A-3 360 955, on the other hand, discloses a double-walled, vacuum-insulated container serving as a vacuum jacket, comprising a plurality of alternate layers of low conductive glass fibre paper sheets with interposed radiation heat reflecting aluminium foil. There is however no indication whatsoever of a possible thermal association of such foil with the heat stations disposed within the vessel. Rather the contrary applies in view of the particular design having the foil sandwiched between the glass fibre paper sheets. No one would be expected to try to make a feasible thermal connection from the plurality of embedded foil to the heat connection plates (heat stations) arranged within the vessel. Consequently, the particular arrangement of the foil of this citation actually leads away from the idea of a thermal connection with a heat conductor disposed outside the vacuum jacket. Hence the postulated application of the teachings of US-A-3 360 955 to the device of the IBM Bulletin would not lead to anything more than a jacket wall insulation and heat stations having no connections whatsoever to the foil. Moreover, the problem of protecting the cryogenic liquid located at the bottom of the vessel from atmospheric influence while removing the refrigerator could not possibly arise, since such removal does indeed entail the removal of the entire cold component assembly and thus also of the self-contained liquid container at the base of the vessel together with all the fluid and electrical connections. Since upon removal of the liquid container together with the cold assembly there is no longer any liquid to be protected against exposure to the atmosphere remaining in the vessel, quite clearly a person skilled in the art reading this citation would not derive any indication as

to what measures would have to be taken for realising such protection in the cryostat according to the IBM Bulletin. Hence, a combination of the teachings of US-A-3 360 955 with the device of the IBM Bulletin would not be feasible because it would not make sense to associate these two devices with one another.

8.3 For these reasons, the subject-matter of Claim 1 does involve an inventive step (Article 56 EPC) and the claim is, therefore, by virtue of Article 52 EPC allowable.

9. The subject-matters of Claims 2 and 3 concern special embodiments of the cryostat of Claim 1 and they are thus likewise allowable.

10. There can be no objection regarding the present description once the introductory portion thereof has been amended to acknowledge sufficiently the closest prior art and the other parts have been corrected as requested by the Board.

11. No application has been made for reimbursement of the appeal fee in accordance with Rule 67 EPC, and the circumstances of the case cannot be considered to justify such a reimbursement.

12. For these reasons,

it is decided that:

1. The decision of Examining Division 074 of 1 March 1982 is set aside.

2. The case is remitted to the first instance with the order to grant a European Patent on the basis of the following documents:

description pages 1A, 1B and 1C, received on 1 April 1983,

pages 1, 2, 6, 8 and 10 amended in manuscript, received on 19th February 1983,

pages 3, 4, 5, 7 and 9 as originally filed,

Claims 1 to 3 received on 1 April 1983, with the amendment effected by the Board to replace in claims 2 and 3 for formal reasons the word "wherein" by "characterised in that",

Drawing sheet 2/2 as originally filed, and

Drawing sheet 1/1 received on 19th February 1983, amended so as to the figure being labelled as "Fig. 1".

The Chairman: The Registrar: