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Datasheet for the decision of 21 January 2014

Case Number: T 0027/10 - 3.4.03

Application Number: 99900849.3

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IPC: H01J1/00

Language of the proceedings: EN

Title of invention:
SPECTROMETER PROVIDED WITH PULSED ION SOURCE AND TRANSMISSION DEVICE TO DAMP ION MOTION AND METHOD OF USE

Patent Proprietor:
UNIVERSITY OF MANITOBA

Opponent:
Thermo Finnigan LLC

Headword:

Relevant legal provisions:
EPC Art. 52(1), 123(2), 123(3)
EPC 1973 Art. 54, 56, 100(a), 100(c), 114(1)
EPC 1973 R. 27(1)(b), 29(1)
RPBA Art. 12(4)

Keyword:
Late-filed auxiliary requests - admitted (yes)
in relation to the first to sixth auxiliary request
Amendments - added subject-matter (no)
in relation to the main and sixth auxiliary request - added subject-matter (yes)
in relation to the second, fourth and fifth auxiliary request
Novelty - (no)
in relation to the main and first and third auxiliary request
Inventive step - (yes)
in relation to the sixth auxiliary request

Decisions cited:
G 0010/91, G 0007/93, T 0002/81

Catchword:

Europäisches Patentamt
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Case Number: T 0027/10 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 21 January 2014

Appellant: (Patent Proprietor)	UNIVERSITY OF MANITOBA Technology Commercialization Programs 631 Drake Centre 181 Freedman Cresc. Winnipeg, Manitoba R3T 5V4 (CA)
Representative:	Roques, Sarah Elizabeth J A Kemp 14 South Square Gray's Inn London WC1R 5JJ (GB)
Respondent: (Opponent)	Thermo Finnigan LLC 355 River Oaks Parkway, San José CA, 95134-1991 (US)
Representative:	Cross, Rupert Edward Blount Boult Wade Tennant Verulam Gardens 70 Gray's Inn Road London WC1X 8BT (GB)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 20 October 2009 revoking European patent No. 1050061 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman: G. Eliasson
Members: T. M. Häusser
T. Bokor

Summary of Facts and Submissions

I. The appeal of the proprietor concerns the decision of the opposition division to revoke European patent No. EP-B-1050061 (Article 101 (2) and (3)(b) EPC).

II. The opposition had been filed against the patent as a whole. Grounds of opposition were lack of novelty and lack of inventive step (Articles 100(a), 54(1) and (2), 56 EPC 1973).

III. Reference is made to the following documents:

D1: US-A-5 373 156,
D4: US-A-5 689 111,
D5: GB-A-2 299 446,
D6: He et al., Detection of Oligonucleotides by External Injection into an Ion Trap Storage/ Reflection Time-of-Flight Device, Rapid Communications in Mass Spectrometry, vol. 11, p. 1440-1448 (1997).

IV. The appellant (patent proprietor) requested in writing that the decision under appeal be set aside and the patent be maintained as granted (main request), or alternatively that the decision under appeal be set aside and the patent be maintained in an amended form on the basis of any of the first to eighteenth auxiliary requests filed with the grounds of appeal dated 26 February 2010. As to procedure, the appellant declared its agreement to a possible remittal to the first instance for the examination of the auxiliary requests while also agreeing to an examination by the board. A remittal was explicitly requested in case issues should be raised in the appeal proceedings that were not covered by the decision under appeal.

V. At the oral proceedings before the board, which took place in the pre-announced absence of the appellant, the respondent (opponent) requested that the appeal be dismissed.

VI. The wording of the relevant claims are as cited below (board's labelling "(i)", ..., "$(iv)_6$").

a) Main request (rejection of the opposition)

The wording of claims 1 and 4 as granted is as follows:

"1. A mass spectrometer system (10) comprising:
an ion source (1; 11, 14, 15), for providing analyte ions;
a mass spectrometer (50);
an ion path (27) extending between the ion source (1; 11, 14, 15) and the mass spectrometer (50);
and an ion transmission device located in said ion path (27) and having a damping gas in at least a portion of the ion path (27); characterized in that
(i) the ion source comprises a pulsed ion source (1; 11, 14, 15),
(ii) whereby ions are subjected to collisional damping and there is effected conversion of pulses of ions from the ion source into a quasi-continuous beam of ions (102; 132)."

"4. A mass spectrometer system (10) as claimed in claim 1, 2 or 3, wherein the ion transmission device includes an RF ion guide (3; 31, 32; 93) and the damping gas is provided in the RF ion guide (3; 31, 32; 93)."

b) First auxiliary request

Claim 1 according to the first auxiliary request differs from claim 1 as granted in that feature (ii) is replaced by the following feature:

$(ii)_1$ "whereby ions are subjected to collisional damping and there is effected the spreading of ions spatially and temporally along the ion path and there is effected conversion of pulses of ions from the ion source into a quasi-continuous beam of ions (102; 132)."

c) Second auxiliary request

Claim 1 according to the second auxiliary request differs from claim 1 as granted in that feature (ii) is replaced by the following feature:

$(ii)_2$ "whereby ions are subjected to collisional damping and there is effected conversion of pulses of ions from the ion source into a continuous beam of ions (102; 132)."

d) Third auxiliary request

Claim 1 according to the third auxiliary request differs from claim 1 as granted in that feature (ii) is replaced by the following feature:

$(ii)_3$ "whereby ions are subjected to collisional damping and there is effected conversion of a pulsed beam of ions from the ion source into a quasi-continuous beam of ions (102; 132)."

e) Fourth auxiliary request

Claim 1 according to the fourth auxiliary request differs from claim 1 as granted in that feature (ii) is replaced by the following feature:

(ii)$_4$ "whereby ions are subjected to collisional damping so that there is effected the spreading of ions spatially and temporally along the ion path and so that there is effected conversion of a pulsed beam of ions from the ion source into a continuous beam of ions (102; 132)."

f) Fifth auxiliary request

Claim 1 according to the fifth auxiliary request differs from claim 1 as granted in that the following features are added:

(iii)$_5$ "wherein the pulsed ion source (1; 11, 14, 15) comprises a surface (15) containing analyte molecules and a pulsed laser (14) directed at the surface (15), for providing laser pulses to cause ionization of the analyte molecules; and

(iv)$_5$ wherein the laser repetition rate is set to be 13 Hz or higher".

g) Sixth auxiliary request

Claim 1 according to the sixth auxiliary request differs from claim 1 as granted in that the following features are added:

(iii)$_6$ "wherein the mass spectrometer comprises an orthogonal time of flight mass spectrometer

(iv)$_6$ whereby the quasi-continuous beam of ions (102; 132) enters the orthogonal time of flight mass spectrometer and is pulsed, to convert the quasi-continuous beam of ions (102; 132) back into pulses of ions".

Claim 23 according to the sixth auxiliary request reads as follows:

"23. A method of generating ions from an ion source and delivering the ions along an ion path (27) extending through an ion transmission device to a time of flight mass spectrometer (50) for analysis, characterized in that the method comprises the steps of:

(1) providing a pulsed ion source (1; 11, 14, 15) as the ion source;

(2) generating pulses of ions from the pulsed ion source (1; 11, 14, 15);

(3) providing the ion transmission device with a damping gas in at least a portion of the ion path (27), to effect collisional damping of ion motion and to effect conversion of pulses of ions from the ion source into a quasi-continuous beam of ions (102; 132);

(4) arranging the ion path (27) orthogonally relative to the axis of the time of flight mass spectrometer (50);

(5) passing the quasi-continuous beam of ions (102; 132) substantially continuously into the time of flight mass spectrometer (50); and pulsing the ions in the time of flight mass spectrometer (50) to effect mass analysis."

VII. The parties argued essentially as follows:

a) Main request (rejection of the opposition)

i) Amendments

The appellant was of the opinion that the fresh ground of added subject-matter, which had been raised by the opponent only one month before the oral proceedings before the opposition division was *prima-facie* not relevant and should not have been admitted into the procedure. In particular, in the description as filed several different types of RF ion guides, such as quadrupole rod sets, hexapole rod sets, octopole rod sets and ring guides had been described. Furthermore, it was clear from the description that the purpose of the RF ion guides was to confine the ions in a narrow beam along the ion path. The particular type of ion guide was not relevant to the inventive concept. The appellant also pointed to several passages in the description as filed mentioning ion guides in general terms. Therefore, claim 4 as granted did not contain added subject-matter.

The respondent argued that the passages pointed out by the appellant related to the corresponding specific embodiments provided in the description. They were not a proper basis for the amendment of claim 4 as granted. Furthermore, there were other RF ion guides, for example bars or wires, which were covered by the general wording of claim 4 but which were not described in the application as filed. Therefore, claim 4 as granted contained added subject-matter.

ii) Novelty

The appellant argued that feature (ii) of claim 1 as granted was not disclosed in document D1. In particular, the expression "quasi-continuous beam of ions" inherently meant ions with a significant spatial

distribution along the axis. This followed also from the specification of the patent (see paragraph [0034]). Furthermore, it was defined in feature (ii) that pulses of ions were converted into a quasi-continuous beam of ions. This meant that the pulses were spread in space to an extent that caused adjacent pulses to merge together somewhat. Document D1, on the other hand, disclosed a device whereby ions from a single pulse were slowed down and fed into an ion trap for mass-sequential scanning. As it was described in D1 that the scanning of the ions of one pulse took about 20 minutes it was impossible that the ions of more than one pulse were converted to a quasi-continuous beam of ions. The subject-matter of claim 1 as granted was therefore new.

The respondent was of the opinion that the appellant's contention that the pulses were spreading in space to an extent that caused adjacent pulses to merge together somewhat was not supported by the disclosure of the opposed patent. The pulse repetition rate of 13 Hz employed in the patent implied a time period of a pulse of about 77 ms. The result of the spreading was shown in Figure 4 to produce pulses with a time distribution of the order of 20 ms. In the description it was furthermore stated that a pulse could be as short as 0.1 ms. The patent document itself contemplated therefore processes where there was no question of adjacent pulses merging together. Moreover, in the opposed patent the spreading of source pulses were explained by reference to the time domain, for example in Figure 4 of the opposed patent. The skilled person would therefore consider the time domain more relevant for the term "quasi-continuous" and conclude that the claimed quasi-continuous beam of ions might include successive pulses of ions, where the pulses became spread out in time. This also happened in the

arrangement disclosed in document D1. The subject-matter of claim 1 as granted was therefore not new.

b) Admission of the auxiliary requests

The appellant argued that the auxiliary requests were legitimate attempts to further clarify the claimed subject-matter to overcome potential lack of novelty and lack of inventive step objections. In the opposed decision the opposition division interpreted "quasi-continuous beam" as being broad enough to cover significant time distributions without any significant spatial distribution, whereas the opponent had always implicitly acknowledged that "quasi-continuous beam" required a significant spatial distribution. The opposition division's interpretation took the appellant by surprise. Since there was no time at the oral proceedings before the opposition division to devise and submit appropriate requests, the auxiliary requests were filed with the grounds of appeal.

The respondent was of the opinion that the number of auxiliary requests was excessive. Furthermore, none of the auxiliary requests corresponded to requests made during opposition proceedings. The opposition division had also included a paragraph concerning lack of novelty of granted claim 1 in view of D1 in the annex to the summons to oral proceedings which was identical to a paragraph in the decision. Therefore, the appellant could not have been taken by surprise by the reasoning of the opposition division as set out in the opposed decision. The appellant should thus have made the proposed amendments during opposition proceedings.

c) First auxiliary request - novelty

The appellant argued that the reference to "spreading of ions spatially" was intended to make explicit what was regarded as implicit within the expression "quasi-continuous beam of ions".

The respondent argued that the ions in a MALDI pulse had typical initial velocity of about 750 m/s with individual velocities varying from approximately 300 m/s to 1200 m/s. Accordingly, the ions would spread spatially along the beam path because of the differences in the initial velocities. In the presence of a collision gas the ions would lose energy as they travelled along the beam path, but the fast ions would always have more energy than the slow ions. The fast ions would thus speed away from the slow ions thus gaining distance on the slower ions and generating spatial spreading. The subject-matter of claim 1 of the first auxiliary request was therefore not new over D1.

d) Second auxiliary request - amendments

The appellant argued that the basis for the feature that the pulses of ions were converted into a continuous beam of ions was on page 5, line 19 of the application as filed.

The respondent was of the opinion that the passage pointed out by the appellant would not be understood by the skilled person as disclosing the invention but merely as indicating that it would be advantageous to convert the pulses into a continuous beam of ions. Furthermore, the passage was preceded by the statement of the invention in which it was stated that there was conversion of pulses of ions into a quasi-continuous beam of ions. The term "quasi-continuous" was also used throughout the claims and the description. Therefore,

claim 1 of the second auxiliary request offended Article 123(2) EPC.

Since the term "continuous" was not a subset of the term "quasi-continuous" the proposed amendment also extended the protection beyond the patent as granted contrary to the requirements of Article 123(3) EPC.

e) Third auxiliary request - novelty

The appellant argued that document D1 merely disclosed slowing down a single pulse but not a pulsed beam of ions.

The respondent was of the opinion that document D1 disclosed a beam (D1, column 5, line 22; claims) and that the beam was pulsed (D1, column 3, line 56 and 64; column 6, line 21 ff.). The subject-matter of claim 1 of the third auxiliary request was therefore not new.

f) Fourth auxiliary request - amendments

The appellant argued that claim 1 of the fourth auxiliary request included all limitations taken from the first, second and third auxiliary requests.

The respondent argued that the comments relating to the first, second and third requests applied to claim 1 of the fourth auxiliary request.

g) Fifth auxiliary request - amendments

The appellant argued that the claimed subject-matter had been narrowed from covering any repetition rate, i.e. 0 Hz up to infinity Hz, to cover only repetition rates in the range above 13 Hz. The value of 13 Hz had

been disclosed at several places in the application as filed, for example on page 11, line 17 and page 18, line 13. The narrowing of the general range containing all values of the repetition rate to the preferred range of 13 Hz or higher was allowable following the reasoning of the decision T 2/81 of the Boards of Appeal.

The respondent argued that the passages pointed out by the appellant did not provide support for 13 Hz as a lower end of a range of repetition rate which was unlimited at the upper end. Concerning the decision T 2/81 a general range having upper and lower limits had been disclosed in the corresponding patent specification which had embraced a narrower range also having upper and lower limits. The applicant was allowed in that case to claim a range from the lower limit of the narrow range to the upper limit of the wider range. It had been noted that the part ranges on either side of the narrow range would be unequivocally and immediately apparent to the skilled person. In the present case there was no equivalent disclosure. Claim 1 of the fifth auxiliary request contained therefore added subject-matter.

h) Sixth auxiliary request

i) Amendments

Both the appellant and the respondent were of the opinion that claim 1 of the sixth auxiliary request had been amended to incorporate the feature of claim 7 as filed.

ii) Novelty / inventive step

The appellant argued that document D1 did not disclose a time-of-flight mass spectrometer and the reconversion of the quasi-continuous beam into a pulsed beam upon entry into the orthogonal time-of-flight mass spectrometer. There was nothing in the prior art that would have motivated the skilled person to arrive at the claimed subject-matter. The required modifications to D1 would involve a complete re-design of the apparatus. As a time-of-flight mass spectrometer required a pulsed input to operate, it would have been obvious to try to match the source pulse with the time-of-flight pulse. Since the conversion of the quasi-continuous beam into a pulsed beam involved substantial loss of ions, because the ions at locations in the beam outside the eventual pulse were lost, the skilled person would not have considered such conversion. It was a surprising effect of the invention that excellent results could nevertheless be achieved. Therefore, the claimed subject-matter was new and involved an inventive step.

The respondent was of the opinion that document D1 did not disclose features $(iii)_6$ and $(iv)_6$ of claim 1 of the sixth auxiliary request. Starting from D1 for the assessment of inventive step the objective technical problem was to use an alternative type of mass spectrometer. Even though in D1 an ion storage type mass spectrometer was used, other forms of mass spectrometer were contemplated as could be deduced from the passage starting in column 3, line 56. The use of a time-of-flight mass spectrometer following damping gas cooling was known from documents D4 (column 6, lines 45-58) and D5 (page 4, lines 12-14). The cooling of ions from a MALDI pulsed ion source prior to insertion into a time-of-flight mass spectrometer was known from

document D6 (page 1441, right-hand column, last paragraph; Figure 1). The claimed subject-matter was therefore obvious for the skilled person. Starting from document D4 for the assessment of inventive step, the difference feature was the pulsed source and the corresponding problem was to allow other types of samples requiring a pulsed source to be investigated. In view of D1 the claimed subject-matter would be obvious for the skilled person. Therefore, the subject-matter of claim 1 of the sixth auxiliary request lacked an inventive step.

Reasons for the Decision

1. Admissibility

The appeal is admissible

2. Main request (rejection of the opposition)

2.1 Amendments - fresh ground of opposition under Article 100(c) EPC 1973

2.1.1 During the opposition proceedings the respondent had raised for the first time the objection of added subject-matter (Article 100(c) EPC 1973) in relation to the feature "RF ion guide" in claim 4 as granted after the expiry of the opposition period. The opposition division regarded the fresh ground to be *prima facie* relevant to the outcome of the opposition proceedings and admitted it into the opposition proceedings. Upon examination of the fresh ground the opposition division was in fact of the opinion that it prejudiced the maintenance of the contested patent (see section 3.1 of the appealed decision).

Advancing the opinion that the fresh ground was *prima facie* not relevant the appellant requested that the fresh ground for opposition not be admitted into the proceedings.

The appellant in effect challenges the opposition division's discretionary decision under Article 114(1) EPC 1973 to examine the fresh ground for opposition of Article 100(c) EPC 1973. In such a case it is not the function the board to review all the facts and circumstances of the case as if it were in the place of the opposition division and to decide whether or not it would have exercised such discretion in the same was as the opposition division. The board should only overrule the way in which the opposition division has exercised its discretion if the board concludes that it has done so according to the wrong principles or without taking into account the right principles or in an unreasonable way (G7/93, OJ EPO, 1994, 775, point 2.6 of the Reasons).

In the present case, the opposition division applied the appropriate principle, namely that of *prima facie* relevance in accordance with the Decision G 10/91 (OJ EPO, 1993, 420) of the Enlarged Board of Appeal. Furthermore, the opposition division assessed the *prima facie* relevance in the proper manner, namely by checking whether the concerned amendment had a basis in the application as filed. In accordance with its function the board does not need to check itself the relevance of the fresh ground at this stage.

In view of the above the board sees no reason to overrule the opposition division's discretionary decision to examine the fresh ground for opposition of

Article 100(c) EPC 1973. The corresponding request of the appellant is therefore rejected.

2.1.2 Claim 1 as granted relates to a mass spectrometer system comprising an ion source, a mass spectrometer and an ion transmission device having a damping gas. In claim 4 as granted, which is dependent on claim 1, it is furthermore specified that the ion transmission device includes an RF ion guide and that the damping gas is provided in the RF ion guide.

In the appealed decision the opposition division was of the opinion that claim 4 as granted included subject-matter going beyond the content of the application as filed.

In the original description a general mass spectrometer system is described in relation to Figure 1 (see page 10, line 3 - page 11, line 7) comprising a pulsed ion source 1, a collisional focusing chamber 2 filled with a buffer gas and comprising a multipole 3 driven at some RF voltage, an optional manipulation stage 4 and a mass analyzer 5. In particular, the following has been disclosed on page 11, lines 1-7, in relation to the collisional focusing chamber 2 of the system shown in Figure 1:

"It will be appreciated that the collisional focusing chamber 2 is shown with a multipole rod set 3, which could be any suitable rod set, e.g. a quadrupole, hexapole or octopole. The particular rod set selected will depend upon the function to be provided.

Alternatively, a radio frequency ring guide could be used for the collisional focusing device, and ion creation could be performed within the volume defined

by the radio frequency field in order to contain the ions."

In the opposition division's judgment there was nothing in the description from which the skilled person would directly and unambiguously derive that any other RF ion guide apart from the multipole rod set or the ring guide was foreseen.

However, neither in the above passage nor anywhere else in the description are specific advantages described of using one type of ion guide rather than another one. Therefore, the skilled person would not regard the use of particular types of ion guides to be crucial. Rather, he would understand that the various types of ion guides were essentially equivalent alternatives for providing the function of guiding the ions.

In view of the above the board is of the opinion that the possibility of providing any type of RF ion guide is also disclosed in the application as originally filed. The respondent's argument that RF ion guides in the shape of, for example, bars or wires had not been disclosed in the application as originally filed is therefore not convincing, as such ion guides would be envisaged by the skilled person for providing the desired function.

Furthermore, the other features of the mass spectrometer system of Figure 1 are described in general terms. It is therefore evident for the skilled person that the use of an RF ion guide is not closely associated with any other specific feature of a mass spectrometer system.

Therefore, the subject-matter of claim 4 as granted is directly and unambiguously derivable for the skilled person from the application as originally filed.

The ground for opposition under Article 100(c) EPC 1973 is therefore not regarded to prejudice the maintenance of the contested patent.

2.2 Novelty

2.2.1 There is agreement between the parties that the features of claim 1 as granted other than feature (ii) are disclosed in document D1.

Indeed, document D1 discloses (see column 5, lines 1-66; Figure 1) a method and device for the mass-spectrometric examination of organic ions. A neodymium YAG laser 1 produces a light pulse lasting about 10 microseconds. A focal point is produced on one side of a foil 4, which is covered on the opposite side with a thin application of the substance under examination. The ions shaken off the foil are decelerated in a friction chamber 23 due to collisions with hydrogen atoms acting as a friction gas and admitted into the friction chamber 23 via inlets 5 and 7. A skimmer 10 feeds the slowed ions to the skimmer opening, the ions then being carried along into the next chamber 24. The ions are then directed into the chamber of the mass spectrometer by the potential of a skimmer 15. An ion-optical lens 17 delays the ions and focuses them on the inlet opening of an RF quadrupole ion trap 18, where the ions are slowed by a damping gas and caught. For examination of the ions, the ion trap is operated with a scanning method in which the ions are ejected mass-sequentially through holes in an end cap. The ejected ions are measured with an ion detector 19.

Therefore, using the wording of claim 1 as granted, document D1 discloses a mass spectrometer system comprising:
an ion source (neodymium YAG laser 1 and foil 4 covered with the substance under examination), for providing analyte ions;
a mass spectrometer (RF quadrupole ion trap 18 and ion detector 19);
an ion path (central regions of chambers 23 and 24 and ion-optical lens 17) extending between the ion source and the mass spectrometer;
and an ion transmission device (friction chamber 23) located in said ion path and having a damping gas (hydrogen atoms acting as a friction gas) in at least a portion of the ion path; wherein the ion source comprises a pulsed ion source (neodymium YAG laser 1 producing a light pulse lasting about 10 microseconds).

2.2.2 It is contentious between the parties whether feature (ii) of claim 1 as granted has been disclosed in document D1. First it has to be assessed how that feature is to be understood before it can be examined whether the feature has been disclosed in document D1.

2.2.3 In the appealed decision the opposition division was of the opinion that it was not defined in claim 1 as granted whether the quasi continuity of the beam related to the temporal or spatial distribution or to a combination of the two.

The board is of the opinion that in this case the specification of the opposed patent has to be consulted in order to determine what is meant by "quasi-continuous". Spatial spreading of the ions has not been described in any detail in the specification; neither

has any advantage of such spreading been mentioned. On the other hand, as pointed out by the respondent, it is described in the specification of the opposed patent that the spreading of the ions out along the ion beam changing the initial beam pulsed at 13 Hz into a quasi-continuous beam is illustrated in Figure 4 which shows the count rate as a function of time after the laser pulse (see paragraph [0044]). It is further stated in relation to Figure 4 that the width of the time distribution is on the order of 20 ms which represents an increase in the time spread by a factor of at least 10^7 compared to the length of the laser pulse of 2 ns duration. Moreover, since optimum extraction conditions do not depend on the time delay after the laser shot, multiple injection pulses into the TOF region 48 can be used for each laser shot.

It emerges thus from the specification of the opposed patent that the temporal domain is the significant one for determining the meaning of "quasi-continuous".

2.2.4 Concerning the alleged merging of pulses, no such merging has been described in the specification of the patent. Furthermore, as pointed out by the respondent, in the example described in relation to Figure 4 a pulse frequency of 13 Hz is used implying a period between pulses of about 77 ms. In addition it is explicitly mentioned in paragraph [0044] of the specification that "the quasi-continuous pulse could be as short as 0.1 ms". In that case the pulse width is therefore almost three orders of magnitude shorter than the period between pulses implying that there cannot be any merging between pulses.

Therefore, in view of the patent specification, feature (ii) is not to be read as implying any merging of

adjacent pulses. Rather, it is to be understood as meaning that each pulse is spread in time due to collisional damping.

2.2.5 As mentioned above, in document D1 it is disclosed that the ions ejected from the foil are decelerated in the friction chamber 23 due to collisions with the atoms of the friction gas. This leads necessarily to a spreading in time of the pulse. Feature (ii) is therefore considered to be disclosed in document D1.

The subject-matter of claim 1 as granted is therefore not new in view of document D1.

The ground for opposition under Article 100(a) EPC 1973 in combination with Article 52(1) EPC and Article 54 EPC 1973 is therefore regarded to prejudice the maintenance of the contested patent.

3. Admission of the auxiliary requests

3.1 The first to sixth auxiliary requests were filed with the appellant's letter setting out the grounds of appeal.

3.2 The appellant argued that it had been taken by surprise by the opposition division's interpretation of "quasi-continuous beam" expressed in the appealed decision. The respondent pointed out that one of the paragraphs in the decision relating to the reasoning of lack of novelty of claim 1 as granted in view of document D1 (see the appealed decision, paragraph 3.2(a1)) had already been included in the annex to the summons to oral proceedings. However, in the decision under appeal further arguments are provided including those concerning the interpretation of the expression "quasi-

continuous beam" (see in particular the appealed decision, paragraph 3.2(a5)). The board accepts that the focus of the attention on what features are most suitable for overcoming novelty and inventive step objections might shift in view of such more detailed arguments. Furthermore, the number of auxiliary requests concerned, namely six, is not considered to be excessive.

Therefore, the board sees no reasons for holding inadmissible the first to sixth auxiliary requests.

3.3 In view of the above, the first to sixth auxiliary requests were admitted into the appeal proceedings.

4. First auxiliary request - novelty

4.1 Claim 1 of the first auxiliary request differs from claim 1 as granted in that the feature "and there is effected the spreading of ions spatially and temporally along the ion path" has been added (see features (ii) and $(ii)_1$ under point VI. above).

4.2 Document D1 discloses a second embodiment in which ions are produced by matrix-assisted laser desorption, the other features of the mass spectrometer remaining the same (see column 6, lines 21-50 and Figure 2). In that case the light pulse of the laser lasts about 10 ns. It was pointed out by the respondent that, when this ion production method is used, the ions generated by the laser pulse have a large velocity spread. For example, according to previous examinations using that method reported in document D1 (column 2, lines 41-49) the individual velocities of the emitted ions vary from approximately 300 m/s to 1200 m/s.

In the presence of the damping gas the ions will be slowed down. However, even after the deceleration a certain velocity spread will remain. Furthermore, the deceleration takes place gradually over a certain distance. The faster ions will thus gain distance on the slower ions leading to a spatial spread in addition to the temporal spread due to the deceleration.

The added feature has therefore also been disclosed in document D1. The subject-matter of claim 1 of the first auxiliary request is therefore not new in view of document D1.

4.3 Accordingly, the first auxiliary request does not meet the requirements of the EPC (Article 52(1) EPC and Article 54 EPC 1973).

5. Second auxiliary request - amendments

5.1 Claim 1 of the second auxiliary request differs from claim 1 as granted in that "quasi-continuous beam of ions" is replaced by "continuous beam of ions" (see features (ii) and $(ii)_2$ under point VI. above).

5.2 The appellant referred to the following passage in the original description as a basis for the amendment (see page 5, lines 18-20 of the original description):

"However, the present inventors have now realised that there are advantages to, in effect converting a pulsed beam into a continuous, or at least quasi-continuous, beam, and than [sic] back into a pulsed beam."

However, as the respondent pointed out, that passage is preceded by a statement of the invention according to which pulses of ions may be converted into a quasi-

continuous beam of ions (see page 5, lines 3-14). It is also stated throughout the original description and claims that the pulses of ions are converted into a quasi-continuous beam of ions, whereas conversion into a continuous beam has nowhere else been mentioned. As demonstrated under point 2.2 above, the skilled person would understand this to mean that each pulse is spread in time due to collisional damping, but not that adjacent pulses were merging together. Therefore, it is not directly and unambiguously derivable for the skilled person that pulses of ions from the ion source were converted into a continuous beam of ions.

Claim 1 of the second auxiliary request contains thus subject-matter extending beyond the content of the application as filed contrary to the requirements of Article 123(2) EPC.

5.3 It follows from the above that the effect of the amendment relating to claim 1 of the second auxiliary request is to shift the extent of protection conferred by the opposed patent. Whereas a device adapted for the conversion of pulses of ions into a continuous beams of ions is not within the scope of protection of claim 1 as granted, such a device is indeed within the scope of protection of claim 1 according to the second auxiliary request as long as it comprises the other features of that claim.

Therefore, as far as the second auxiliary request is concerned, the opposed patent has been amended in such a way as to extend the protection it confers, contrary to the requirements of Article 123(3) EPC.

5.4 Accordingly, the second auxiliary request does not meet the requirements of the EPC.

6. Third auxiliary request - novelty

6.1 Claim 1 of the third auxiliary request differs from claim 1 as granted in that "pulses of ions" is replaced by "a pulsed beam of ions" (see features (ii) and $(ii)_3$ under point VI. above).

6.2 The respondent correctly pointed out that it is explicitly mentioned in document D1 that the ions ejected from the foil 4 form an "ion beam" (D1, column 5, lines 19-22). Furthermore, as described under points 2.2 and 4.2 above, in both embodiments described in document D1 the YAG laser 1 produces a light pulse and thus creates a pulse of ions. An "ion pulse" is also explicitly mentioned in document D1 in column 3, lines 54-56. The wording of claim 1 of the third auxiliary request is not considered to imply that a plurality of pulses are involved. The board therefore concludes that the modified feature $(ii)_3$ has been disclosed in document D1. The subject-matter of claim 1 of the third auxiliary request is therefore not new in view of document D1.

6.3 Accordingly, the third auxiliary request does not meet the requirements of the EPC (Article 52(1) EPC and Article 54 EPC 1973).

7. Fourth auxiliary request - amendments

7.1 Claim 1 of the fourth auxiliary request differs from claim 1 as granted in comprising amendments which are a combination of the amendments effected in relation to claim 1 according to the first to third auxiliary requests. In particular, the expression "quasi-continuous beam of ions" is replaced by "continuous

beam of ions" (see features (ii) and $(ii)_4$ under point VI. above).

7.2 Therefore, for the reasons provided under point 5. above, claim 1 of the fourth auxiliary request contains subject-matter extending beyond the content of the application as filed contrary to the requirements of Article 123(2) EPC. Furthermore, as far as the fourth auxiliary request is concerned, the opposed patent has been amended in such a way as to extend the protection it confers, contrary to the requirements of Article 123(3) EPC.

7.3 Accordingly, the fourth auxiliary request does not meet the requirements of the EPC.

8. Fifth auxiliary request - amendments

8.1 Claim 1 of the fifth auxiliary request differs from claim 1 as granted in that, *inter alia*, the feature "wherein the laser repetition rate is set to be 13 Hz or higher" has been added (see feature $(iv)_5$ under point VI. above).

8.2 The appellant referred to the following two passages in the original description as a basis for the amendment mentioned above (see page 11, lines 15-17 and page 18, lines 12-15):

"The laser beam is indicated at 20, and the laser is run at a repetition rate of anywhere from below a few Hz to tens of kHz, more specifically in this embodiment tested at a rate of 13 Hz."

"In these experiments, the repetition rate was 13 Hz, but can easily be increased to 20 Hz with the current

laser, or in principle up to at least 100 Hz before the counting rate becomes saturated."

Both passages relate to the repetition rate of the laser employed in the mass spectrometer system of Figure 2. The respondent pointed out that in the above passages the value of 13 Hz is not described as a lower end point of a range of repetition rates which is unlimited at the upper end. Indeed, 13 Hz is mentioned as the value employed in the reported experiments. Even though it is stated that the repetition rate could in principle be increased up to at least 100 Hz, the caveat "before the counting rate becomes saturated" is added. The skilled person would thus understand that the repetition rate can only be increased up to values which are compatible with the given counting rate. An interval of repetition rates without a maximum value has thus neither been explicitly disclosed in the application as filed nor would it occur to the skilled person having common general knowledge in view of the above passages or other parts of the application documents.

The decision T 2/81 (OJ EPO, 1982, 394), cited by the appellant, relates to the disclosure of a quantitative range of values together with an included preferred narrower range. The board held in that case that the two possible part-ranges lying within the overall range on either side of the narrower range was also directly disclosed. In the present case, on the other hand, the claimed range does not lie within a disclosed range, but comprises values lying beyond what has been disclosed in the application as filed. The reasoning of that decision is therefore not applicable in the present case.

For these reasons claim 1 of the fifth auxiliary request contains subject-matter extending beyond the content of the application as filed contrary to the requirements of Article 123(2) EPC.

8.3 Accordingly, the fifth auxiliary request does not meet the requirements of the EPC.

9. Sixth auxiliary request

9.1 Amendments

Claim 1 of the sixth auxiliary request differs from claim 1 as granted in that the feature "wherein the mass spectrometer comprises an orthogonal time of flight mass spectrometer whereby the quasi-continuous beam of ions (102; 132) enters the orthogonal time of flight mass spectrometer and is pulsed, to convert the quasi-continuous beam of ions (102; 132) back into pulses of ions" has been added (see features $(iii)_6$ and $(iv)_6$ under point VI. above).

As noted by both parties the added feature to claim 1 of the sixth auxiliary request is based on claim 7 as originally filed. Similarly, the added feature to claim 23 is based on claim 31 as originally filed.

Claim 4 of the sixth auxiliary request corresponds to claim 4 as granted. For the reasons provided above under point 2.1.2, the subject-matter of that claim as well as the corresponding method claim 27 of the sixth auxiliary request does not extend beyond the application as filed.

No further objections in relation to added subject-matter were raised by the respondent.

The set of claims according to the sixth auxiliary request is therefore not considered to extend beyond the application as filed (Article 123(2) EPC).

The amendments also comply with Article 123(3) EPC.

9.2 Novelty

9.2.1 The respondent did not argue that claim 1 of the sixth auxiliary request lacked novelty.

9.2.2 Indeed, in the system of document D1 an RF quadrupole ion trap 18 is used as the mass spectrometer (see column 5, lines 49-62). Hence, document D1 does not disclose features $(iii)_6$ and $(iv)_6$, in which it is specified that the mass spectrometer of the claimed system comprises an orthogonal time of flight mass spectrometer. The subject-matter of claim 1 of the sixth auxiliary request is therefore new over document D1.

9.2.3 Document D4 discloses (column 3, line 53 - column 7, line 25; Figures 1 and 2) an ion storage time-of-flight mass spectrometer comprising a continuously operating ion source 10. The ions are introduced into a first stage pumping region 20, formed into a beam by a multipole ion guide and collimated and transferred into the pulsing region 26 of the time-of-flight mass analyzer. The mass analyzer is operating in an orthogonal injection mode and employs a pulsed electric field between a repeller lens 23 and a draw-out lens 24. The pulsed electric field establishes the start time for the measurement of the flight time distribution of the ions arriving at the detector 36,

the flight time being related to the mass to charge ratios of the ions.

Document D4 discloses two embodiments, a continuous mode embodiment and a storage mode embodiment. In the continuous mode embodiment the ions emitted from the ion source 10 are directly fed through the ion guide into the time-of-flight mass analyzer. In the storage mode embodiment, on the other hand, the ions are first stored in the ion guide by means of a potential well in the longitudinal direction of the ion guide and then emitted from the ion guide into the time-of-flight mass analyzer by switching for a short duration the voltage on the exit electrode 15 thereby creating a leak of the potential well. After a variable delay t2 the electric field in region 26 of the mass analyzer is pulsed for a short period of time by the repeller plate 23 to accelerate the ions perpendicular to their original direction towards the flight tube 35 to be detected for mass analysis (column 7, last paragraph - column 8, second paragraph; Figure 6).

Since the ion source 10 described in document D4 is continuously operating, that document does not disclose features (i), (ii) and $(iv)_6$, which are all related to the claimed pulsed ion source.

The subject-matter of claim 1 of the sixth auxiliary request is therefore new over document D4.

9.2.4 The remaining prior-art documents referred to by the respondent are not closer to the claimed subject-matter than documents D1 or D4. Independent method claim 23 corresponds essentially to system claim 1. Claims 2 to 22 and 24 to 44 are dependent on claims 1 and 23, respectively.

Accordingly, the subject-matter of claims 1 to 44 of the sixth auxiliary request is new (Article 52(1) EPC and Article 54 EPC 1973).

9.3 Inventive step

9.3.1 Closest state of the art

The respondent argued in relation to inventive step both starting from document D1 and alternatively starting from document D4. Both documents are conceived for the same purpose as the invention, namely to provide a mass spectrometer system. However, the systems disclosed in these documents are distinguished from the claimed invention in different respects. While the system of document D1 does not comprise the features of claim 1 of the sixth auxiliary request relating to the time of flight mass spectrometer, the system of document D4 does not comprise the features relating to the pulsed ion source. In the board's view it cannot be said that either system is closer to the claimed invention than the system of the other document, for example because it has more relevant features in common or is structurally closer. Therefore, inventive step has to be assessed starting in turn from either of these documents.

9.3.2 Distinguishing features

As discussed above under points 9.2.2 and 9.2.3, the subject-matter of claim 1 of the sixth auxiliary request differs

- from the system of document D1 in comprising features $(iii)_6$ and $(iv)_6$, and

- from the system of document D4 in comprising features (i), (ii) and $(iv)_6$.

9.3.3 Objective technical problem

(a) Document D1 as the starting point

Starting from document D1 for the assessment of inventive step, the respondent argued that the objective technical problem was to use an alternative type of mass spectrometer. However, in the specification of the opposed patent it is described (see paragraph [0003]) that time of flight mass spectrometers have several advantages over conventional or ion trap mass spectrometers (the type of mass spectrometer used in the system of D1), namely that a wider mass-to-charge range can be analyzed and that all ions can be recorded simultaneously without scanning and with higher sensitivity. In the board's opinion it is therefore the objective technical problem, when starting from document D1, to achieve these advantages.

(b) Document D4 as the starting point

It emerges from the specification of the opposed patent (see paragraph [0014]) that the pulsed ion source causes desorption and ionization of the analyte molecules. When starting from document D4 for the assessment of inventive step it is therefore the objective technical problem to allow the mass analysis of analyte ions requiring such ionization.

9.3.4 Obviousness

(a) Document D1 as the starting point

When arguing in relation to D1 as the starting point for the assessment of inventive step, the respondent pointed to the passage starting in column 3, line 56 of D1 alleging that other forms of mass spectrometer had been contemplated in that document. In that passage it is stated that using the system described in detail in D1 more than one percent of the ions could be transferred to the mass spectrometer which was several orders of magnitude higher than when using a time of flight spectrometer for ions not slowed down. The time of flight spectrometer is thus merely mentioned as a reference of comparison for the mass spectrometer system described in D1. The skilled person would therefore not be prompted by that passage to replace the ion trap spectrometer in the system of D1 by a time of flight spectrometer.

The respondent also argued that the use of a time of flight mass spectrometer following damping gas cooling of an ion beam was well-known and referred to document D4, in particular the passage in column 6, lines 45-57. In this connection, the respondent also referred to documents D5 (in particular page 4, lines 12-14) and D6 (in particular page 1441, right-hand side column, last paragraph and Figure 1).

In the cited passage of document D4 the conditions in the ion guide and the function of the gas in the ion guide are described. In particular, it is mentioned that an expanding background gas jet entails that the region 30 of the ion guide is under viscous flow pressure with gas flowing and becoming less dense in the direction of the ion beam. In this way due to collisional cooling a well-defined and narrow ion energy of the beam 21 was set and high-efficiency trapping of the ions in the ion guide was achieved. In

fact, in both the continuous and the storage mode embodiments, due to the collisional cooling the energy of the ions entering the time-of-flight analyzer is determined by the voltage difference set between the ion guide bias voltage 76 and the repeller plate 23 in the mass analyzer (see column 6, lines 58-63). In addition, in the storage mode embodiment the gas in the higher pressure region 71 prevents the ions from hitting the conical lens 19 and thus contributes to efficient trapping of the ions in the ion guide (see column 7, lines 1-21).

When starting from document D1 and considering the teaching of document D4 for solving the posed technical problem, in the board's view the skilled person would disregard the continuous mode embodiment described in D4 since the pulsed ion source of document D1 does not deliver a continuous beam of ions. On the other hand, the storage mode embodiment described in D4 involves the trapping of ions in the ion guide similar to the trapping of the ions in the RF quadrupole ion trap 18 described in document D1. The skilled person would therefore - in order to solve the posed problem - consider using in the system of document D1 instead of the RF quadrupole ion trap 18 the ion guide trap followed by the time-of-flight mass analyzer described in D4 in relation to the storage mode embodiment. He would thus arrive at a system in which the ions emitted by the pulsed ion source are first stored in the ion guide by means of a potential well and then emitted from the ion guide into the time-of-flight mass analyzer by switching for a short duration the voltage on an exit electrode of the ion guide. Further following the teaching of D4, the skilled person would arrange the system to pulse for a short period of time and after a certain delay the electric field in a

region of the mass analyzer by means of a repeller plate to accelerate the ions perpendicular to their original direction towards a flight tube to be detected for mass analysis. The skilled person would therefore not be led to the claimed invention, in particular he would not be led to incorporate in the system of document D1 feature $(iv)_6$, in which it is specified that the quasi-continuous beam of ions enters the orthogonal time of flight spectrometer and is pulsed, to convert the quasi-continuous beam of ions back into pulses of ions.

Documents D5 and D6 are not considered to be more relevant than document D4. In particular, the systems of both documents comprise an ion trap from which the ions are extracted to be detected in a time-of-flight detector, thus resembling the storage mode embodiment described in document D4. These documents would therefore not lead the skilled person to the claimed invention, either.

When starting from document D1 it would therefore not be obvious for the skilled person to arrive at the invention according to claim 1 of the sixth auxiliary request.

(b) Document D4 as the starting point

When starting from document D4 for the assessment of inventive step the same considerations as those above would lead the skilled person to incorporate the pulsed ion source of document D1 in the storage mode embodiment of document D4, i.e. a system having an ion trap from which ions are extracted to be detected in a time-of-flight detector. He would therefore not be led to incorporate feature $(iv)_6$ in the system of D4.

When starting from D4 it would therefore not be obvious for the skilled person to arrive at the invention according to claim 1 of the sixth auxiliary request, either.

(c) Conclusion regarding inventive step

For the above reasons the subject-matter of claim 1 of the sixth auxiliary request involves an inventive step.

Independent method claim 23 corresponds essentially to system claim 1. Hence, the method of claim 23 involves an inventive step for the same reasons as for the system of claim 1. Claims 2 to 22 and 24 to 44 are dependent on claims 1 and 23, respectively.

Accordingly, the subject-matter of claims 1 to 44 of the sixth auxiliary request involves an inventive step (Article 52(1) EPC and Article 56 EPC 1973).

9.4 Other requirements of the EPC

No further objections were raised by the respondent in relation to the sixth auxiliary request. It is however noted by the board that the following issues still have to be addressed:

- drawing up claims 1 and 23 of the sixth auxiliary request in accordance with Rule 29(1) EPC 1973,
- indicating the background art in the description in accordance with Rule 27(1)(b) EPC 1973, and
- bringing the description into conformity with the claims of the sixth auxiliary request (Article 84 EPC 1973).

10. Conclusion

In view of the above, the board considers it appropriate to remit the case to the department of first instance in order that the issues mentioned under point 9.4 above can be dealt with.

Order

For these reasons it is decided that:

1. The decision is set aside.

2. The case is remitted to the department of first instance for further prosecution.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated