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- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

[Continued on next page]

(54) **Title:** INTEGRATED NANOSPRAY SYSTEM

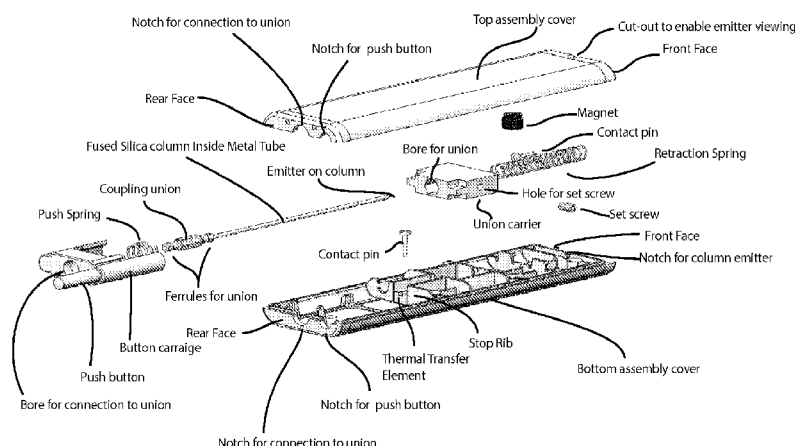


Fig. 1 Exploded schematic view

(57) **Abstract:** Integrated nanospray ionization package, comprising a nanospray emitter, a push button carriage with button element projecting through a bore in said package, an integral high voltage contact pin, a bore in said package for reversible protrusion of the nanospray emitter, a push-and-retract spring mechanism in which the range of forward motion of the emitter is not dependent on range of travel of the said button, and then upon actuation of said button element and spring element for retraction of said nanospray emitter, said nanospray emitter is pushed forward to establish electrical contact, and upon release of said button retracts and breaks the electrical contact.



(88) Date of publication of the international search report:
5 February 2015

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1, 3-9 and 11, 12 directed to a package for nanospray ionization.

Group II: Claims 2 and 10 directed to a nanospray mass spectrometer source mounting system.

see extra sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B05B 5/025 (2014.01) CPC - H01J 49/165 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8) - B05B 5/025 (2014.01) CPC - H01J 49/165 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched IPC(8) - B05B5/025; H01J27/02; H01J49/10 (2014.01) CPC- B05B5*; H01J27/02; H01J49/10; H01J49/165; H01J49/167 USPC- 250/281,423*,424,425,426,427 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Patbase, Proquest Dialog, Google Patents . Search terms: nanospray nanoelectrospray electrospray mass spectroscopy liquid chromatography ionization ionisation housing body shell cover package cartridge module emitter tube needle coaxial concentric bore hole opening aperture screw ferrule bushing grommet ring collar seal button carriage shuttle carr		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,667,474 B1 (Abramson et al.) 23 December 2003 (23.12.2003) Fig 1 and 6; col 2, ln 25-43; col 4, ln 15-18	1-12
A	US 2011/0085852 A1 (Ferrara) 14 April 2011 (14.04.2011) abstract; Fig 5A, 5B; para [0023]; para [0054]; para [0056]	1-12
A	WO 2012/148699 A1 (Murphy et al.) 01 November 2012 (01.11.2012) Fig 1-3, 9C; pg 4-6,10	1-12
A	US 2012/0115213 A1 (Hofstadler et al.) 10 May 2012 (10.05.2012) para [0005], [0271]	1-12
A	WO 2013/063502 A2 (Peterson et al.) 02 May 2013 (02.05.2013) abstract; para [0085]; para [0093]	1-12
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 29 October 2014 (29.10.2014)		Date of mailing of the international search report 05 DEC 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Continuation of Box No III -- Observations where unity of invention is lacking

The inventions listed as Groups I-II do not relate to a single inventive concept under PCT Rule 13.1 because under PCT Rule 13.2 they lack the same or corresponding technical features for the following reasons:

Special Technical Features:

Group I does not include the special technical feature of a mounting stage, guide pins, electrical contact receptacle, one or more magnets, two or more retracting or spring loaded locking pins of Group II.

Group II does not include the special technical feature of a top cover, bottom cover, emitter, union, union carrier, electrical contact pin, set-screw, push-button carriage, button carrier, limiting element, compression push spring, compression retraction spring, electrical contact pad in the bottom part of said package, a bore for projection of said button, a bore permitting connection of external tubing, bore permitting emitter to protrude from said front face or bores within bottom cover of Group I.

Common Technical Features:

The only technical features shared by Groups I and II that would otherwise unify the groups, are nanospray and a spring loaded and a retracting element. However, these shared technical features do not represent a contribution over prior art, because the shared technical features are disclosed by US 2012/0115213 A1 to Hofstadler et al. (hereinafter Hofstadler).

Hofstadler discloses nanospray (para [0005]) and a spring loaded and a retracting element (para [0271], [0080]).

As the technical feature was known in the art at the time of the invention, this cannot be considered a special technical feature that would otherwise unify the groups.

Therefore, Groups I and II lack unity under PCT Rule 13.