PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2007/020807	27.09.2007	27.09.2006

International Patent Classification (IPC) or both national classification and IPC
INV. G21B1/05 H05H1/11 H05H1/16

Applicant
EMC2

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	see form PCT/ISA/210	Crescenti, Massimo Telephone No. +31 70 340-2367

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2007/020807

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material:

      ☐ on paper

      ☐ in electronic form

   c. time of filing/furnishing:

      ☐ contained in the international application as filed.

      ☐ filed together with the international application in electronic form.

      ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	5-18
	No:	Claims	1-4
Inventive step (IS)	Yes:	Claims	
	No:	Claims	5-18
Industrial applicability (IA)	Yes:	Claims	1-18
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1: US-A-4 826 646 (BUSSARD ROBERT W [US]) 2 May 1989 (1989-05-02)

D2: US-A-4 007 392 (VALFELLS AUGUST ET AL) 8 February 1977 (1977-02-08)

D3: US-A-5 160 694 (STEUDTNER WERNER [CH]) 3 November 1992 (1992-11-03)

1. PRELIMINARY REMARKS

1.1 In claims 1,2 the expression ".. *creating* positively charged particles within said region .." does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved (i.e. *creating* positively charged particles), which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

1.2 In claims 5,11 the term "collisional reactions" is very broad and does not exclude, e.g., elastic reactions comprising momentum exchange between particles.

1.3 In claims 5,11 the term *great* is inappropriate, it appears that should be changed with the term *high*.

1.4 In claims 5,11 the expression " .. having energies sufficiently great (high) .. to produce collisional reactions .." is very broad because one can always consider a collisional reaction (see Sect. 1.2 above) requiring very low amounts of energy to be produced. Moreover, the use of relative/unclear terms (i.e. sufficiently, great) should be avoided.

1.5 In claims 2,5 the expression "..current carrying means .. *spaced from and adjacent to*

edges of said polyhedron.." is unclear because the terms "spaced from" and "adjacent" appear in contradiction. It appears however unavoidable to have a space between current carrying means placed on adjacent surfaces of a polyhedron and carrying different currents.

1.5 In claims 5,11 the expression ".. a housing .. has a cross sectional shape conformal to the B field .." appears meaningless. In view of the description (par.[0097] and Fig.9C), it appears to mean that the housing has a circular cross section, and as such is interpreted in this opinion.

2. INDEPENDENT CLAIMS

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of apparatus **claim 2** is not new in the sense of Article 33(2) PCT. The document D1 discloses (the references in parentheses applying to this document):

- An apparatus (abstract, claim 4) for controlling positively charged particles comprising:
- means for generating a magnetic field within a region, all the cusps of said magnetic field being point cusps (column 27, lines 66-68);
- means for injecting electrons into the center of said region for forming a negative potential well within said region (column 28, lines 1-3);
- means for injecting positively charged particles into said region and using said negative potential well to confine said positively charged particles within said region (column 28, lines 4-7);
- and means for maintaining the number of electrons greater than the number of positively charged particles (column 28, lines 8-10);
- wherein said magnetic field generating means includes current carrying means for carrying an electric current (column 28, lines 11-13),
- said current carrying means so arranged as to lie on at least some faces of a polyhedron and spaced from and adjacent to edges of said polyhedron and spaced apart at each vertex of said polyhedron, said polyhedron having an even number of faces about each vertex (Fig.4 and column 14, lines 50-56, since the means are part of different circuits,

there must necessarily be space between them and therefore between them and each edge and vertex of the polyhedron, see also Sect. 1.5);

- wherein said magnetic field generating means generates only point cusps at positions corresponding to the centers of faces of said polyhedron (column 14, lines 56-59); and
- wherein said electron injecting means is arranged to inject said electrons through one of said point cusps along a first line corresponding to an axis of said polyhedron (column 16, lines 29-36 and Fig.9).

2.2 Therefore the subject-matter of claim 2 cannot be considered novel in the sense of Article 33(2) PCT, and the application does not meet the requirements of Article 33(1) PCT.

2.3 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **claim 5** does not involve an inventive step in the sense of Article 33(3) PCT. The document D1 is regarded as being the closest prior art to the subject-matter of claim 5, and discloses (the references in parentheses applying to this document):

- a device for producing collisional reactions comprising:

- means for generating a magnetic field within a region, said means including magnetic field coils (500, cf. Fig.5A,B) arranged so as to lie on at least some faces of a polyhedron and positioned spaced from and adjacent to edges of said polyhedron and spaced apart at each vertex of said polyhedron by a spacing distance, each vertex of said polyhedral being surrounded by an even number of faces, said field coils carrying currents such that adjacent faces of said polyhedral have opposing magnetic polarities (column 14, lines 50-63, see also claim 17, a);

- means for injecting electrons within said region, said electrons having gyro radii effectively smaller than the radius of said region (column 18, Table 1 and lines 15-28) such that said electrons are trapped within said region by said magnetic field, said trapped electrons forming a negative potential well within a volume of said region (see also claim 17, b);

- means for injecting positively charged ions into said region, said ions having gyro radii effectively larger than a radius of said region when at their maximum energy within the potential well, such that said positively charged ions are not trapped within said region by said magnetic field, said positively charged ions being confined within said region by electric potential gradient forces resulting from said negative potential well, the number of electrons within said region maintained larger than the number of said positively charged ions, and said positively charged ions having energies sufficiently great within said region to produce collisional reactions (column 26, lines 41-46, see also claim 17, c).

2.4 The subject-matter of claim 5 therefore differs from this known D1 in that said field coils are contained within a housing which has a cross sectional shape conformal (i.e. having a circular cross section, see Sect.1.5) to the B field produced by said field coils.

2.5 The problem to be solved by the present invention may therefore be regarded as how to find a shape for the housing avoiding disturbances on the B field generated by the coils.

2.6 However, the use of circular cross section housing is a well established practice in the art of producing such coils, (see general purpose superconducting cables, which normally have a circular cross-section housing, see e.g. D2, coils 30-37, cf. Figs.3,4 and column 4, line 17 and undisturbed field lines; see also D3, Fig. 11,12,14, coils 121,143 whose (schematic) cross sections are circular, and whose B field lines are not disturbed), to solve the same above mentioned problem. It would be therefore obvious to employ a superconducting cable having a circular cross-section housing for the coils of D1, therefore arriving to the subject-matter of claim 5.

2.7 Therefore claim 5 cannot be considered as involving an inventive step (Article 33(3) PCT) and the application does not meet the requirements of Article 33(1) PCT.

2.8 The same reasoning as above, (see Sect. 2.1-2,7) applies, mutatis mutandis, to the subject-matter of the corresponding independent method **claims 1,11** which therefore are also considered respectively not new or not inventive.

3. DEPENDENT CLAIMS

3.1 Dependent claims 3-4.6-10,12-18 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows.

3.2 D1 discloses also an apparatus/method with:

- second electron means according to **claim 3** and means injecting electrons with rotation, according to **claim 4**; see claims 5,11.

- gyro radii of electrons on the order of 0.5-5mm at 20-50KeV with a field of 1-5Gauss, according to **claim 7**; see claim 18.

- isotopes being lithium, beryllium, etc., according to **claim 9,15**; see claim 30.

- means outside the device for converting energy coming form the device, according to **claim 10,17**; see claim 25.

- a step of continuously increasing the number of electrons in said region, according to **claim 18**; see claim 35.
- a step of having electron gyro-radii 10-100 times smaller than the diameter of said region, according to **claim 12**; see claim 18.

- a step of injecting energies large enough to produce sufficiently large potential well for fusion reactions to occur, according to **claim 16**; see claim 22.

- providing a spacing distance of 3-10 electron gyro radii, according to **claims 6,13**; since the B field amplitude and electron injection energy are not specified in claims 5,11, a combination of field amplitude and electron injection energy satisfying such spacing distance is necessarily present in the device of D1.

3.3 Additional feature of **claims 8,14** (polyhedron with square faces) is merely one of several

straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem of selecting the dimensions of the polyhedron.