(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 January 2014 (23.01.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/014912 A3

(51) International Patent Classification:
H02M 5/00 (2006.01)

(21) International Application Number:
PCT/US2013/050682

(22) International Filing Date:
16 July 2013 (16.07.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/672,377 17 July 2012 (17.07.2012) US

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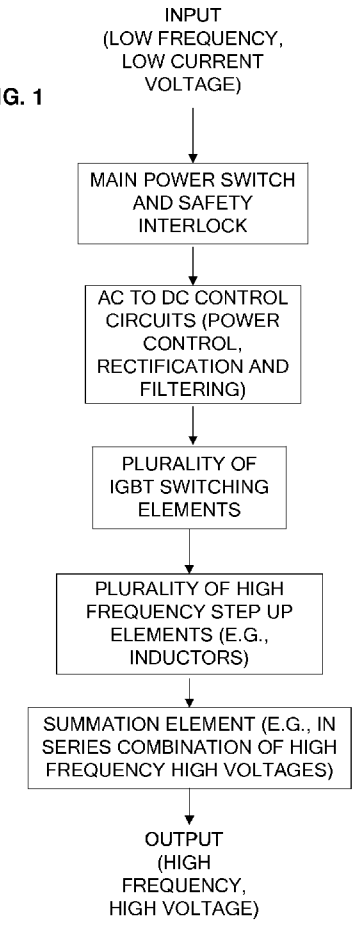
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,

[Continued on next page]

(54) Title: POWER SOURCES

(57) Abstract: Methods and systems are described for providing a high frequency high voltage source. For example, a power source for use in a particle accelerator, an arc welder or an inductive heater.

FIG. 1



WO 2014/014912 A3

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, 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.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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))*

(88) Date of publication of the international search report:
10 April 2014

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/050682

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H02M 5/00 (2014.01)
USPC - 363/13
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) - H02M 5/00, 5/40, 5/42, 5/44 (2014.01)
USPC -363/13, 51, 71, 98

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - H02M 5/00, 5/40, 5/42, 5/44 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Orbit, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,486,993 A (SAKURAI et al) 23 January 1996 (23.01.1996) entire document	1-3, 10-15, 23-25, 32-34, 37-39, 50-53, 65-67, 73-75, 81-83, 85-89
Y	US 6,031,737 A (GREEN) 29 February 2000 (29.02.2000) entire document	1-3, 10-15, 23-25, 32-34, 37-39, 52, 53, 65-67, 73-75, 81-83, 85-89
Y	US 8,130,040 B2 (STASZEWSKI et al) 06 March 2012 (06.03.2012) entire document	1-3, 10-15, 23-25, 32-34, 37-39, 52, 53, 65-67, 73-75, 81-83, 85-89
Y	US 2009/0286295 A1 (MEDOFF et al) 19 November 2009 (19.11.2009) entire document	50-53
A	WO 2009/147551 A1 (URBAN) 10 December 2009 (10.12.2009) entire document	1-3,10-15,23-25,32-34,37-39,50-53,65-67,73-75,81-83,85-89

☐ Further documents are listed in the continuation of Box C. ☐

* 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	Date of mailing of the international search report
23 January 2014	04 FEB 2014

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/050682

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.: 4-9, 16-22, 26-31, 35-36, 40-49, 54-64, 68-72, 76-80, 84
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:

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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/050682

Continuation of Box III

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, 10-15, 23-25, 32-34, 37-39, 65-67, 73-75, 81-83, 85-89, drawn to a power supply and method comprising: providing a first DC current in parallel to a first Insulated Gate Bipolar Transistor (IGBT) and a second IGBT; stepping up a first AC voltage output from the first IGBT to produce a first high frequency high voltage current; stepping up a second AC voltage output from the second IGBT to produce a second high frequency high voltage current.
Group II, claims 50-53, drawn to a method for processing biomass material, the method comprising; providing a high frequency high voltage current to a particle accelerator, accelerating a plurality of particles and, irradiating a biomass material with the accelerated particles.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: providing a first DC current in parallel to a first Insulated Gate Bipolar Transistor (IGBT) and a second IGBT; stepping up a first AC voltage output from the first IGBT to produce a first high frequency high voltage current; stepping up a second AC voltage output from the second IGBT to produce a second high frequency high voltage current; as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: a particle accelerator, accelerating a plurality of particles and, irradiating a biomass material with the accelerated particles as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a generating a combined high frequency voltage current, this technical feature is not a special technical feature as it does not make a contribution over the prior art in view of WO 2009/147551 A1 (URBAN) 10 December 2009 (10.12.2009) figure 1; page 7, lines 15-28; page 8, lines 12-13; page 9, lines 4-15.

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.