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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(S7) Abstract: A DC-DC converter comprises a primary circuit fed by a DC power source. The primary circuit comprises a transformer primary winding having a first end coupled to one side of the DC power source through a capacitor and inductor, the capacitor being coupled to the second side of the DC power source through a switching means comprising a pair of switches connected to the inductor side and transformer primary winding side of the capacitor; a transformer coupling the primary and secondary circuits together; a secondary circuit including a transformer secondary winding and rectifying means for producing a DC output; and control circuitry operating the switches of the switching means to connect the second side of the DC power source to the inductor side and transformer primary winding side of the capacitor alternately, such that the capacitor discharges through the primary winding alternately. The control circuitry for the switching means causes a transient delay in the closing of one switch relative to the opening of the other switch of the switching means.

INTERNATIONAL SEARCH REPORT

International Application No

PC B 02/00394

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H02M3/335

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 7 H02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 706 182 A (RICHARD A. FAULK) 6 January 1998 (1998-01-06)	1,8, 11-13
Y	figure 4 column 6, line 66 -column 7, line 63 ---	2-4
A	WO 88 00768 A (COMBUSTION ELECTROMAGNETICS INC.) 28 January 1988 (1988-01-28) page 8, line 7 - line 14 ---	1
Y	US 5 886 882 A (PHILIP RODULFO) 23 March 1999 (1999-03-23) cited in the application abstract figure 1 -----	2-4

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

☒ Patent family members are listed in annex.

° 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 document 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

5 June 2002

Date of mailing of the international search report

14. 10. 2002

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 02/00394**Box I Observations where certain claims were found unsearchable (Continuation of item 1 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.: 6, 10
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:
see FURTHER INFORMATION sheet PCT/ISA/210
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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional 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 an additional fee, this Authority did not invite payment of any additional fee.
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.:
1-4, 8, 11-13

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 6, 10

The claims 6 and 10 are only searched in the context of claim 2, THOUGH CLAIM 10 IS AN INDEPENDENT CLAIM AND CLAIM 6 MAY BE DEPENDENT ON OTHER CLAIMS AS WELL.

The reason for this limitation is the fact, that the characterising part of claim 10 (and 6) does specify the special technical features (the switch timing) but does not explain the technical effect. This technical effect is not explained in the description and is not evident.

Claim 10 is stated in the first part of the description to relate to "another aspect of the invention". As the special technical effect of the special technical features is not revealed, it is not clear if this "another aspect of the invention" relates to the first inventive concept, the second inventive concept (non-unitary) or a third inventive concept. Further it is not possible to search for a similar, inventive idea.

Claims 6 and 10 MAY relate to a timing example described in the description on page 13 but without describing the special technical features in the same way. In this case claims 6 and 10 form a third inventive concept (non-unitary). In such case it is, however, the choice of the applicant not to provide a clear link between this small part of the description and the two claims.

Claim 8 is specifying the transient delay to be approximately 1 microsecond. The description specifies this delay to be in the order of 0.1 microsecond with a typical range of 0.05 to 0.1 microseconds. The figure of 0.1 microseconds from the description appears to be more likely than the figure of 1 microsecond with a cycle-period of 5 microseconds (page 9). Further there is nowhere provided an explanation for a special technical effect relating to a 1 microsecond delay. For the search it has been assumed, that a delay sufficiently large to avoid an ON-overlap of the two switches (typically 50-100ns) is the technical effect aimed at.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-4, 8, 11-13

A DC-DC converter,
with both terminals of the isolating transformer being
connected to the respective terminals of the power source
through a series-coupled capacitor and inductor, and using
two sets of two switches.

2. Claims: 5, 7, 9

A DC-DC converter,
with one set of two switches and a control circuit operating
at least one of these switches when there is substantially
no voltage across the switch.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PO B 02/00394

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5706182	A	06-01-1998	US 5818702 A	06-10-1998
WO 8800768	A	28-01-1988	AU 7702587 A	10-02-1988
			EP 0274513 A1	20-07-1988
			JP 1500949 T	30-03-1989
			WO 8800768 A1	28-01-1988
			US 4868730 A	19-09-1989
US 5886882	A	23-03-1999	NONE	