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<i>H01M 12/00</i> (2006.01)	<i>H02M 3/04</i> (2006.01)
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15/208,143	12 July 2016 (12.07.2016)	US
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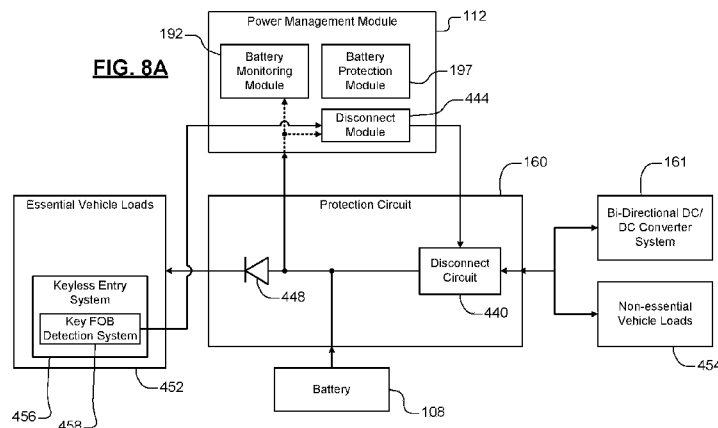
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(72) Inventors: **CIACCIO, Michael Peter**; 331 Fairways Lane, Chelsea, Michigan 48118 (US). **MOORHEAD, Brian**; 9250 Macey Road, Willis, Michigan 48191 (US).

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR SUPPLYING POWER IN A HYBRID VEHICLE PROVIDED WITH CAPACITORS, A BATTERY AND ONE OR MORE DC/DC CONVERTERS



(57) Abstract: A system for discharging or charging a capacitor of a hybrid vehicle according to the present disclosure includes a target state of charge (SOC) module and a capacitor charge/discharge module. The target SOC module determines a target state of charge of the capacitor based on a speed of the vehicle. The capacitor charge/discharge module determines whether a state of charge of a capacitor is greater than a target state of charge. The capacitor charge/discharge module dissipates power from the capacitor to at least one of a battery of the vehicle and an electrical load of the vehicle when the state of charge of the capacitor is greater than the target state of charge.

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— *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:**  
19 October 2017

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2017/020236

## 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:

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 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/US2017/020236

A. CLASSIFICATION OF SUBJECT MATTER					
INV.	F02N11/08	F02N11/04	B60W20/00	H02J7/14	H01M12/00
	B60L11/12	B60R16/033	H01M10/44	B60L11/18	
ADD.	B60L7/10	H02J7/00	H02M3/04	E05B81/78	

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) F02N B60W H02J H01M B60L B60R H02M E05B

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 practicable, search terms used) EPO-Internal, WPI Data
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2007 003005 A1 (AUDI AG [DE]) 28 February 2008 (2008-02-28)	1,3-8, 10-12, 28,30-35
Y	the whole document	2,9,29
Y	DE 10 2014 203030 A1 (CONTINENTAL AUTOMOTIVE GMBH [DE]) 20 August 2015 (2015-08-20) abstract; figure 1 paragraphs [0012] - [0018], [0029] - [0033], [0036], [0038]	2,9,29
Y	WO 99/12044 A2 (BATTERYGUARD LIMITED [NZ]; PARSONAGE PETER CECIL JOSEPH [NZ]) 11 March 1999 (1999-03-11)  abstract; figures 1-2 page 6, line 19 - page 7, line 8	1,3,4, 6-8,28, 30,31, 33-35
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Further documents are listed in the continuation of Box C.  See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p>
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Date of the actual completion of the international search  7 September 2017	Date of mailing of the international search report  19/09/2017
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Mineau, Christophe
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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2017/020236

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 196 28 222 A1 (BOSCH GMBH ROBERT [DE]) 22 January 1998 (1998-01-22)  abstract; figures 1-2 -----	1,3,4, 6-8,28, 30,31, 33-35
A	DE 40 28 242 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 12 March 1992 (1992-03-12) abstract; figures 1-6 -----	1-12, 28-35
A	DE 10 2009 006665 A1 (PORSCHE AG [DE]) 5 August 2010 (2010-08-05) abstract; figures 1-4 paragraph [0016] -----	1-12, 28-35
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A	EP 2 607 178 A1 (VOLVO CAR CORP [SE]) 26 June 2013 (2013-06-26) abstract; figure 1 -----	1-12, 28-35
A	EP 0 945 959 A2 (BOSCH GMBH ROBERT [DE]) 29 September 1999 (1999-09-29) abstract; figure 1 -----	1-12, 28-35
Y	US 2013/127399 A1 (TANG XIDONG [US] ET AL) 23 May 2013 (2013-05-23) abstract; figures 7-10 paragraphs [0061] - [0067] -----	13-22, 36-43
Y	DE 10 2005 051433 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 3 May 2007 (2007-05-03) abstract paragraphs [0002] - [0012] -----	13-22, 36-43
Y	KR 101 157 413 B1 (AGENCY DEFENSE DEV [KR]) 21 June 2012 (2012-06-21) paragraphs [0015] - [0016], [0025] - [0030] -----	13-22, 36-43
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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2017/020236

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2004 062939 A1 (VOLKSWAGEN AG [DE]; SKODA AUTO AS [CZ]) 6 July 2006 (2006-07-06) abstract; figures 1-2 paragraphs [0026] - [0028] -----	23-27, 44-52

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/020236

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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

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

1. claims: 1-12, 28-35

hybrid vehicle with two power sources, a capacitor and a battery and with a battery protection protection module which is configured to disconnect the non-critical loads when the battery's state of charge is low.

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2. claims: 13-27, 36-52

System and method for charging/discharging a capacitor in a hybrid vehicle with two power sources, the capacitor and a battery.

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