



(51) International Patent Classification:
G01R 31/34 (2006.01) *H02K 7/20* (2006.01)

(21) International Application Number:
PCT/US2018/016349

(22) International Filing Date:
01 February 2018 (01.02.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
15/422,052 01 February 2017 (01.02.2017) US

(71) Applicant: **BORGWARNER INC.** [US/US]; 3850 Ham-
lin Road, Auburn Hills, MI 48326 (US).

(72) Inventors: **ZHOU, Mingshe**; 600 Corporation Drive, 2nd
Floor, Pendleton, IN 46064 (US). **KIRK, Michael E.**; 600
Corporation Drive, 2nd Floor, Pendleton, IN 46064 (US).
WACHOWSKI, Kurt; 600 Corporation Drive, 2nd Floor,
Pendleton, IN 46064 (US).

(74) Agent: **KERNUS, Victor**; CANTOR COLBURN LLP, 20
CHURCH STREET, 22ND FLOOR, HARTFORD, Con-
necticut 06103 (US).

(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, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
KR, KW, KZ, LA, LC, LK, LR, LS, 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.

(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, ST, 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,

(54) Title: SYSTEM AND METHOD FOR DETECTING AN OPERATING MOTOR

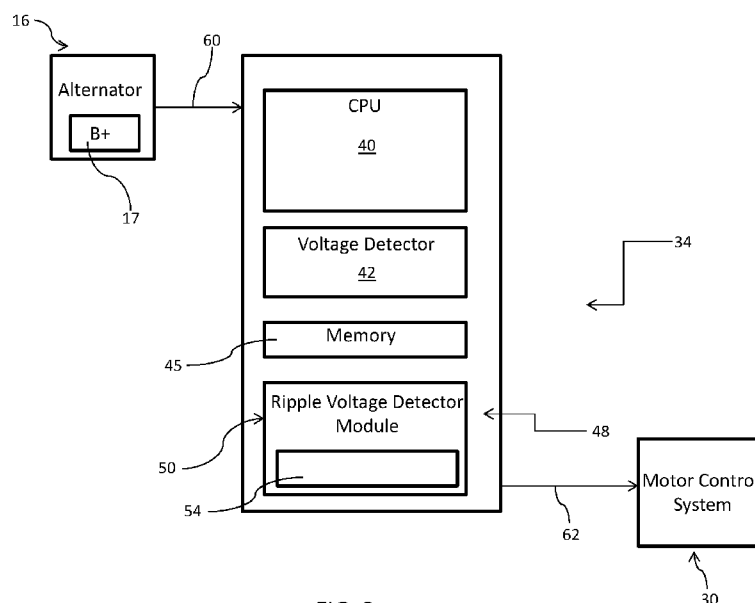


FIG. 2

(57) Abstract: A system for detecting operation of a motor includes a ripple voltage detector module including a ripple voltage detector unit, an input operatively connected to the ripple voltage detector unit and connectable to an alternator, and an output operatively connected to the ripple voltage detector unit and connectable to a starter motor control system. The ripple voltage detector module provides a motor operation signal to the starter motor control system upon detection of a ripple voltage produced by the alternator.

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report (Art. 21(3))*

SYSTEM AND METHOD FOR DETECTING AN OPERATING MOTOR

INTRODUCTION

[0001] Exemplary embodiments pertain to the art of motor systems and, more particularly, to a system and method for detecting an operating motor.

[0002] Many motor systems rely on starter motors to initiate operation. Upon activation of the starter motor, a gear is brought into meshing engagement with, for example, a fly wheel of the motor. The gear is rotated causing a corresponding rotation of the fly wheel to initiate operation of the motor. Once the motor is in operation, it is undesirable to re-engage the starter motor. Shifting the gear into engagement with a rotating fly wheel could result in damage to the starter motor. In order to prevent undesirable activation of the starter motor, many motor systems include a system for detecting motor operation.

[0003] Certain systems for detecting motor operation may detect movement of various rotating parts such as crankshafts, cams shafts and the like. Such systems add to an overall motor system cost by requiring a sensor to detect movement of the rotating part as well as periodic maintenance. Other systems may monitor output voltage from an alternator. If output voltage is above a certain threshold value, the motor may be deemed to be in operation and the starter motor prevented from activating. Occasionally, systems associated with the motor may represent a load causing a voltage drop that draws output voltage below the threshold value while the motor is operating. At such times, the starter motor could be activated and the gear sent toward a rotating fly wheel.

SUMMARY

[0004] Disclosed is a system for detecting operation of a motor including a ripple voltage detector module including a ripple voltage detector unit, an input operatively connected to the ripple voltage detector unit and connectable to an alternator, and an output operatively connected to the ripple voltage detector unit and connectable to a starter motor control system. The ripple voltage detector module provides a motor operation signal to the starter motor control system upon detection of a ripple voltage produced by the alternator.

[0005] Also disclosed is a motor system including a motor, a starter motor mechanically connected to the motor, a starter motor control system operatively connected to the starter motor, and an alternator operatively connected to the motor. The alternator is operable through operation of the motor to produce a voltage. A motor operation detector system is operatively connected to the motor. The motor operation detector system is

operable to detect motor operation and includes a ripple voltage detector module having a ripple voltage detector unit, an input operatively connected to the ripple voltage detector unit and the alternator, and an output operatively connected to the ripple voltage detector unit and the starter motor control system. The ripple voltage detector module provides a motor operation signal to the starter motor control system upon detection of ripple voltage produced by the alternator.

[0006] Further disclosed is a method of detecting motor operation including monitoring a motor system component for an electrical signal, detecting ripple voltage from the motor system component, and preventing activation of a starter motor based on detecting the ripple voltage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0008] FIG. 1 depicts a block diagram of a motor system including a motor operation detector system, in accordance with an exemplary embodiment;

[0009] FIG. 2 depicts a block diagram of the motor operation detector system including a ripple voltage detector module, in accordance with an exemplary embodiment; and

[0010] FIG. 3 depicts a block diagram illustrating a method of controlling operation of a starter motor, in accordance with an aspect of an exemplary embodiment.

DETAILED DESCRIPTION

[0011] The following description is merely exemplary in nature and is not intended to limit the present disclosure, its application or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features.

[0012] A motor system, in accordance with an exemplary embodiment, is indicated generally at 10 in FIG. 1. Motor system 10 includes a motor 14 operatively connected to a alternator 16 having a B+ output terminal 17 that provides a charging current to a battery 20. Motor 14 takes the form of an internal combustion engine that may operate on a variety of fuels such as gasoline, diesel fuel, or the like. Motor 14 may be employed in a wide array of systems including vehicles such as cars, trucks and ships, as power for a generator, and the like. Motor system 10 includes a starter motor 24 that may be selectively activated to provide

a motive force to initiate operation of motor 14. Starter motor 24 is mechanically linked to motor 14 and electrically connected to battery 20.

[0013] Motor system 10 also includes a starter motor control system 30 that may selectively activate starter motor 24 upon receiving an input from, for example, an ignition system (not shown). Starter motor control system 30 may also operate to prevent activation of starter motor 24 if motor 14 is in operation. In this manner, starter motor control system 30 operates to prevent damage associated with attempting to engage a pinion gear (not shown) of starter motor 24 with a rotating ring gear (also not shown) of motor 14.

[0014] In accordance with an aspect of an exemplary embodiment, motor 14 includes a motor operation detection system 34 operatively connected to starter motor control system 30. Motor operation detection system 34 provides a motor operation signal to starter motor control system 30 if motor 14 is running. The motor operation signal may be associated with voltage produced by alternator 16. That is, as alternator 16 is driven by motor 14, a voltage output may provide an indication of motor operation.

[0015] Referring to FIG. 2, motor operation detection system 34 includes a processor 40, a voltage detector 42 connected to processor 40 and, for example, to alternator 16, and a memory 45. Memory 45 may store a predetermined threshold voltage value associated with motor 14. If, for example, voltage output from alternator 16 is above the predetermined threshold value, motor 14 may be deemed to be in operation. Alternatively, if voltage output from alternator 16 is below the predetermined threshold value, motor 14 may be deemed to not be in operation. It is to be understood that while shown in FIG. 2 as discrete components, motor operation detection system 34 may be fully integrated with alternator 16.

[0016] It has been found that various electrical loads associated with motor system 10 may cause a voltage drop such that output voltage is below the predetermined threshold while motor 14 is in operation. Under such circumstances, motor operation detection system 34 may provide a false negative output to starter motor control system 30. In order to prevent a false negative from allowing operation of starter motor 24, motor operation detection system 34 includes a ripple voltage detector unit 48, in accordance with an aspect of an exemplary embodiment.

[0017] In accordance with an aspect of an exemplary embodiment, ripple voltage detector unit 48 includes a ripple voltage detector module 50, which includes a voltage divider circuit 54 that senses the existence of ripple voltage. Ripple voltage exists at B+ output terminal 17 as long as alternator 16 is producing voltage regardless of the existence of electrical loads. Accordingly, motor operation detection system 34 includes an input 60

coupled to B+ output terminal 17. If ripple voltage is present at B+ output terminal 17, motor operation detection system 34 may provide a signal to starter motor control system 30. It is to be understood that the signal may be an instruction, such as through software passed internally of motor operation detection system 34 or a physical signal that is passed through output 62. The signal would indicate that motor 14 is in operation and that starter motor 24 should be prevented from being activated and/or operation of starter motor 24 may be inhibited.

[0018] Reference will now follow to FIG. 3 in describing a method 150 of detecting motor operation in accordance with an aspect of an exemplary embodiment. In block 160 motor operation detection system 34 monitors a motor system component for an electrical signal such as voltage. In accordance with an aspect of an exemplary embodiment, motor operation detection system 34 monitors B+ output terminal 17 of alternator 16 in block 160. If, in block 180, voltage is present at a level above the predetermined threshold, motor operation detection system 34 signals, in block 190, starter motor control system 30 to prevent operation of starter motor 24.

[0019] If, in block 180, voltage is below the predetermined threshold, motor operation detection system 34 determines, in block 200 whether ripple voltage exists. If ripple voltage exists, motor operation detection system 34 outputs a signal to starter motor control system 30 in block 190 to prevent operation of starter motor 24. If no ripple voltage is present, motor operation detection system 34 continues to monitor the motor system 10 at block 160.

[0020] At this point it should be understood that exemplary embodiments describe a system that relies upon sensing ripple voltage from a motor system component to determine whether a motor is in operation. It should also be understood that while described as working in cooperation with sensing a voltage value relative to a threshold level, the detection of ripple voltage may be the only input used to determine whether a motor is in operation.

[0021] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

[0022] While the above disclosure has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from its scope. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the disclosure without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed, but will include all embodiments falling within the scope of the application.

CLAIMS

What is claimed is:

1. A system for detecting operation of a motor comprising:
a ripple voltage detector module including a ripple voltage detector unit;
an input operatively connected to the ripple voltage detector unit and connectable to an alternator; and
an output operatively connected to the ripple voltage detector unit and connectable to a starter motor control system, wherein the ripple voltage detector module provides a motor operation signal to the starter motor control system upon detection of a ripple voltage produced by the alternator.
2. The system for detecting operation of a motor according to claim 1, wherein the ripple voltage detector unit includes a voltage divider circuit.
3. A motor system comprising:
a motor;
a starter motor mechanically connected to the motor;
a starter motor control system operatively connected to the starter motor;
an alternator operatively connected to the motor, the alternator being operable through operation of the motor to produce a voltage; and
a motor operation detector system operatively connected to the motor, the motor operation detector system being operable to detect motor operation and comprises:
a ripple voltage detector module including a ripple voltage detector unit;
an input operatively connected to the ripple voltage detector unit and the alternator;
and
an output operatively connected to the ripple voltage detector unit and the starter motor control system, wherein the ripple voltage detector module provides a motor operation signal to the starter motor control system upon detection of ripple voltage produced by the alternator.
4. The motor system according to claim 3, wherein the ripple voltage detector unit includes a voltage divider circuit.
5. The motor system according to claim 3, wherein the motor is part of a vehicle.
6. The motor system according to claim 3, wherein the starter motor control system is operable to prevent operation of the starter motor upon receipt of the motor operation signal.

7. The motor system according to claim 3 wherein the alternator includes a B+ output terminal operatively connected to the input.

8. A method of detecting motor operation comprising:
monitoring a motor system component for an electrical signal;
detecting ripple voltage from the motor system component; and
preventing activation of a starter motor based on detecting the ripple voltage.

9. The method of claim 8, wherein monitoring the motor system component includes monitoring a terminal of an alternator.

10. The method of claim 9, wherein monitoring the terminal of the alternator includes monitoring a B+ terminal of the alternator.

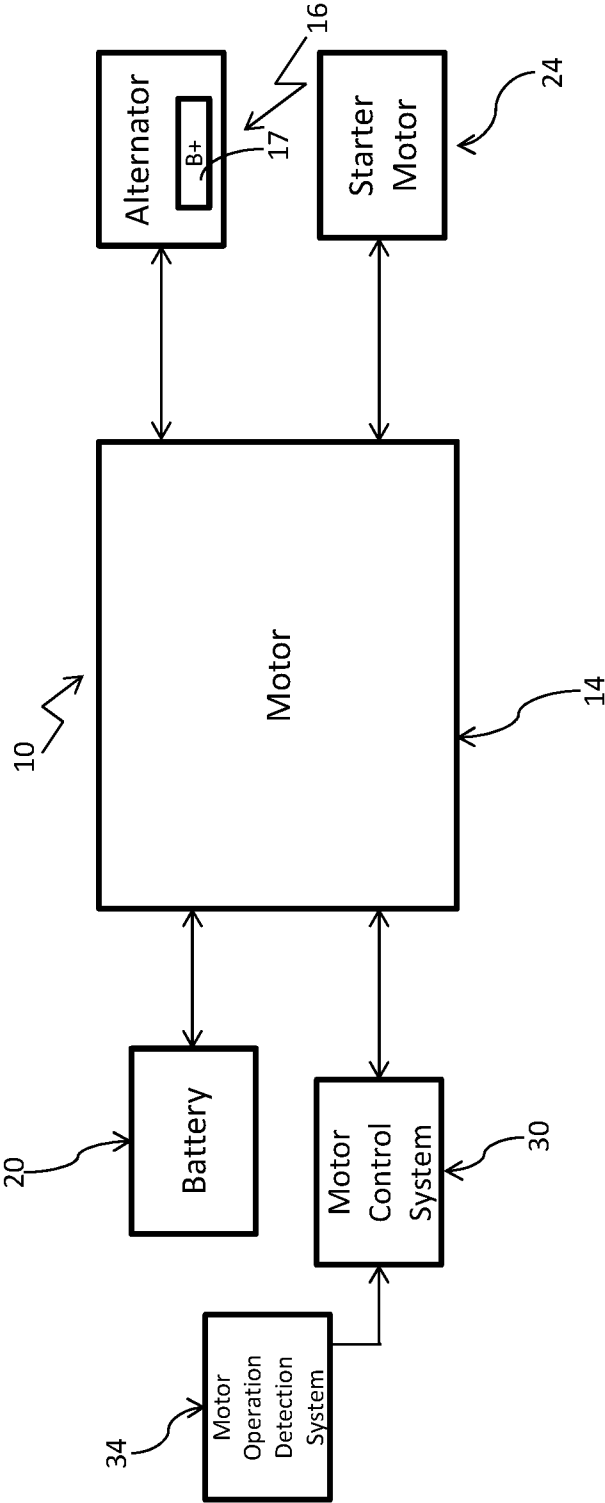


FIG. 1

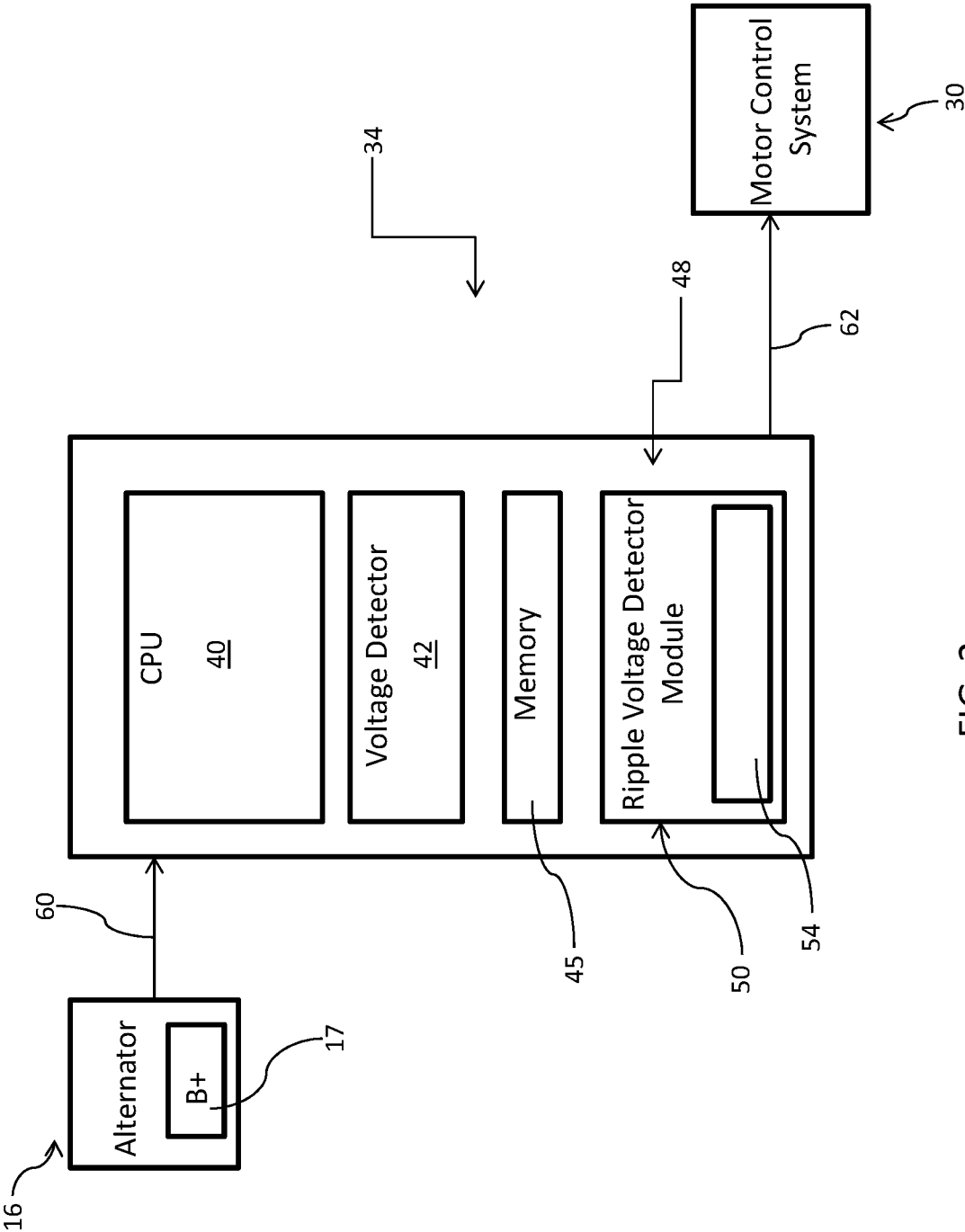


FIG. 2

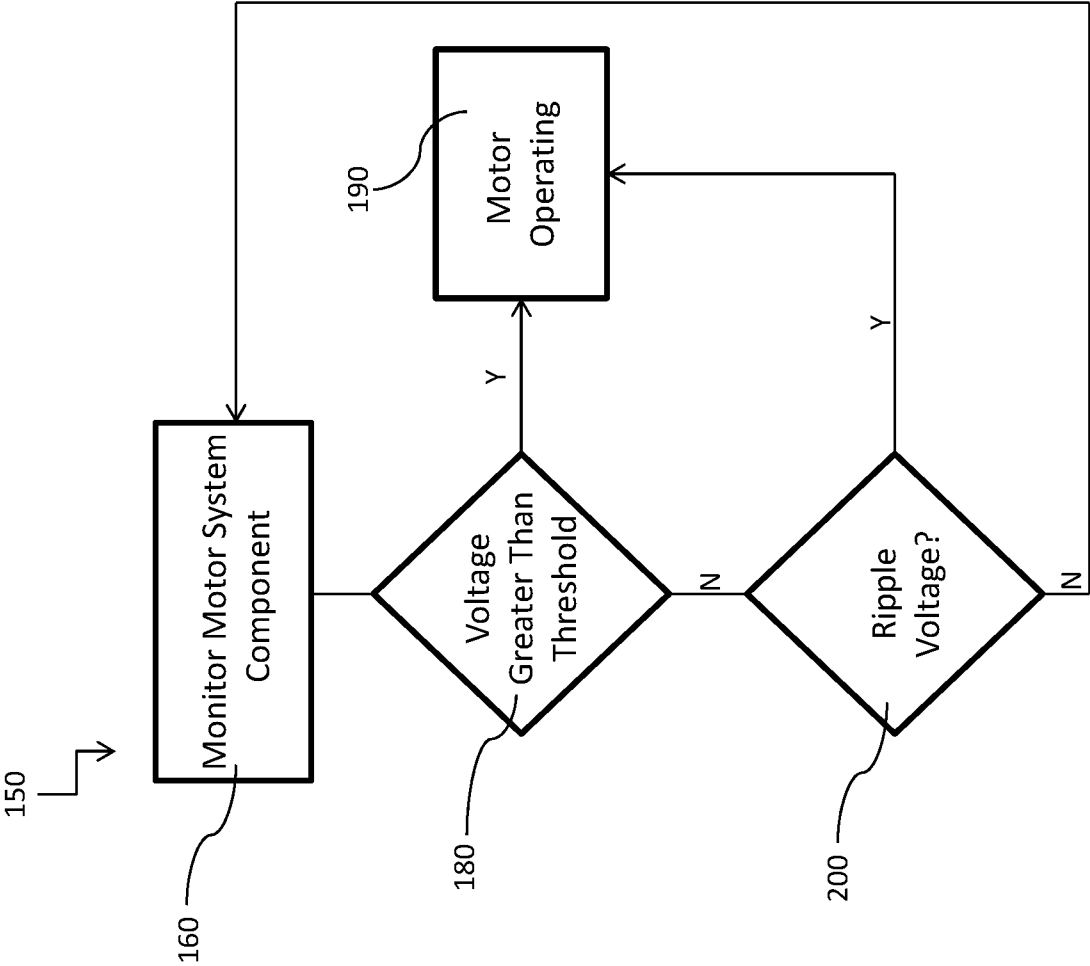


FIG. 3

A. CLASSIFICATION OF SUBJECT MATTER**G01R 31/34(2006.01)i, H02K 7/20(2006.01)i**

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)

G01R 31/34; B23K 9/10; B60K 15/00; H02J 7/00; H02P 1/26; G01M 19/00; F02N 11/08; H02P 7/36; H02K 7/20

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: motor, ripple voltage, starter, alternator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0922855 B1 (VALEO EQUIPEMENTS ELECTRIQUES MOTEUR) 05 February 2003 See claim 1 and figure 1.	1,2,8-10
Y		3-7
Y	US 6661195 B1 (SCHMIDT et al.) 09 December 2003 See column 1, lines 24-29, column 2, lines 30-42 and figure 1.	3-7
A	US 4415812 A (GRIFFITH et al.) 15 November 1983 See the whole document.	1-10
A	US 2007-0227237 A1 (BROTT et al.) 04 October 2007 See the whole document.	1-10
A	US 6445158 B1 (BERTNESS et al.) 03 September 2002 See the whole document.	1-10



Further documents are listed in the continuation of Box C.



See patent family 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 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

18 May 2018 (18.05.2018)

Date of mailing of the international search report

21 May 2018 (21.05.2018)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

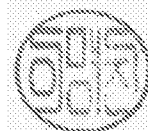
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

LEE, Myung Jin

Telephone No. +82-42-481-8474



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/016349

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0922855 B1	05/02/2003	DE 69811193 T2 EP 0922855 A1 ES 2192757 T3 FR 2772085 A1 FR 2772085 B1	25/09/2003 16/06/1999 16/10/2003 11/06/1999 25/02/2000
US 6661195 B1	09/12/2003	AT 455958 T DE 19949822 A1 EP 1092867 A2 EP 1092867 A3 EP 1092867 B1 ES 2338404 T3 JP 2001-115936 A JP 4996007 B2	15/02/2010 19/04/2001 18/04/2001 31/07/2002 20/01/2010 07/05/2010 27/04/2001 08/08/2012
US 4415812 A	15/11/1983	None	
US 2007-0227237 A1	04/10/2007	CA 2642852 A1 MX 2008012303 A US 7409856 B2 WO 2007-114806 A1	11/10/2007 10/10/2008 12/08/2008 11/10/2007
US 6445158 B1	03/09/2002	AU 1279199 A AU 1999-12791 A1 AU 2000-47004 A1 AU 2003-200919 B2 AU 2003-217904 A1 AU 2003-220264 A1 AU 2003-223266 A1 AU 2003-301787 A1 AU 2003-301787 A8 AU 3663097 A AU 4700400 A DE 10297252 B4 DE 10297252 T5 DE 10297339 T5 DE 10332625 A1 DE 10348031 A1 DE 10349080 A1 DE 112006002329 T5 EP 1206826 A1 EP 1206826 B1 EP 1485726 A1 EP 1485726 B1 GB 2401952 A GB 2401952 B GB 2406656 A GB 2406656 B GB 2416215 A	24/05/1999 24/05/1999 17/11/2000 05/02/2004 22/09/2003 29/09/2003 29/09/2003 07/06/2004 07/06/2004 20/02/1998 17/11/2000 06/07/2017 09/09/2004 27/01/2005 18/03/2004 29/04/2004 06/05/2004 10/07/2008 22/05/2002 25/02/2009 15/12/2004 13/10/2010 24/11/2004 14/12/2005 06/04/2005 28/03/2007 18/01/2006

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/016349

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		GB 2443373 A	30/04/2008
		GB 2443373 B	09/12/2009
		JP 2002-543754 A	17/12/2002
		JP 2002-543754 U	17/12/2002
		JP 2004-144753 A	20/05/2004
		JP 2004-201484 A	15/07/2004
		JP 2005-503952 A	10/02/2005
		JP 2005-520158 A	07/07/2005
		JP 4414757 B2	10/02/2010
		JP 4815098 B2	16/11/2011
		KR 10-2002-0026428 A	10/04/2002
		US 2002-0003423 A1	10/01/2002
		US 2002-0036504 A1	28/03/2002
		US 2002-0153864 A1	24/10/2002
		US 2002-0171428 A1	21/11/2002
		US 2003-0001579 A1	02/01/2003
		US 2003-0025481 A1	06/02/2003
		US 2003-0038637 A1	27/02/2003
		US 2003-0048106 A1	13/03/2003
		US 2003-0088375 A1	08/05/2003
		US 2003-0090272 A1	15/05/2003
		US 2003-0173971 A1	18/09/2003
		US 2004-0036443 A1	26/02/2004
		US 2004-0104728 A1	03/06/2004
		US 2004-0145371 A1	29/07/2004
		US 2004-0232918 A1	25/11/2004
		US 2004-0263176 A1	30/12/2004
		US 2005-0001626 A1	06/01/2005
		US 2005-0021475 A1	27/01/2005
		US 2005-0024061 A1	03/02/2005
		US 2005-0035752 A1	17/02/2005
		US 2005-0057256 A1	17/03/2005
		US 2005-0068039 A1	31/03/2005
		US 2005-0075807 A1	07/04/2005
		US 2005-0162172 A1	28/07/2005
		US 2005-0212521 A1	29/09/2005
		US 2005-0218901 A1	06/10/2005
		US 2005-0231205 A1	20/10/2005
		US 2006-0006876 A1	12/01/2006
		US 2006-0217914 A1	28/09/2006
		US 2006-0279287 A1	14/12/2006
		US 2006-0282226 A1	14/12/2006
		US 2006-0282227 A1	14/12/2006
		US 2007-0069734 A1	29/03/2007
		US 2007-0159177 A1	12/07/2007
		US 2007-0244660 A1	18/10/2007
		US 2008-0315830 A1	25/12/2008
		US 2009-0085571 A1	02/04/2009
		US 2009-0160451 A1	25/06/2009
		US 2010-0013489 A1	21/01/2010

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/016349

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2010-0188091 A1	29/07/2010
		US 2010-0194576 A1	05/08/2010
		US 2010-0262404 A1	14/10/2010
		US 2010-0295549 A1	25/11/2010
		US 2011-0208454 A1	25/08/2011
		US 2011-0257913 A1	20/10/2011
		US 2012-0016609 A1	19/01/2012
		US 2013-0090870 A1	11/04/2013
		US 6051976 A	18/04/2000
		US 6081098 A	27/06/2000
		US 6091245 A	18/07/2000
		US 6104167 A	15/08/2000
		US 6313608 B1	06/11/2001
		US 6316914 B1	13/11/2001
		US 6329793 B1	11/12/2001
		US 6331762 B1	18/12/2001
		US 6351102 B1	26/02/2002
		US 6456045 B1	24/09/2002
		US 6566883 B1	20/05/2003
		US 6586941 B2	01/07/2003
		US 6633165 B2	14/10/2003
		US 6759849 B2	06/07/2004
		US 6801040 B2	05/10/2004
		US 6801040 WD	05/10/2004
		US 6850037 B2	01/02/2005
		US 6871151 B2	22/03/2005
		US 6885195 B2	26/04/2005
		US 6909287 B2	21/06/2005
		US 6914413 B2	05/07/2005
		US 6930485 B2	16/08/2005
		US 6941234 B2	06/09/2005
		US 6967484 B2	22/11/2005
		US 6998847 B2	14/02/2006
		US 7003410 B2	21/02/2006
		US 7003411 B2	21/02/2006
		US 7034541 B2	25/04/2006
		US 7126341 B2	24/10/2006
		US 7246015 B2	17/07/2007
		US 7295936 B2	13/11/2007
		US 7363175 B2	22/04/2008
		US 7398176 B2	08/07/2008
		US 7446536 B2	04/11/2008
		US 7557586 B1	07/07/2009
		US 7598743 B2	06/10/2009
		US 7598744 B2	06/10/2009
		US 7642787 B2	05/01/2010
		US 7656162 B2	02/02/2010
		US 7688074 B2	30/03/2010
		US 7705602 B2	27/04/2010
		US 7706991 B2	27/04/2010

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/016349

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 7728597 B2	01/06/2010
		US 7772850 B2	10/08/2010
		US 7774151 B2	10/08/2010
		US 7924015 B2	12/04/2011
		US 7940052 B2	10/05/2011
		US 7999505 B2	16/08/2011
		US 8198900 B2	12/06/2012
		US 8237448 B2	07/08/2012
		US 8493022 B2	23/07/2013
		US 8513949 B2	20/08/2013
		US 8674654 B2	18/03/2014
		US 8754653 B2	17/06/2014
		US 8872516 B2	28/10/2014
		US 8872517 B2	28/10/2014
		US 8958998 B2	17/02/2015
		US 9052366 B2	09/06/2015
		WO 00-067359 A1	09/11/2000
		WO 03-025602 A1	27/03/2003
		WO 03-034084 A1	24/04/2003
		WO 03-076960 A1	18/09/2003
		WO 03-079032 A1	25/09/2003
		WO 03-079033 A1	25/09/2003
		WO 2004-042840 A2	21/05/2004
		WO 2004-042840 A3	13/01/2005
		WO 2007-027702 A2	08/03/2007
		WO 2007-027702 A3	13/12/2007
		WO 98-004910 A1	05/02/1998
		WO 99-023738 A1	14/05/1999