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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, IR, IS, JP, KE, KG, KN, KP, KR, 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, 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.
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[Continued on next page]

(54) **Title:** AN AUTONOMOUS EXCITATION CONTROL SYSTEM FOR AN INTERNAL COMBUSTION DRIVEN ELECTRIC GENERATOR AND A METHOD THEREOF

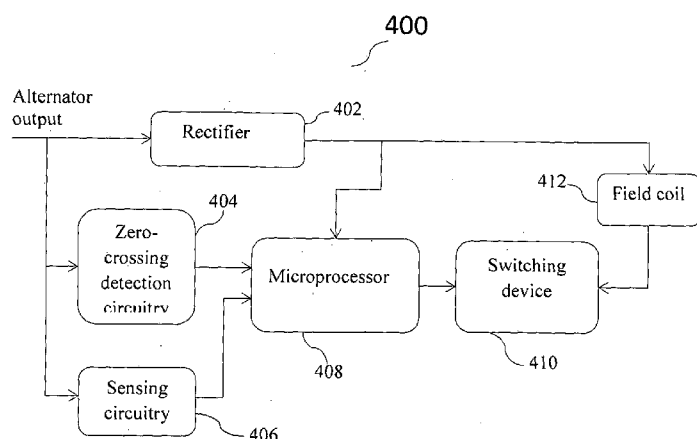


Fig. 4

(57) **Abstract:** An autonomous excitation control system for an internal combustion driven electric generator comprising: a rectifier circuitry coupled to alternator output to convert AC waveform from alternator output to a DC waveform; a zero crossing detection circuitry coupled to alternator output and generating an output pulse when the generator output crosses zero value; a sensing circuitry for sensing generator output voltage and converting said output voltage to low-power electric signals; a microprocessor receiving power from said rectifier circuit and having first input from said zero crossing detection circuitry and second input from said sensing circuitry.

**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H02P 9/48 (2014.01)

CPC - H02P 9/48 (2014.11)

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) - H02P 9/04, 10, 30, 48 (2014.01)

USPC - 307/10.1, 322/20, 23, 24, 25, 28, 37, 59

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - H02J 7/1446, 1492; H02P 2009/002, 9/04, 10, 105, 30, 302, 305, 307, 48 (2014.11) (keyword delimited)

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

Orbit, Google Patents, Google Scholar.

Search terms used: excitation, control, alternator, generator, engine, vehicle, zero cross, crankshaft, fluctuation

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,773,964 A (PETER) 30 June 1998 (30.06.1998) entire document	5, 6, 8, 9
Y		1-4, 7, 10
Y	US 5,390,068 A (SCHULTZ et al) 14 February 1995 (14.02.1995) entire document	1-4, 7
Y	US 5,703,410 A (MAEKAWA) 30 December 1997 (30.12.1997) entire document	10
A	US 6,700,356 B1 (DORN) 02 March 2004 (02.03.2004) entire document	1-10
A	US 5,376,877 A (KERN et al) 27 December 1994 (27.12.1994) entire document	1-10
A	US 2012/0146593 A1 (AKITA et al) 14 June 2012 (14.06.2012) entire document	1-10
A	US 5,469,816 A (MURAKAWA et al) 28 November 1995 (28.11.1995) entire document	1-10

☐ 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

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"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

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14 January 2015

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