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13/075,453 30 March 2011 (30.03.2011) US(71) Applicant (for all designated States except US): **BOSE CORPORATION** [US/US]; The Mountain, Framingham, Massachusetts 01701 (US).

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**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.1 7(H))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.1 7(in))

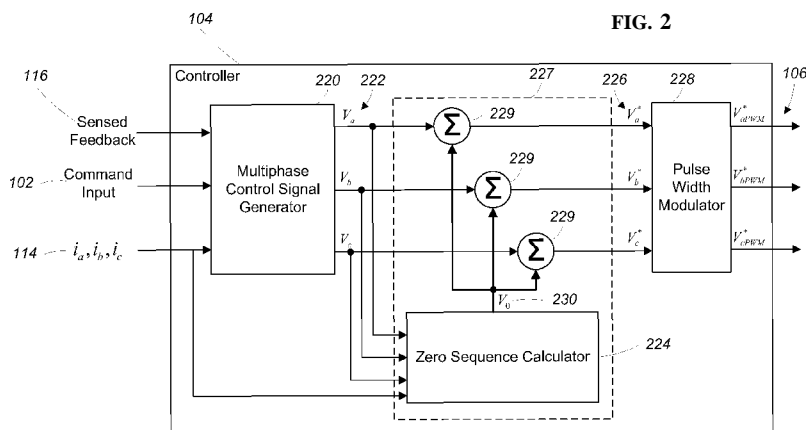
**Published:**

- 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:

20 December 2012

(54) Title: COMMON MODE HYSTERESIS FOR PULSE-WIDTH MODULATION DRIVES



(57) Abstract: In an aspect, in general, a method for pulse width modulation control of a multiple phase drive includes identifying a set of at least one phase from the plurality of phases for the drive as eligible for clamping to one of a plurality of extreme power supply voltages, including excluding from the set of eligible phases those phases with intermediate control signal levels and excluding phases according to a proximity criterion on the control signal levels. A phase is selected from the set of eligible phases. A first offset signal is determined as a difference between a control signal level for the selected phase and an extreme control signal level associated with one of the plurality of extreme power supply voltages. A modified control signal is determined for each of the phases for the drive, by forming a combination of the first offset signal and a control signal level for each phase to determine the modified control signal for each phase.

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/029639

## A. CLASSIFICATION OF SUBJECT MATTER

INV. H02M7/5387

ADD.

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)

H02M H02P

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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/194925 AI (ITO TAKESHI [JP] ET AL) 8 September 2005 (2005-09-08)	1,6,7 , 10-22
Y	figure 2 figure 3 paragraph [0060] paragraph [0081]	2-5 ,8,9
Y	----- US 5 990 657 A (MASAKI RYOSU [JP] ET AL) 23 November 1999 (1999-11-23) figure 4 figure 5 column 4, line 42 - line 50 column 4, line 63 - line 67 column 5, line 50 - column 6, line 10 ----- -/--	8,9



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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

3 October 2012

Date of mailing of the international search report

12/10/2012

Name and mailing address of the ISA/

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Ri ehl , Phi l i ppe

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2012/029639

## 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, 1-22 (partially)  
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 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:

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/US2012/029639

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 324 085 B2 (KIMURA TOMONORI [JP] ET AL) 27 November 2001 (2001-11-27) figure 7 col umn 15, line 64 - col umn 16, line 10 col umn 20, line 56 - line 62 -----	2, 3, 5
Y	US 5 699 240 A (OBAYASHI KAZUYOSHI [JP] ) 16 December 1997 (1997-12-16) figure 6 col umn 6, line 22 - line 24 -----	4

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/029639

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005194925 AI	08-09-2005	CN 1658486 A US 2005194925 AI	24-08-2005 08-09-2005
US 5990657 A	23- 11-1999	JP 3259626 B2 JP 9233845 A US 5990657 A	25-02-2002 05-09-1997 23-11-1999
US 6324085 B2	27- 11-2001	DE 10065432 AI FR 2803137 AI US 2001015904 AI	02-08-2001 29-06-2001 23-08-2001
US 5699240 A	16- 12-1997	JP 8340691 A US 5699240 A	24-12-1996 16-12-1997

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 1-22 (partially)

Search has only been possible for the part of the claims that appears to be clear and known from the prior art. Indeed the independent claims 1 and 12 are using vague and unclear terms like "intermediate control signal levels" and "proximity criterion" which leave the reader in doubt as to the meaning of the technical feature to which they refer.

The applicant's attention is drawn to the fact that 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 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. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2) declaration be overcome.