



- (51) **International Patent Classification:**
F04D 27/00 (2006.01) *F04D 27/02* (2006.01)
- (21) **International Application Number:**
PCT/US20 12/043047
- (22) **International Filing Date:**
19 June 2012 (19.06.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/500,205 23 June 2011 (23.06.2011) US
- (71) **Applicant (for all designated States except US):** JOHN-
SON CONTROLS TECHNOLOGY COMPANY
[US/US]; 915 East 32nd Street, Holland, Michigan 49423
(US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** DE LARMINAT,
Paul [FR/FR]; 93, rue de Coulmiers, F-44000 Nantes (FR).
ARNOU, Damien Jean Daniel [FR/FR]; 19 rue du 11
novembre, F-49280 La Seguniere (FR).
- (74) **Agents:** SMITH, William P. et al; McNeese Wallace &
Nurick LLC, 100 Pine Street, P.O. Box 1166, Harrisburg,
Pennsylvania 17108-1 166 (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, 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, IS, JP, KE, KG, KM, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, 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,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

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:

6 June 2013

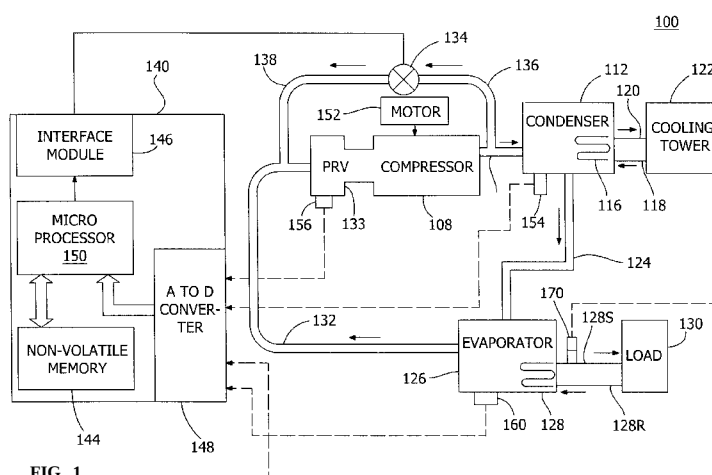
(54) Title: CAPACITY CONTROL SYSTEM AND METHOD FOR CENTRIFUGAL COMPRESSOR

FIG. 1

(57) **Abstract:** A system and method for controlling compressor capacity while maintaining compressor stability includes providing a compressor (108) and a flow reduction device (FRD) for controlling flow of refrigerant through the compressor; measuring suction pressure and discharge pressure of the compressor; calculating a compressor head factor based on the suction and the discharge pressures; calculating the speed of sound in the refrigerant; calculating the tip speed of the impeller divided by the speed of sound; calculating the tip speed of the impeller at the minimum Mach number; calculating a multiplier of speed increase as a function of the flow reduction device based on an actuator feed-back signal; determining a minimum rotational speed at which the compressor may operate free from a surge condition; and controlling a rotational speed of the compressor above the minimum rotational speed.



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/043047

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04D27/00 F04D27/02
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)
F04D

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	GB 1 593 361 A (BORG WARNER)	15-19
A	15 July 1981 (1981-07-15) page 1, lines 34-42; figures 1-4 page 3, lines 24-40 -----	1-14, 20



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 March 2013

Date of mailing of the international search report

03/04/2013

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

de Martino, Marcel lo

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/043047

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1593361	A	15-07-1981	
		AU 517011 B2	02-07-1981
		AU 3555278 A	01-11-1979
		CA 1115381 A1	29-12-1981
		DE 2820209 A1	16-11-1978
		FR 2390689 A1	08-12-1978
		GB 1593361 A	15-07-1981
		HK 6082 A	19-02-1982
		JP S6336436 B2	20-07-1988
		JP S53138506 A	04-12-1978
		NL 7804750 A	13-11-1978
