

(12) **United States Patent**
Katoh et al.

(10) **Patent No.:** **US 9,410,745 B2**
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **HEAT EXCHANGER**
(71) Applicant: **DENSO CORPORATION**, Kariya, Aichi-pref. (JP)
(72) Inventors: **Yoshiki Katoh**, Kariya (JP); **Mitsuyoshi Saito**, Hamamatsu (JP); **Kenji Yamada**, Okazaki (JP)
(73) Assignee: **DENSO CORPORATION**, Kariya, Aichi-pref. (JP)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 257 days.

9/0204; F28F 9/0278; F28F 9/262; B60H 1/00328; B60H 1/00342; B60H 1/3213; B60H 1/00921
USPC 62/515; 165/157
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,854,286 B2* 2/2005 Bureau B60H 1/00321 62/244
2003/0188857 A1 10/2003 Kawakubo et al.
(Continued)

FOREIGN PATENT DOCUMENTS

EP 1108575 A1 6/2001
JP H0330068 U 3/1991
(Continued)

OTHER PUBLICATIONS

Office Action mailed Jul. 21, 2015 in the corresponding Japanese application No. 2012-250502 with English translation.
(Continued)

(21) Appl. No.: **14/360,808**
(22) PCT Filed: **Nov. 28, 2012**
(86) PCT No.: **PCT/JP2012/007627**
§ 371 (c)(1),
(2) Date: **May 27, 2014**

(87) PCT Pub. No.: **WO2013/080534**
PCT Pub. Date: **Jun. 6, 2013**

(65) **Prior Publication Data**
US 2014/0305159 A1 Oct. 16, 2014

(30) **Foreign Application Priority Data**

Nov. 30, 2011 (JP) 2011-262053
Nov. 14, 2012 (JP) 2012-250502

(51) **Int. Cl.**
F28D 7/00 (2006.01)
F28F 9/02 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **F28D 7/0008** (2013.01); **B60H 1/00328** (2013.01); **B60H 1/00342** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ... F28D 7/008; F28D 1/0435; F28D 1/05391;
F28D 2021/0091; F28D 2021/0085; F28F

Primary Examiner — Mohammad M Ali
(74) *Attorney, Agent, or Firm* — Harness, Dickey & Pierce, P.L.C.

(57) **ABSTRACT**

In a heat exchanger, a refrigerant side header tank and a coolant side header tank which are connected with refrigerant tubes and coolant tubes include a plate header member, a communication intermediate plate member, a blocking intermediate plate member, and a tank header member. The communication intermediate plate member includes first and second fluid communication holes through which refrigerant and coolant flow, respectively. In this situation, with a simple configuration in that a part of the first and second fluid communication holes is blocked by the blocking intermediate plate member, a communication state between both tubes and internal spaces of the header tanks is regulated.

14 Claims, 19 Drawing Sheets

