(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 977 697 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
27.04.2016 Bulletin 2016/17

(43) Date of publication A2:
27.01.2016 Bulletin 2016/04

(21) Application number: **15167869.5**

(22) Date of filing: **15.05.2015**

(51) Int Cl.:
F28D 1/03 *(2006.01)* ***F28D 1/053*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(30) Priority: **16.05.2014 JP 2014102391**

(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

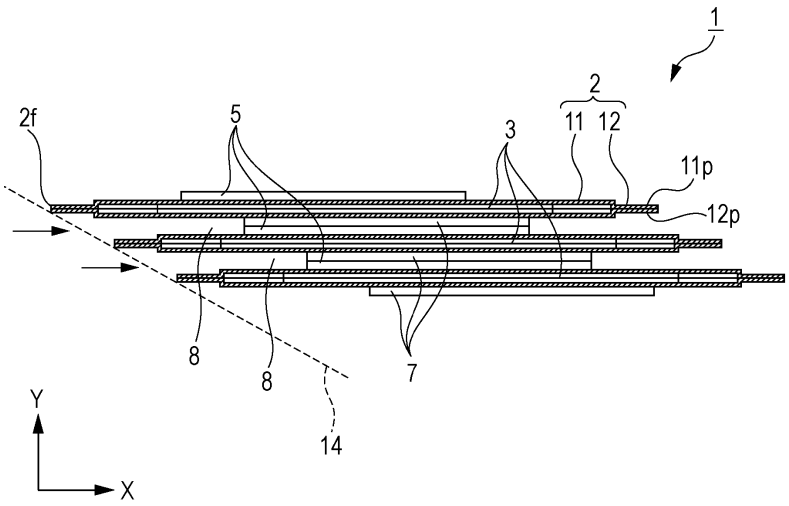
(72) Inventors:
- **MATSUURA, Takahiro**
  Osaka, 540-6207 (JP)
- **HASEGAWA, Hiroshi**
  Osaka, 540-6207 (JP)
- **TAMURA, Tomoichiro**
  Osaka, 540-6207 (JP)
- **OKAICHI, Atsuo**
  Osaka, 540-6207 (JP)

(74) Representative: **Eisenführ Speiser Patentanwälte Rechtsanwälte PartGmbB**
Postfach 31 02 60
80102 München (DE)

(54) HEAT EXCHANGER AND HEAT EXCHANGING UNIT

(57) A heat exchanger has a plurality of heat exchanger tubes. Each heat exchanger tube has an internal flow path through which a first fluid flows. These heat exchanger tubes are arranged so that an external flow path, through which a second fluid that exchanges heat with the first fluid flows, is formed between each two adjacent heat exchanger tubes. Each two adjacent heat exchanger tubes are bonded together at the inlets and outlets of the internal flow paths in the two heat exchanger tubes. One of each two adjacent heat exchanger tubes is offset with respect to the other heat exchanger tube in a direction perpendicular to an arrangement direction in which these heat exchanger tubes are arranged.

FIG. 2C



EP 2 977 697 A3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 16 7869

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 10 2007 032790 A1 (DENSO CORP [JP]) 17 January 2008 (2008-01-17) * paragraphs [0054] - [0060]; figures 3,4 *	1-7, 18-20	INV. F28D1/03 F28D1/053
X	US 2006/278382 A1 (BHATTI MOHINDER S [US] ET AL) 14 December 2006 (2006-12-14) * paragraphs [0026] - [0041]; figures 1-6 *	1-7, 18-20	
A	US 2014/116672 A1 (MARTIN MICHAEL A [CA] ET AL) 1 May 2014 (2014-05-01) * the whole document *	1-7, 18-20	
A	US 2014/048238 A1 (TAN DONGMING [US] ET AL) 20 February 2014 (2014-02-20) * the whole document *	1-7, 18-20	

TECHNICAL FIELDS SEARCHED (IPC)

F28D

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	27 November 2015	Axters, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 15 16 7869

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

"see additional sheet(s)"

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

Europäisches Patentamt
European Patent Office
Office européen des brevets

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 15 16 7869

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7(completely); 18-20(partially)

A heat exchanger comprising a plurality of heat exchanger tubes, each of which includes a first plate member and a second plate member wherein a first inlet bonding portion and a first outlet bonding portion bonding to an adjacent heat exchanger tube of the first plate member are located at positions relatively close to an edge of each of the plurality of the heat exchanger tubes, and a second inlet bonding portion and a second outlet bonding portion bonding to an adjacent heat exchanger tube of the second plate member are located at positions relatively distant from the edge of each of the heat exchanger tubes.

---

2. claims: 8-10(completely); 18-20(partially)

A heat exchanger comprising a plurality of heat exchanger plates, each of which includes a first plate member and a second plate member, wherein the first plate member has a first bonding portion for bonding to a second plate member of an adjacent heat exchanger tube and the second plate member has a second bonding portion for bonding to a first plate member of an adjacent heat exchanger tube, wherein a bonding plane on which the first bonding portion and second portion are bonded together is inclined with respect to a direction perpendicular to the arrangement direction of the plurality of heat exchanger tubes, wherein an axis of the first bonding portion and an axis of the second portion are inclined with respect to the arrangement direction of the plurality of heat exchanger tubes.

---

3. claims: 11-17(completely); 18-20(partially)

A heat exchanger comprising a plurality of heat exchanger tubes, wherein the plurality of heat exchanger tubes are arranged in a fan shape, and the external flow paths extend radially.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 16 7869

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-11-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102007032790 A1	17-01-2008	DE 102007032790 A1	17-01-2008
		JP 2008039373 A	21-02-2008
		US 2008011458 A1	17-01-2008
US 2006278382 A1	14-12-2006	NONE	
US 2014116672 A1	01-05-2014	CA 2889399 A1	08-05-2014
		CN 104755869 A	01-07-2015
		DE 112013005225 T5	06-08-2015
		US 2014116672 A1	01-05-2014
		WO 2014066998 A1	08-05-2014
US 2014048238 A1	20-02-2014	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82