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

(11) EP 2 650 633 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
11.04.2018 Bulletin 2018/15

(43) Date of publication A2:
16.10.2013 Bulletin 2013/42

(21) Application number: **13160236.9**

(22) Date of filing: **20.03.2013**

(51) Int Cl.:
F28D 9/00 *(2006.01)* ***F28F 3/04*** *(2006.01)*
F25B 43/02 *(2006.01)* ***F25B 39/04*** *(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

(30) Priority: **12.04.2012 JP 2012091375**

(71) Applicant: **Mitsubishi Electric Corporation**
Chiyoda-ku
Tokyo 100-8310 (JP)

(72) Inventor: **Uchino, Shinichi**
Tokyo, 100-8310 (JP)

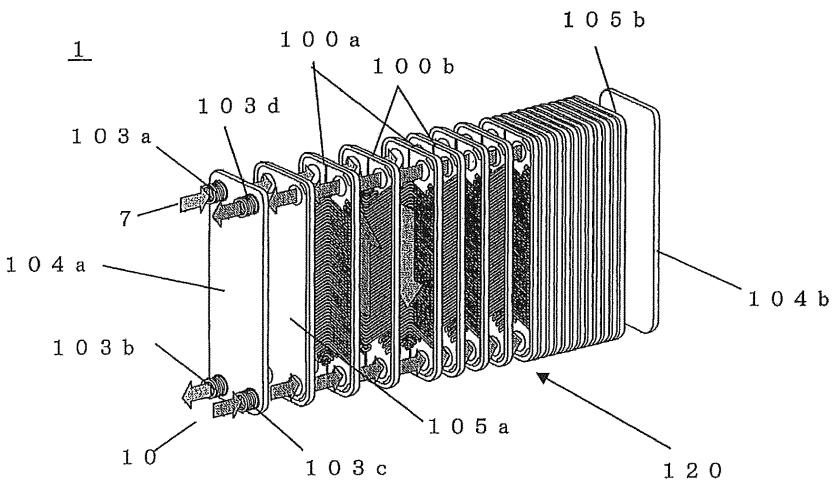
(74) Representative: **Pfenning, Meinig & Partner mbB**
Patent- und Rechtsanwälte
Theresienhöhe 11a
80339 München (DE)

(54) Plate-type heat exchanger, method of manufacturing the same, and heat pump device

(57) To guide lubricating oil flowing into a plate-type heat exchanger to an oil-recovery port, while minimizing the amount of lubricating oil trapped therein.

A plate-type heat exchanger includes: a plate assembly 120 that is a plate stacked body including a stack of a plurality of heat-transfer plates 100; an inlet port and an outlet port for refrigerant 7 provided in the plate assembly 120; an inlet port and an outlet port for water 10 provided in the plate assembly 120; and an oil-recovery port 103e from which lubricating oil 8 contained in the refrigerant 7 is extracted, the oil-recovery port 103e being provided below the outlet port for the refrigerant 7 provided in the lower part of the plate assembly 120. Oil recovery holes 200 communicating with the oil-recovery port 103e are provided at the lower part inside the plate assembly 120, and a flow-smoothing embossed portion 201 is provided on each heat-transfer plate 100 so that the lubricating oil 8 smoothly flows toward the oil recovery hole 200.

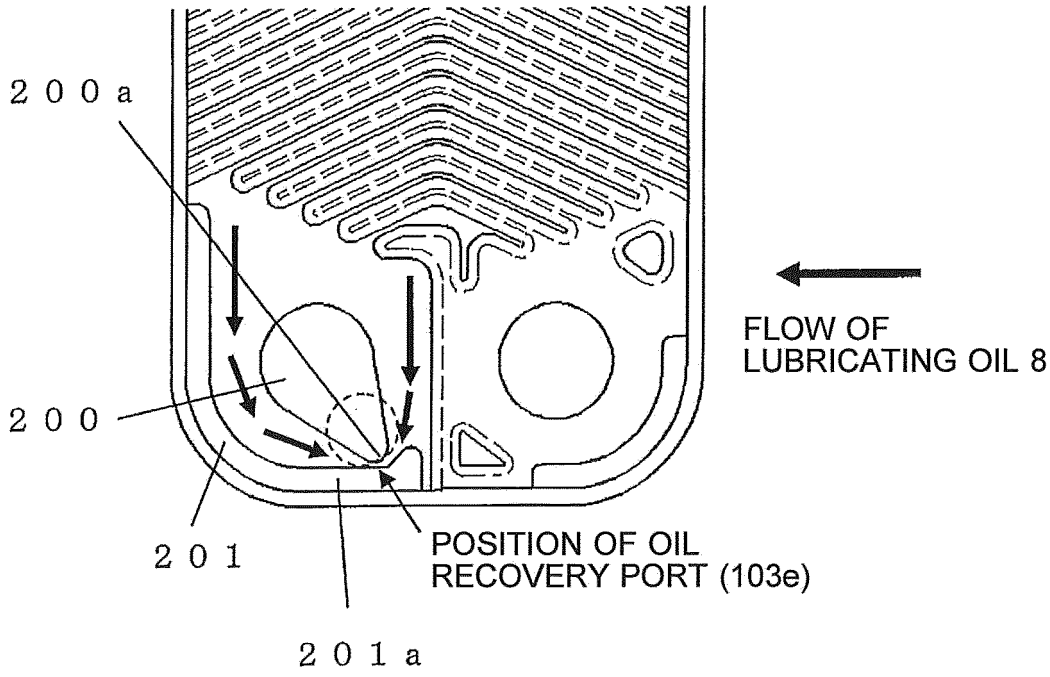
F I G. 3



EP 2 650 633 A3

(Cont. next page)

FIG. 4


200a
200
201
201a
POSITION OF OIL RECOVERY PORT (103e)
FLOW OF LUBRICATING OIL 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 16 0236

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 Y	WO 2008/024066 A1 (ALFA LAVAL CORP AB [SE]; EKELUND ROLF [SE]; STENHEDE CLAES [IT]; BJOER) 28 February 2008 (2008-02-28) * the whole document * -----	1-4,6,7, 9,10 5,8	INV. F28D9/00 F28F3/04 F25B43/02 F25B39/04
Y	DE 20 2010 007615 U1 (SARTORIUS STEDIM BIOTECH GMBH [DE]) 26 August 2010 (2010-08-26) * figures 2,3 * -----	5,8	
A	WO 2011/117988 A1 (MITSUBISHI ELECTRIC CORP [JP]; UCHINO SHINICHI [JP]; HAYASHI TAKEHIRO) 29 September 2011 (2011-09-29) * figure 8 * -----	1-10	
A	US 2011/083833 A1 (ZORZIN ALVARO [IT] ET AL) 14 April 2011 (2011-04-14) * the whole document * -----	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

F28D
F28F
F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 February 2018	Schindler, Martin

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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 16 0236

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.

27-02-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008024066 A1	28-02-2008	CN 101512252 A	19-08-2009
		EP 2054679 A1	06-05-2009
		WO 2008024066 A1	28-02-2008
DE 202010007615 U1	26-08-2010	DE 102009032370 A1	13-01-2011
		DE 202010007615 U1	26-08-2010
		EP 2452149 A2	16-05-2012
		JP 5892930 B2	23-03-2016
		JP 2012532307 A	13-12-2012
		US 2012103579 A1	03-05-2012
		WO 2011003496 A2	13-01-2011
WO 2011117988 A1	29-09-2011	EP 2551626 A1	30-01-2013
		JP 5496321 B2	21-05-2014
		JP WO2011117988 A1	04-07-2013
		WO 2011117988 A1	29-09-2011
US 2011083833 A1	14-04-2011	BR PI0913116 A2	05-01-2016
		CN 102084203 A	01-06-2011
		EP 2307842 A1	13-04-2011
		JP 5553828 B2	16-07-2014
		JP 2011523025 A	04-08-2011
		KR 20110005913 A	19-01-2011
		US 2011083833 A1	14-04-2011
		WO 2009151399 A1	17-12-2009

EPO FORM P0459

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