

(12)

EUROPEAN PATENT APPLICATION

(88)

Date of publication A3:
19.03.2003 Bulletin 2003/12

(51)

Int Cl.7: F28D 1/03, F28F 9/18,
F28F 3/04

(43)

Date of publication A2:
12.09.2001 Bulletin 2001/37

(21)

Application number: 01105273.5

(22)

Date of filing: 05.03.2001

(84)

Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30)

Priority: 06.03.2000 JP 2000060914

(71)

Applicant: Mitsubishi Heavy Industries, Ltd.
Tokyo (JP)

(72)

Inventors:
• Nakado, Koji, Mitsubishi Heavy Ind. Ltd.
Nishi-kasugai-gun, Aichi-ken (JP)

• Okamura, Toru, Mitsubishi Heavy Ind. Ltd.
Nishi-Kasugai-gun, Aichi-ken (JP)

• Inoue, Masashi, Mitsubishi Heavy Ind. Ltd.
Nishi-Kasugai-gun, Aichi-ken (JP)

• Yoshitomi, Kei, Mitsubishi Heavy Industries Ltd.
Nakamura-ku, Nagoya, Aichi-ken (JP)

(74)

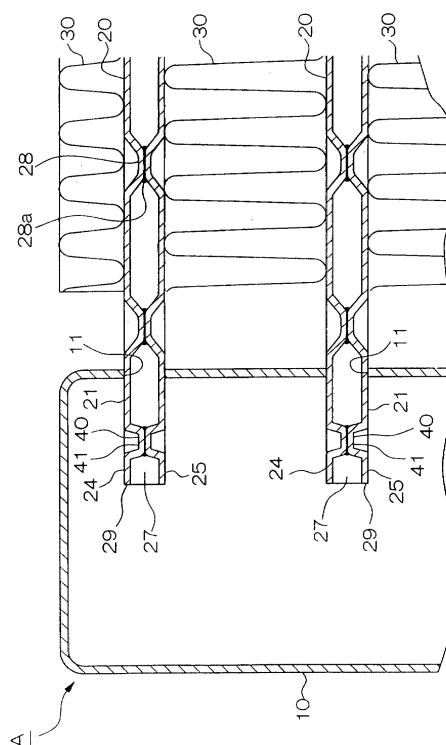
Representative: Henkel, Feiler, Hänzel
Möhlstrasse 37
81675 München (DE)

(54)

Heat exchanger

(57) A heat exchanger comprises: a pair of headers (10, 10) which are provided in parallel facing each other through a predetermined distance and a pathway of the fluid is respectively provided therein; and a plurality of flat heat-exchange tubes (20,20...) which are provided between the headers in parallel, both ends thereof are fastened to the headers, and a pathway of the refrigerant for connecting the pathways of both headers is respectively provided therein. In this heat exchanger, the heat-exchange tubes and the headers are air-tightly and liquid-tightly fastened by inserting end portions (21,21...) of the heat-exchange tubes into insertion holes (11,11...) which are bored on the headers. Furthermore, in the vicinity of opening ends (29) of both end portions of the flat heat-exchange tubes, shape-holding portions (41) for preventing deformation of the opening ends are provided.

FIG. 1





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 5273

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 88 01 411 U (SÜDDEUTSCHE KÜHLERFABRIK BEHR GMBH & CO KG) 24 March 1988 (1988-03-24) * page 5, line 13 - page 7, line 18; figures 1-3 *	1,2,7,10	F28D1/03 F28F9/18 F28F3/04
X	DE 197 28 247 A (ZEXEL CORP) 8 January 1998 (1998-01-08) * column 9, line 19 - column 15, line 10; figures 2,5,7 *	1,7	
X	US 4 458 749 A (MELNYK WILLIAM) 10 July 1984 (1984-07-10) * column 2, line 33 - column 3, line 6; figures 4-9 *	1,2,7	
A		8	
X	US 5 046 555 A (NGUYEN HUNG P) 10 September 1991 (1991-09-10) * column 3, line 37 - column 6, line 22; figures 1-8 *	3,4	
Y		5	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 01, 30 January 1998 (1998-01-30) -& JP 09 229584 A (SANDEN CORP), 5 September 1997 (1997-09-05) * abstract *	1,2,7	F28F F28D
Y		5	
X	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 03, 31 March 1999 (1999-03-31) -& JP 10 332294 A (CALSONIC CORP), 15 December 1998 (1998-12-15) * abstract *	1,7	
	-/--		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 January 2003	Examiner Beltzung, F
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

EPO FORM 1503 03/92 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 5273

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 853 227 A (ZEXEL CORP) 15 July 1998 (1998-07-15) * column 3, line 42 - column 5, line 47; figures 1-5 *	1,7	
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 247 (M-717), 13 July 1988 (1988-07-13) -& JP 63 034491 A (TOYO RADIATOR KK), 15 February 1988 (1988-02-15) * abstract; figures 1-6 *	1,7	
A	---	3-5	
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 12, 26 December 1996 (1996-12-26) -& JP 08 215776 A (CALSONIC CORP;KARUTETSUKU:KK), 27 August 1996 (1996-08-27) * abstract; figures 6-10 *	1,2,7	
A	DE 40 15 830 A (BEHR GMBH & CO) 21 November 1991 (1991-11-21) * column 2, line 33 - column 4, line 13; figures 1-9 *	1-10	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 10, 31 October 1996 (1996-10-31) -& JP 08 145586 A (ZEXEL CORP), 7 June 1996 (1996-06-07) * abstract *	1-10	

		-/--	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 January 2003	Examiner Beltzung, F
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 (P4/C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 5273

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 076 (M-288), 9 April 1984 (1984-04-09) -& JP 58 221393 A (HITACHI SEISAKUSHO KK), 23 December 1983 (1983-12-23) * abstract * -----	1-10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 January 2003	Examiner Beltzung, F
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 01 10 5273

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.

28-01-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 8801411 U	24-03-1988	DE 8801411 U1	24-03-1988
		DE 58900097 D1	06-06-1991
		EP 0326813 A1	09-08-1989
DE 19728247 A	08-01-1998	JP 10019492 A	23-01-1998
		JP 10019493 A	23-01-1998
		DE 19728247 A1	08-01-1998
		KR 261006 B1	01-07-2000
		US 6073688 A	13-06-2000
US 4458749 A	10-07-1984	AR 231475 A1	30-11-1984
		CA 1227478 A1	29-09-1987
		DE 3414495 A1	18-10-1984
		DE 8412053 U1	12-10-1989
		FR 2544480 A1	19-10-1984
		GB 2138554 A , B	24-10-1984
US 5046555 A	10-09-1991	NONE	
JP 09229584 A	05-09-1997	NONE	
JP 10332294 A	15-12-1998	NONE	
EP 0853227 A	15-07-1998	JP 10206079 A	07-08-1998
		EP 0853227 A2	15-07-1998
JP 63034491 A	15-02-1988	JP 1902148 C	08-02-1995
		JP 6012229 B	16-02-1994
JP 08215776 A	27-08-1996	NONE	
DE 4015830 A	21-11-1991	DE 4015830 A1	21-11-1991
JP 08145586 A	07-06-1996	NONE	
JP 58221393 A	23-12-1983	NONE	