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(54) **Low pressure drop fin with selective micro surface enhancement**

(57) The assembly includes a heat exchanger assembly (20) including a plurality of tubes (32) extending between first and second manifolds. A plurality of fins (42) extend back and forth between and along the tubes (32) in a continuous patch and define a plurality of legs (48) extending between the tubes (32). Each of the legs (48) includes a plurality of front long louvers (52) for conveying a stream of air through the legs. Each of the legs

further defines a plurality of main spoilers (56) between the front long louvers (52) and the back edges (44,46) of the legs (48) for inducing turbulence in the stream of air with each of the main spoilers (56) having a spoiler height in the range of 50 to 90 percent of the long louver height and each of the main spoilers (56) having a spoiler length in the range of 10 to 35 percent of the long louver length.

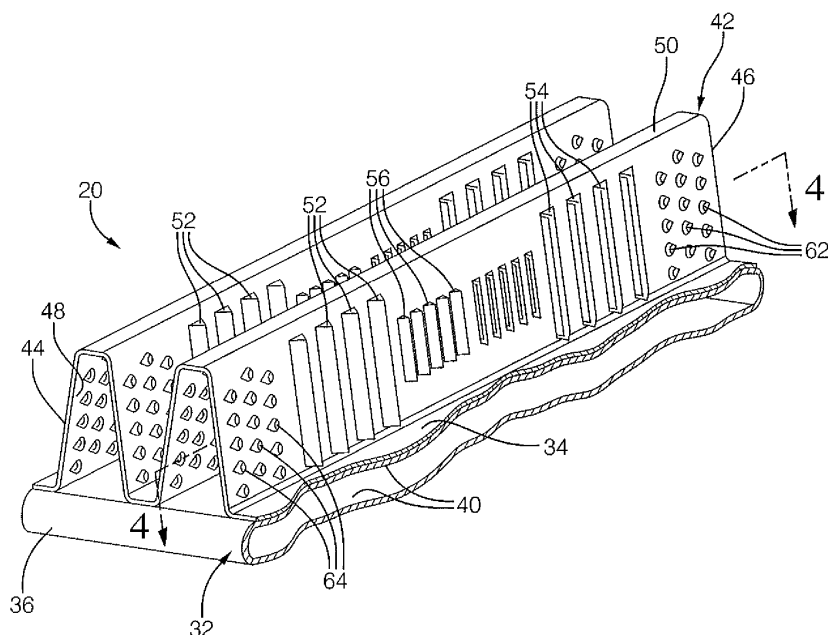


FIG. 2



EUROPEAN SEARCH REPORT

Application Number
EP 10 19 3609

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| 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 | JP 3 687876 B2 (ZEXEL CORP) 24 August 2005 (2005-08-24) * the whole document * | 1,2,6-12 | INV. F28F1/12 |
| X | US 2002/189799 A1 (OZAKI TATSUO [JP]) 19 December 2002 (2002-12-19) * the whole document * | 1,2,6-12 | |
| X | EP 1 164 345 A1 (DENSO CORP [JP]) 19 December 2001 (2001-12-19) * the whole document * | 1-12 | |
| A | KR 100 833 479 B1 (HALLA CLIMATE CONTROL CORP [KR]) 29 May 2008 (2008-05-29) * the whole document * | 1-12 | |
| A | JP S61 59195 A (TOYO RADIATOR CO LTD) 26 March 1986 (1986-03-26) * the whole document * | 1-12 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | F28F |
| The present search report has been drawn up for all claims | | | |
| Place of search The Hague | | Date of completion of the search 25 April 2017 | Examiner Garmendia Irizar, A |
| <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> | | | |

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 19 3609

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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
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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| JP 3687876 B2 | 24-08-2005 | JP 3687876 B2 | 24-08-2005 |
| | | JP H10170184 A | 26-06-1998 |
| US 2002189799 A1 | 19-12-2002 | JP 2002372389 A | 26-12-2002 |
| | | US 2002189799 A1 | 19-12-2002 |
| EP 1164345 A1 | 19-12-2001 | DE 60037879 T2 | 19-02-2009 |
| | | EP 1164345 A1 | 19-12-2001 |
| | | JP 4482991 B2 | 16-06-2010 |
| | | JP 2001174179 A | 29-06-2001 |
| | | US 2002017381 A1 | 14-02-2002 |
| | | WO 0144741 A1 | 21-06-2001 |
| KR 100833479 B1 | 29-05-2008 | NONE | |
| JP S6159195 A | 26-03-1986 | NONE | |