



(51) International Patent Classification:

F28F 9/04 (2006.01) F28D 7/16 (2006.01)

(21) International Application Number:

PCT/EP2019/062285

(22) International Filing Date:

14 May 2019 (14.05.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

18461557.3 15 May 2018 (15.05.2018) EP

(71) Applicant: VALEO AUTOSYSTEMY SP. Z O.O.
[PL/PL]; ul. Przemysłowa 3, 32 050 SKAWINA (PL).

(72) Inventors: KOLACZ, Adam; C/o Valeo Autosystemy Sp.
z o. o, Ul. Przemysłowa 3, 32-050 SKAWINA (PL). PO-
TOK, Dariusz; C/o Valeo Autosystemy sp. zo.O, Ul. Prze-
myslowa 3, 32 050 SKAWINA (PL). MATYSZKOWICZ,

Wojciech; C/o Valeo Autosystemy Sp. z o.o., Ul. Przemys-
lowa 3, 32 050 SKAWINA (PL). LIS, Tomasz; C/o Va-
leo Autosystemy Sp. z o.o., Ul. Przemysłowa 3, 32 050
SKAWINA (PL).

(74) Agent: TRAN, Chi-Hai; VALEO SYSTEMES THER-
MIQUES, ZA l'Agot, 8 rue Louis Lormand, CS 80517 La
Verrière, 78322 LE MESNIL SAINT DENIS CEDEX (FR).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) Title: A HEADER FOR A HEAT EXCHANGER

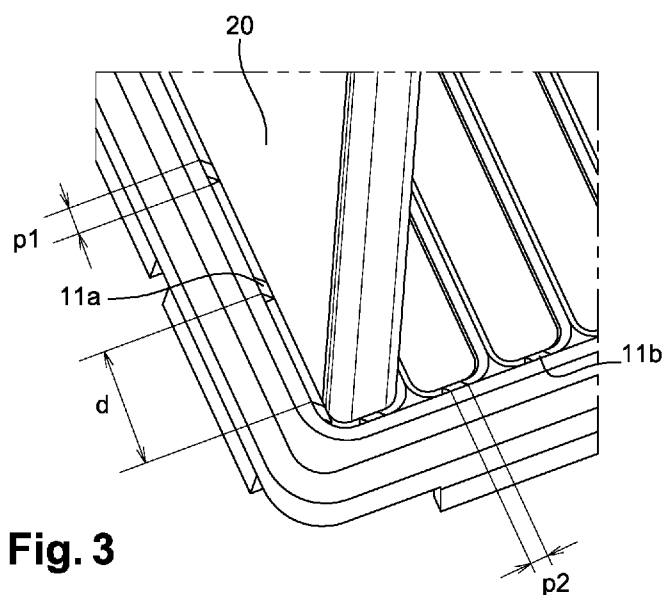


Fig. 3

(57) Abstract: A header (10) for a heat exchanger, in particular for a charge air cooler, comprising an opening plane (12) with plurality of openings (14) for attachment of tubes, a collar (13) encircling the perimeter of the opening plane (12) and protruding at least partially above the opening plane (12), wherein the header (10) further comprises guiding protrusions (11a, 11b) located along inner perimeter of the collar (13) adjacent to said openings (14) and configured to guide the tubes into the openings (14) upon insertion, wherein the openings (14) have substantially rectangular shape with longer sides (14a) and shorter sides (14b) and are arranged in series along their longer sides (14a), wherein a first group of guiding protrusions (11a) is located adjacent the longer sides (14a) of the openings (14), while a second group of guiding protrusions (11b) is located adjacent the shorter sides (14b) of the openings (14).

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

A HEADER FOR A HEAT EXCHANGER

5 FIELD OF THE INVENTION

The invention relates to a header for a heat exchanger. In particular the invention relates to a header for an automotive heat exchanger, in particular for a charge air cooler.

10 BACKGROUND OF THE INVENTION

There are known heat exchangers where a bundle of tubes is mounted in a fluid tight manner in a header, preferably in two opposite headers on each ending side of the tubes in the bundle. The headers are attached to tanks, so that a fluid communication can be achieved between them through said bundle of tubes. This is a case for
15 example for charge air coolers or water charge air coolers.

European patent application EP2310789 discloses a heat exchanger which comprises fluid flow/heat-exchange elements, at least one fluid manifold into which the heat-exchange elements open, at least one header plate for holding the heat-exchange elements in place and at least one casing for accommodating the heat-exchange elements. The fluid manifold is held in place directly by the casing.
20

A problem has been observed in relation to assembly of tubes and headers. In particular, when a bundle of tubes is being inserted into openings in headers during assembly process, the outer-most tubes in the bundle sometimes collide with a collar of the header, which leads to deformation of tubes and/or the header. This can lead
25 to leaks in the assembly, which renders the whole heat exchanger non-operational or non-efficient.

There is therefore a need to provide a header for a heat exchanger with tubes, which would solve the above-mentioned problem in a cost-effective and relatively easy to implement manner.

5 SUMMARY OF THE INVENTION

The object of the invention is a header for a heat exchanger, in particular for a charge air cooler, comprising an opening plane with plurality of openings for attachment of tubes, a collar encircling the perimeter of the opening plane and protruding at least partially above the opening plane, wherein the header further comprises guiding protrusions located along inner perimeter of the collar adjacent to said openings and configured to guide the tubes into the openings upon insertion, wherein the openings have substantially rectangular shape with longer sides and shorter sides and are arranged in series along their longer sides, wherein a first group of guiding protrusions is located adjacent the longer sides of the openings, while a second group of guiding protrusions is located adjacent the shorter sides of the openings.

Preferably, the collar has a rounded inside collar edge, the openings have rounded inside opening edges, and each guiding protrusion forms a flat surface which connects tangentially with the inside collar edge and the adjacent inside opening edges.

Preferably, the flat surface is inclined with respect to the opening plane at an angle of α , the α being comprised in the range 30-60°.

Preferably, the rounded inside collar edge has a radius R1, the rounded inside opening edges have a radius R2, and the radius R1 is bigger than the radius R2.

Preferably, the rounded inside collar edge has a radius R1, the rounded inside opening edges have a radius R2, and the radius R1 is equal to the radius R2.

Preferably, the guiding protrusions at the longer sides of the openings have a width p1, while the guiding protrusions at the shorter sides of the openings have a width p2, and the width p1 is equal to width p2.

Preferably, the guiding protrusions at the longer sides of the openings have a width p_1 and are arranged in a distanced manner with respect to each other by a distance d , wherein ratio p_1/d is $2/15$.

Preferably, the guiding protrusions at the short sides of the openings are located
5 substantially in the middle of those short sides.

The object of the invention is also a heat exchanger comprising a header as described above and/or below.

BRIEF DESCRIPTION OF DRAWINGS

10 Examples of the invention will be apparent from and described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows an assembly of headers and tubes in an exploded view;

Fig. 2 shows a header in a top view;

15 Fig. 3 shows a header with a tube inserted into an outer-most opening of the header;

Fig. 4 shows a header with a tube in a closer view.

DETAILED DESCRIPTION OF EMBODIMENTS

Fig. 1 shows an assembly of headers and tubes in an exploded view. The tubes 20
20 are generally grouped into a bundle and together form a conduit for a liquid. The tubes 20 are connected at both ends to headers 10. The headers 10 are adapted for receiving said ends of the tubes 20. The tubes 20 have generally rectangular cross-section, with rounded corners.

Fig. 2 shows a header 10 according to the invention in a top view. Header 10
25 comprises an opening plane 12 with plurality of openings 14 for attachment of tubes. The tubes 20 can be introduced into these openings 14 and brazed, so that a fluid-tight connection is obtained. Header 10 further comprises a collar 13 encircling the

perimeter of the opening plane 12. The collar 13 protrudes at least partially above the opening plane 12. Consequently, the opening plane 12 is located below the top surface of the collar 13, i.e. it is not at the same level, and an inner perimeter 18 of the collar 13 is created at the contact portion between the collar 13 and the opening plane 12. The header 10 further comprises guiding protrusions 11a, 11b located along the inner perimeter 18 of the collar 13 adjacent to the openings 14. The guiding protrusions 11a, 11b are configured to guide the tubes 20 into the openings 14 upon insertion. This means that even if the tubes 20 facing the openings 14 with adjacent guiding protrusions 11a, 11b are slightly shifted towards the collar 13, the guiding protrusions 11a, 11b will guide them so that they will enter the openings without any damage done to header 10 and/or tubes 20.

The openings 14 have substantially rectangular shape with longer sides 14a and shorter sides 14b and are arranged in series along their longer sides 14a. This arrangement corresponds to the general arrangement of tubes 20 in a bundle which are intended to be inserted into and connected to the header 10. A first group of guiding protrusions 11a is located adjacent the longer sides 14a of the openings 14, while a second group of guiding protrusions 11b is located adjacent the shorter sides 14b of the openings 14. This allows to prevent damage to collar 13 and/or tubes 20 along the whole inner perimeter of the collar 13 during insertion of the tubes 20.

Fig. 3 shows a header with a tube 20 inserted into an outer-most opening 14 of the header 10. The guiding protrusions 11a at the longer sides 14a of the openings 14 have a width p_1 . The guiding protrusions 11b at the shorter sides 14b of the openings 14 have a width p_2 . Preferably, the width p_1 is equal to width p_2 .

Further, the guiding protrusions 11a at the longer sides 14a of the openings 14 have a width p_1 and are arranged in a distanced manner with respect to each other by a distance d . Preferably, the ratio p_1/d is $2/15$.

Preferably, the guiding protrusions 11b at the short sides 14b of the openings 14 are located substantially in the middle of those short sides 14b. This maximizes the chance of proper insertion of tubes into the openings 14.

Fig. 4 shows a header 10 with an inserted tube 20 in a closer view. The collar 13 has a rounded inside collar edge 15. The openings 14 have rounded inside opening

- edges 16. Each guiding protrusion 11a, 11b forms a flat surface 17 which connects tangentially with the inside collar edge 15 and the adjacent inside opening edges 16. This facilitates the insertion of the tubes 20. The guiding protrusions 11a, 11b are manufactured by for example through stamping. Preferably, the flat surface 15 is
- 5 inclined with respect to the opening plane 12 at an angle of α , the α being comprised in the range 30-60°. As can be seen in Fig. 3 the rounded inside collar edge 15 has a radius R1, while the rounded inside opening edges 16 have a radius R2. The radius R1 can be bigger than the radius R2. Alternatively, the radius R1 is equal to the radius R2.
- 10 Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of drawings, the disclosure, and the appended claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to the advantage.

Claims

1. A header 10 for a heat exchanger, in particular for a charge air cooler, comprising an opening plane 12 with plurality of openings 14 for attachment of tubes, a collar 13 encircling the perimeter of the opening plane 12 and protruding at least partially above the opening plane 12, wherein the header 10 further comprises guiding protrusions 11a, 11b located along inner perimeter of the collar 13 adjacent to said openings 14 and configured to guide the tubes into the openings 14 upon insertion, wherein the openings 14 have substantially rectangular shape with longer sides 14a and shorter sides 14b and are arranged in series along their longer sides 14a, wherein a first group of guiding protrusions 11a is located adjacent the longer sides 14a of the openings 14, while a second group of guiding protrusions 11b is located adjacent the shorter sides 14b of the openings 14.
2. A header 10 according to claim 1, wherein the collar 13 has a rounded inside collar edge 14, the openings 14 have rounded inside opening edges 16, and each guiding protrusion 11a, 11b forms a flat surface 15 which connects tangentially with the inside collar edge 14 and the adjacent inside opening edges 16.
3. A header 10 according to claim 2, wherein the flat surface 15 is inclined with respect to the opening plane 12 at an angle of α , the α being comprised in the range 30-60°.
4. A header 10 according to claim 2 or 3, wherein the rounded inside collar edge 14 has a radius R1, the rounded inside opening edges 16 have a radius R2, and the radius R1 is bigger than the radius R2.

5. A header 10 according to claim 2 or 3, wherein the rounded inside collar edge 14 has a radius R_1 , the rounded inside opening edges 16 have a radius R_2 , and the radius R_1 is equal to the radius R_2 .

5 6. A header 10 according to any preceding claim, wherein the guiding protrusions 11a at the longer sides 14a of the openings 14 have a width p_1 , while the guiding protrusions 11b at the shorter sides 14b of the openings 14 have a width p_2 , and the width p_1 is equal to width p_2 .

10 7. A header 10 according to any preceding claim, wherein the guiding protrusions 11a at the longer sides 14a of the openings 14 have a width p_1 and are arranged in a distanced manner with respect to each other by a distance d , wherein ratio p_1/d is $2/15$.

15 8. A header according to any preceding claim, wherein the guiding protrusions 11b at the short sides 14b of the openings 14 are located substantially in the middle of those short sides 14b.

9. A heat exchanger comprising a header according to any of preceding claims.

1/2

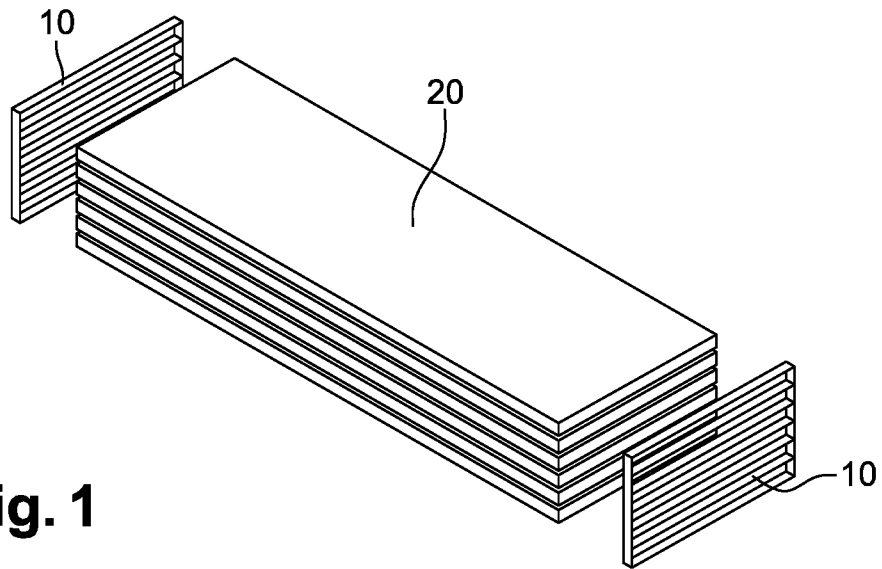


Fig. 1

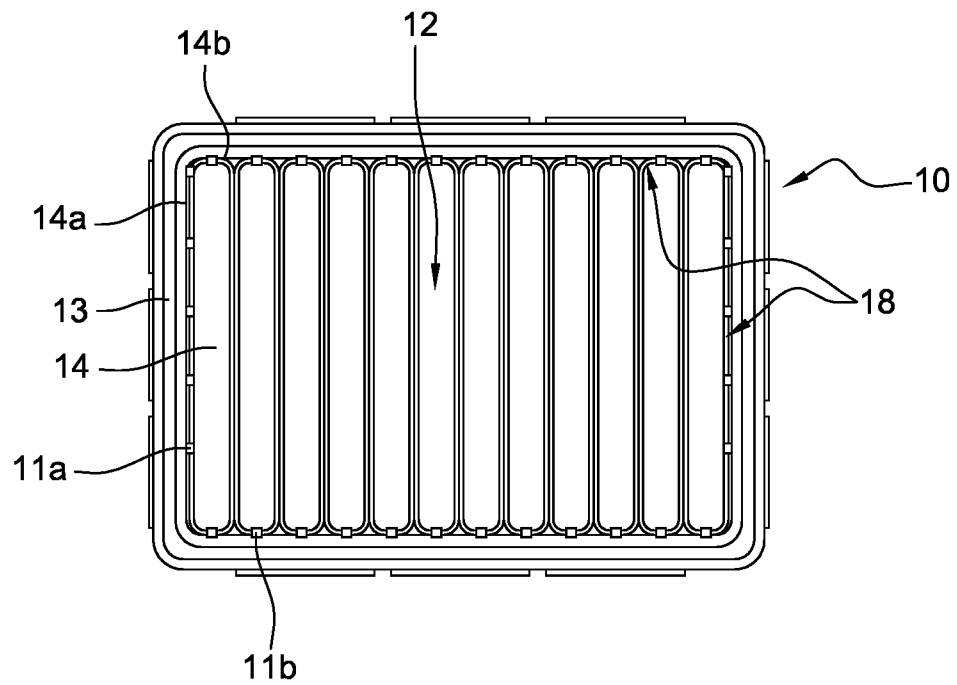


Fig. 2

2 / 2

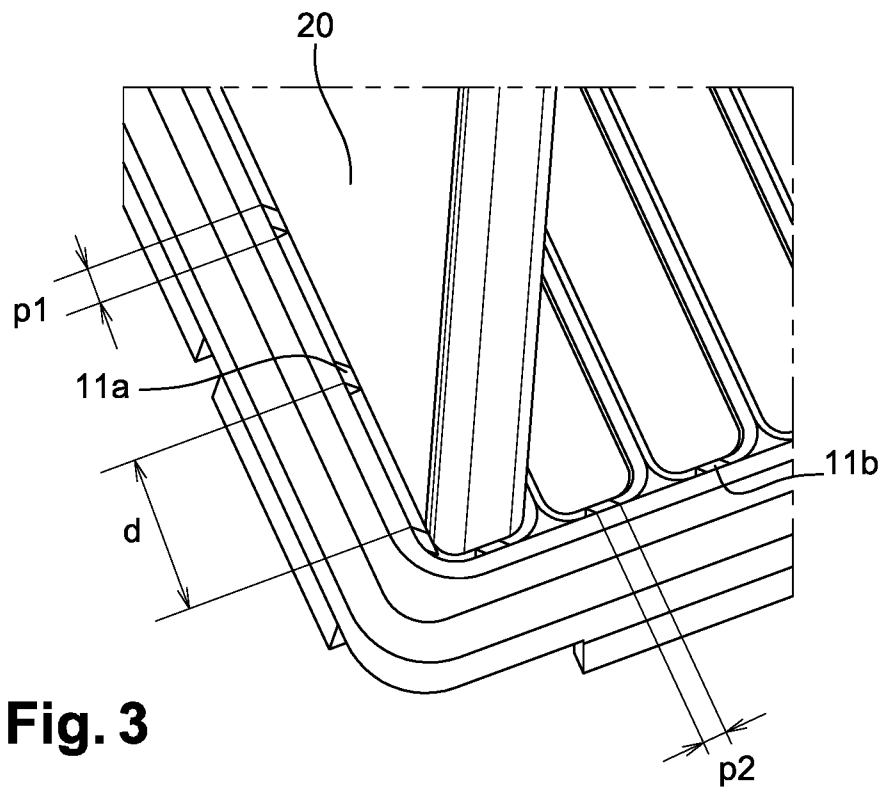


Fig. 3

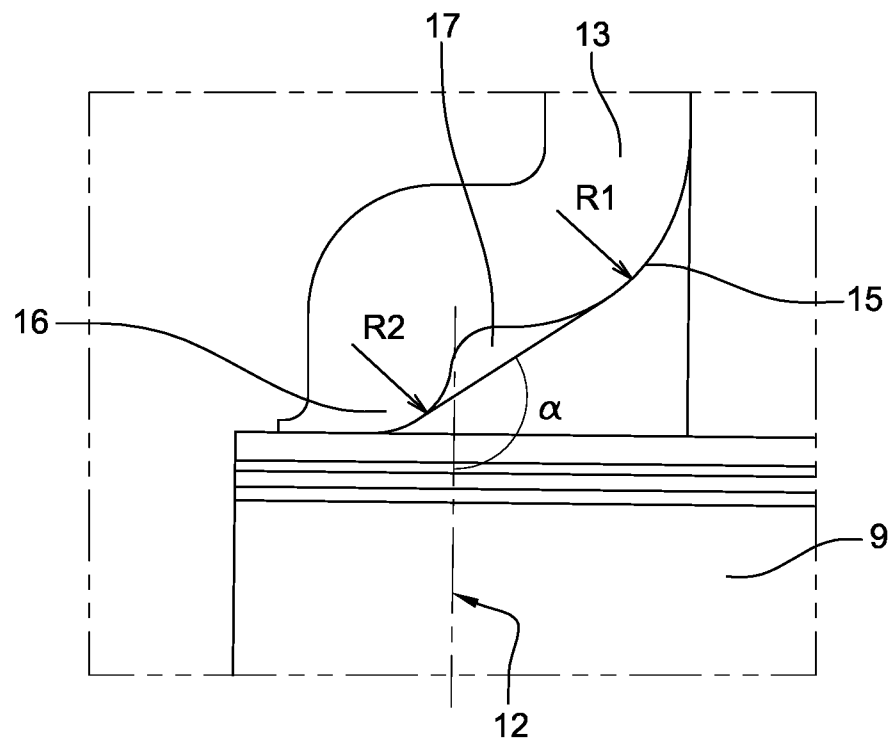


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/062285

A. CLASSIFICATION OF SUBJECT MATTER
INV. F28F9/04 F28D7/16
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F28F F28D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009/121531 A1 (VALEO SYSTEMES THERMIQUES [FR]; AMAYA LUIS [FR]) 8 October 2009 (2009-10-08) column 5, line 3 - column 7, line 17; figures 1-3 -----	1-9
A	EP 2 310 789 A1 (VALEO SYSTEMES THERMIQUES [FR]) 20 April 2011 (2011-04-20) cited in the application paragraph [0024] - paragraph [0036]; figures 1,5,11 -----	1-9
A	US 8 656 988 B1 (PAUL NEAL [US] ET AL) 25 February 2014 (2014-02-25) column 3, line 19 - column 6, line 4; figures 1-5 -----	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

6 August 2019

Date of mailing of the international search report

12/08/2019

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Jessen, Flemming

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2019/062285

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
WO 2009121531	A1	08-10-2009	CN 102047065 A	04-05-2011
			EP 2265882 A1	29-12-2010
			JP 5775448 B2	09-09-2015
			JP 2011516811 A	26-05-2011
			US 2011088884 A1	21-04-2011
			WO 2009121531 A1	08-10-2009

EP 2310789	A1	20-04-2011	AT 547682 T	15-03-2012
			CN 102138056 A	27-07-2011
			CN 103438748 A	11-12-2013
			EP 2310789 A1	20-04-2011
			EP 2378235 A1	19-10-2011
			ES 2382729 T3	13-06-2012
			FR 2933178 A1	01-01-2010
			JP 2011525609 A	22-09-2011
			JP 2014013140 A	23-01-2014
			PL 2310789 T3	31-07-2012
			US 2011168370 A1	14-07-2011
			WO 2010003807 A1	14-01-2010

US 8656988	B1	25-02-2014	NONE	
