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

(11) EP 1 369 658 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.12.2003 Bulletin 2003/50

(51) Int Cl.[7]: **F28D 1/053**

(21) Application number: **02012205.7**

(22) Date of filing: **03.06.2002**

(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

(71) Applicant: **VALMEX S.p.A.**
61030 Cartoceto (IT)

(72) Inventor: **Ariotti, Maurizio**
61032 Carignano di Fano (IT)

(74) Representative: **Cerbaro, Elena, Dr. et al**
STUDIO TORTA S.r.l.,
Via Viotti, 9
10121 Torino (IT)

(54) **Radiating element and relative radiator**

(57) In a radiator (1) having a number of superimposed radiating elements (2), each radiating element (2) is formed from a flattened tubular member (10) and has permanently deformed end portions (9), each of which has two facing, substantially flat walls (11) which project with respect to an undeformed central portion (8), have respective holes (14), and are soldered to the walls (11) of adjacent radiating elements (2); and at least one pair (17) of adjacent radiating elements (2a,2b) has an aligning and connecting device (16) for maintaining the radiating elements (2a,2b) in a given relative position.

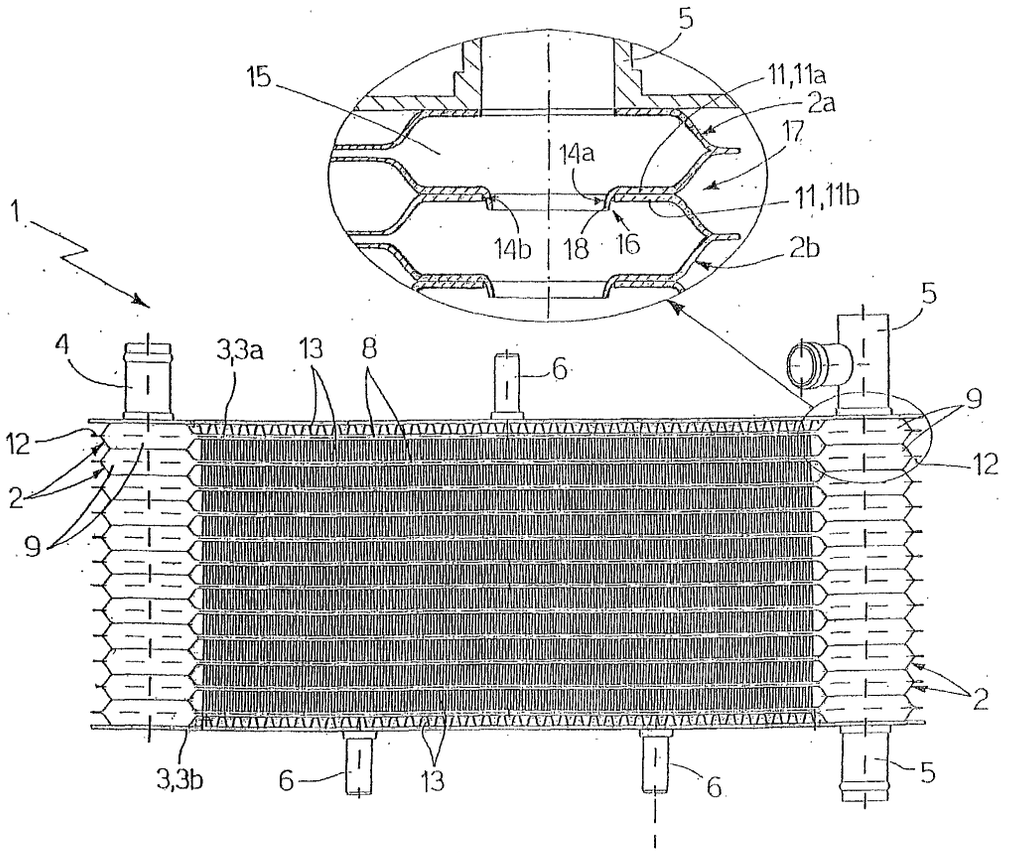

Fig.1

EP 1 369 658 A1

Description

[0001] The present invention relates to a radiating element, to a radiator comprising at least one radiating element, and to two methods of producing the radiating element and radiator respectively.

[0002] The present invention may be used to advantage for cooling the cooling fluid of a vehicle, in particular a motor vehicle, engine, to which the following description refers purely by way of example.

[0003] A radiator is currently produced comprising a number of superimposed radiating elements, each of which is formed from a flattened tubular member and has permanently deformed end portions to define, at each end portion, two facing, substantially flat walls projecting with respect to an undeformed central portion of the radiating element; and each wall is placed in contact with, and normally soldered to, at least one wall of an adjacent radiating element.

[0004] Each wall has a hole to define, in the radiator, two end manifolds communicating with respective cooling fluid inlet and outlet fittings.

[0005] When forming or transporting the pack of radiating elements, prior to soldering, relative movement of the end portions may occur caused by the walls of one radiating element slipping with respect to the walls of one or both the adjacent radiating elements. This represents a serious drawback by partly or fully closing the holes, thus resulting in a defective radiator.

[0006] It is an object of the present invention to provide a radiating element and relative radiator designed to eliminate the aforementioned drawbacks.

[0007] A first object of the present invention is to provide a radiating element for radiators as claimed in independent Claim 1.

[0008] A second object of the present invention is to provide a method of producing a radiating element for radiators as claimed in independent Claim 5.

[0009] A third object of the present invention is to provide a radiator as claimed in independent Claim 8.

[0010] A fourth object of the present invention is to provide a radiator as claimed in independent Claim 9.

[0011] A fifth object of the present invention is to provide a method of producing radiators as claimed in independent Claim 11.

[0012] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a front view and enlarged detail in section of a preferred embodiment of a radiator in accordance with the teachings of the present invention;

Figure 2 shows a side view of Figure 1;

Figures 3 to 7 show steps, with partly sectioned enlarged details, in a method of producing a radiating element and radiator in accordance with the present invention;

Figure 8 is a plan view of Figure 7 and shows a preferred embodiment of a radiating element in accordance with the present invention.

[0013] Number 1 in Figure 1 indicates as a whole a radiator for cooling the cooling fluid of a vehicle, in particular a motor vehicle, engine.

[0014] Radiator 1 comprises a number of superimposed radiating elements 2; two parallel, facing guard plates 3 on opposite sides of radiating elements 2; a water inlet fitting 4 fitted to a top plate 3a; two water outlet fittings 5 at the opposite end to inlet fitting 4 and fitted to top plate 3a and a bottom plate 3b respectively; and anchoring pins 6 connected integrally to plates 3 for assembly to a supporting structure (not shown).

[0015] Each radiating element 2 extends along a longitudinal axis 7, and comprises a central portion 8, and two end portions 9 at opposite ends of central portion 8. As explained in detail later on, each end portion 9 is formed by permanent deformation of a respective end portion of a flattened tubular member 10 (Figure 3), and comprises two parallel, facing, substantially flat walls 11, and a closed end 12. Each wall 11 is placed in contact with a respective wall 11 of an adjacent radiating element 2, or with a portion of a plate 3, and projects with respect to central portion 8; and, in the gaps between central portions 8 of adjacent radiating elements 2, or between central portions 8 and plates 3, undulated sheet metal strips 13 are inserted to improve heat exchange.

[0016] Each wall 11 is soldered or welded, and preferably though not necessarily projection welded, to the adjacent wall 11 or adjacent plate 3.

[0017] Walls 11 have respective through holes 14 which, when walls 11 are soldered to one another, define at end portions 9 respective end manifolds 15 (only one shown), a first of which has one end communicating with fitting 4 and one end closed by bottom plate 3b, and a second of which has two ends communicating with respective fittings 5.

[0018] Each pair of adjacent radiating elements 2 has an aligning and connecting device 16 for assembling radiating elements 2 one on top of the other in a given relative position, in particular with holes 14 substantially coaxial with each other.

[0019] With reference to a generic pair 17 of adjacent radiating elements 2 comprising a first radiating element 2a and a second radiating element 2b, aligning and connecting device 16 comprises two annular collars 18 (only one shown in Figure 1) located at respective end portions 9 of radiating element 2a, and each of which projects from a bottom wall 11a of a respective end portion 9 and extends along the edge of a hole 14a formed in bottom wall 11a; and two holes 14b, each of which is formed through a top wall 11b of a respective end portion 9 of radiating element 2b, and is of such a cross section as to house relative annular collar 18 with relatively little slack.

[0020] Radiating element 2 adjacent to bottom plate 3b preferably has no annular collars 18.

[0021] Figure 3 shows a first step in a method of producing radiating element 2 and radiator 1, and wherein a flattened tubular member 10 with open ends and of given length is prepared, and, as shown in Figure 4, is provided with end portions 9 by means of permanent deformation by two forming punches 19, while central portion 8 is left undeformed. Forming punches 19 move in opposite directions along a path coincident with longitudinal axis 7, and are inserted inside respective open ends of each tubular member 10, which is held in position by a known supporting device not shown.

[0022] In the next step shown in Figure 5, each tubular member 10 is provided, at each end portion 9 and in walls 11a and 11b, with respective holes 14a and 14b, which are coaxial along an axis 7a crosswise to longitudinal axis 7, have different cross sections, and are formed by a respective pair of cutting punches 20 (only one pair shown) also of different sizes and moving in opposite directions along a path crosswise to longitudinal axis 7. More specifically, hole 14a has a smaller cross section than hole 14b.

[0023] As shown in Figure 6, each hole 14a is then widened and provided along the edge with annular collar 18 projecting from wall 11a. This is done by means of an edging punch 21, which is moved along a path crosswise to longitudinal axis 7, is inserted through hole 14b, and is fed forward so as to interfere with the edge of hole 14a and so widen hole 14a and simultaneously form, by permanent deformation of wall 11a, annular collar 18 projecting from wall 11a.

[0024] In the next step shown in Figure 7, ends 12 of end portions 9 are closed by permanent deformation, by compressing ends 12 between two pressure members 22 moving in opposite directions along a path crosswise to longitudinal axis 7. To prevent walls 11 from also being deformed during compression, each end portion 9 is inserted, at the closing step, in a die (not shown) from which end 12 projects.

[0025] In a further step not shown, each end 12 may then be folded onto itself or towards central portion 8.

[0026] The above operations result in the formation of a radiating element 2 as shown in Figure 8.

[0027] A number of radiating elements 2 are then placed one on top of the other by inserting annular collars 18 inside respective holes 14b to align and connect each radiating element 2 to the adjacent radiating element 2.

[0028] As stated, walls 11 of adjacent radiating elements 2 are joined by soldering or welding, and each end 12 is also preferably, though not necessarily, soldered or welded - in particular, projection welded.

[0029] Aligning and connecting device 16 is particularly advantageous by enabling more stable, more compact stacking of radiating elements 2, which may thus be superimposed and transported safely with no risk of misalignment or of end portions 9 slipping with respect to one another and so partly or fully closing holes 14.

[0030] Clearly, the radiating element and radiator described and illustrated herein may be used for cooling various types of fluid, and changes may be made without, however, departing from the scope of the present invention.

Claims

1. A radiating element for radiators, said radiating element (2) being formed from a flattened tubular member (10) and comprising a central portion (8), and two closed end portions (9) at opposite ends of said central portion (8); each said end portion (9) comprising two facing, substantially flat walls (11) projecting with respect to said central portion (8) and having respective through holes (14); and the radiating element (2) being **characterized by** comprising an annular collar (18) projecting from a first (11a) of said walls (11), in particular from the edge of a respective first (14a) of said holes (14).

2. A radiating element as claimed in Claim 1, **characterized in that** said first hole (14a) has a smaller cross section than a second (14b) of said holes (14); said annular collar (18) being associated with said first hole (14a).

3. A radiating element as claimed in Claim 1 or 2, **characterized in that** said annular collar (18) is formed by permanent deformation of a portion of said first wall (11a) extending along the edge of said first,hole (14a).

4. A radiating element as claimed in any one of the foregoing Claims, **characterized in that** said first (14a) and said second (14b) hole are coaxial.

5. A method of producing radiating elements (2) for radiators, comprising the steps of:

   - preparing at least one flattened tubular member (10) of given length, extending along a longitudinal axis (7) and having open ends;
   - permanently deforming the open end portions (9) of said tubular member (10) by means of forming punches (19) moving parallel to said longitudinal axis (7) to define, at each said end portion (9), two facing, substantially flat walls (11) projecting with respect to an undeformed central portion (8) of said tubular member (10); and
   - perforating said two walls (11) of each said end portion (9) by means of a pair of cutting punches (20) moving crosswise to said longitudinal axis (7) to form respective through holes (14);

the method being **characterized by**:

- forming, on a first (11a of said walls (11) of each said end portion (9), a respective annular collar (18) projecting from the first wall (11a), in particular from the edge of a respective first (14a) of said holes (14).

6. A method as claimed in Claim 5, **characterized by** performing said perforating step so that said first hole (14a) has a smaller cross section than a second (14b) of said holes (14) formed in a respective second (11b) of said two walls (11).

7. A method as claimed in Claim 6, **characterized by** permanently deforming a portion of said first wall (11a) by means of an edging punch (21) moving crosswise to said longitudinal axis (7); said edging punch (21) being inserted through said second hole (14b) and fed forward so as to interfere with and permanently deform the edge of said first hole (14a) to widen said first hole (14a) and simultaneously form said annular collar (18) projecting from said first wall (11a).

8. A radiator comprising at least one radiating element (2) as claimed in one of Claims 1 to 4.

9. A radiator comprising a number of superimposed radiating elements (2) connected hydraulically and formed from respective flattened tubular members (10); each said radiating element (2) comprising a central portion (8), and two closed end portions (9) at opposite ends of said central portion (8); each said end portion (9) comprising two facing, substantially flat walls (11a, 11b) which project with respect to said central portion (8), have respective through holes (14a, 14b), and at least one (11a, 11b) of which is placed in contact with a wall (11b, 11a) of an adjacent radiating element (2); said end portions (9) defining two end manifolds (15) of the radiator (1); and the radiator (1) being **characterized in that** at least one pair (17) of adjacent said radiating elements (2) comprising a first (2a) and a second (2b) radiating element comprises aligning and connecting means (16) for maintaining said first (2a) and said second (2b) radiating element in a given relative position.

10. A radiator as claimed in Claim 9, **characterized in that** said first radiating element (2a) comprises, at each said end portion (9), an annular collar (18) projecting from a first (11a) of said walls (11a, 11b), in particular from the edge of a respective first (14a) of said holes (14a, 14b), and said second radiating element (2b) is positioned with a second (11b of said walls (11a, 11b contacting said first wall (11a); and **in that** said second wall (11b has a respective second (14b) of said holes (14a, 14b), which has a cross section for housing said annular collar (18); said aligning and connecting means (16) comprising said annular collar (18) and said second hole (14b).

11. A method of producing radiators (1) comprising a number of superimposed, hydraulically connected radiating elements (2), **characterized by** comprising the steps of:

- preparing a number of flattened tubular members (10) of given length, each extending along a longitudinal axis (7) and having open ends;
- permanently deforming the open end portions (9) of each said tubular member (10) by means of forming punches (19) moving parallel to said longitudinal axis to define, at each said end portion (9), two facing, substantially flat walls (11) projecting with respect to an undeformed central portion (8) of said tubular member (10);
- perforating said two walls (11) of each said end portion (9) by means of a pair of cutting punches (20) moving crosswise to said longitudinal axis (7); and
- assembling said radiating elements (2) by placing one on top of another so that at least one of said walls (11a, 11b contacts a respective wall (11b 11a) of an adjacent radiating element (2) to define two end manifolds (15) of the radiator (1);

the method being **characterized by**:

- aligning and connecting at least one pair (17) of adjacent said radiating elements (2), comprising a first (2a) and a second (2b) radiating element, at said assembling step by means of aligning and connecting means (16) for maintaining said first (2a) and said second (2b) radiating element in a given relative position.

12. A method as claimed in Claim 11, **characterized by** performing said perforating step so that a first hole (14a) formed in a first (11a) of said two walls (11) has a smaller cross section than a second hole (14b) formed in a second (11b) of said two walls (11).

13. A method as claimed in Claim 12, **characterized by** permanently deforming, at each said end portion (9), a portion of said first wall (11a) by means of an edging punch (21) moving crosswise to said longitudinal axis (7); said edging punch (21) being inserted through said second hole (14b) and fed forward so as to interfere with and deform the edge of said first hole (14a) to widen said first hole (14a) and simultaneously form an annular collar (18) projecting from said first wall (11a).

14. A method as claimed in Claim 13, **characterized by** inserting said annular collar (18) on said first radiating element (2a) inside a respective said second hole (14b) on said second radiating element (2b) at said aligning and connecting step; said aligning and connecting means (16) comprising said annular collar (18) and said second hole (14b).

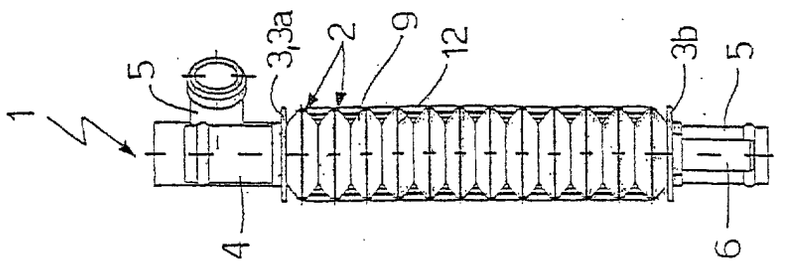
1
5
3,3a
2
9
12
3b
5
4
6

Fig.2

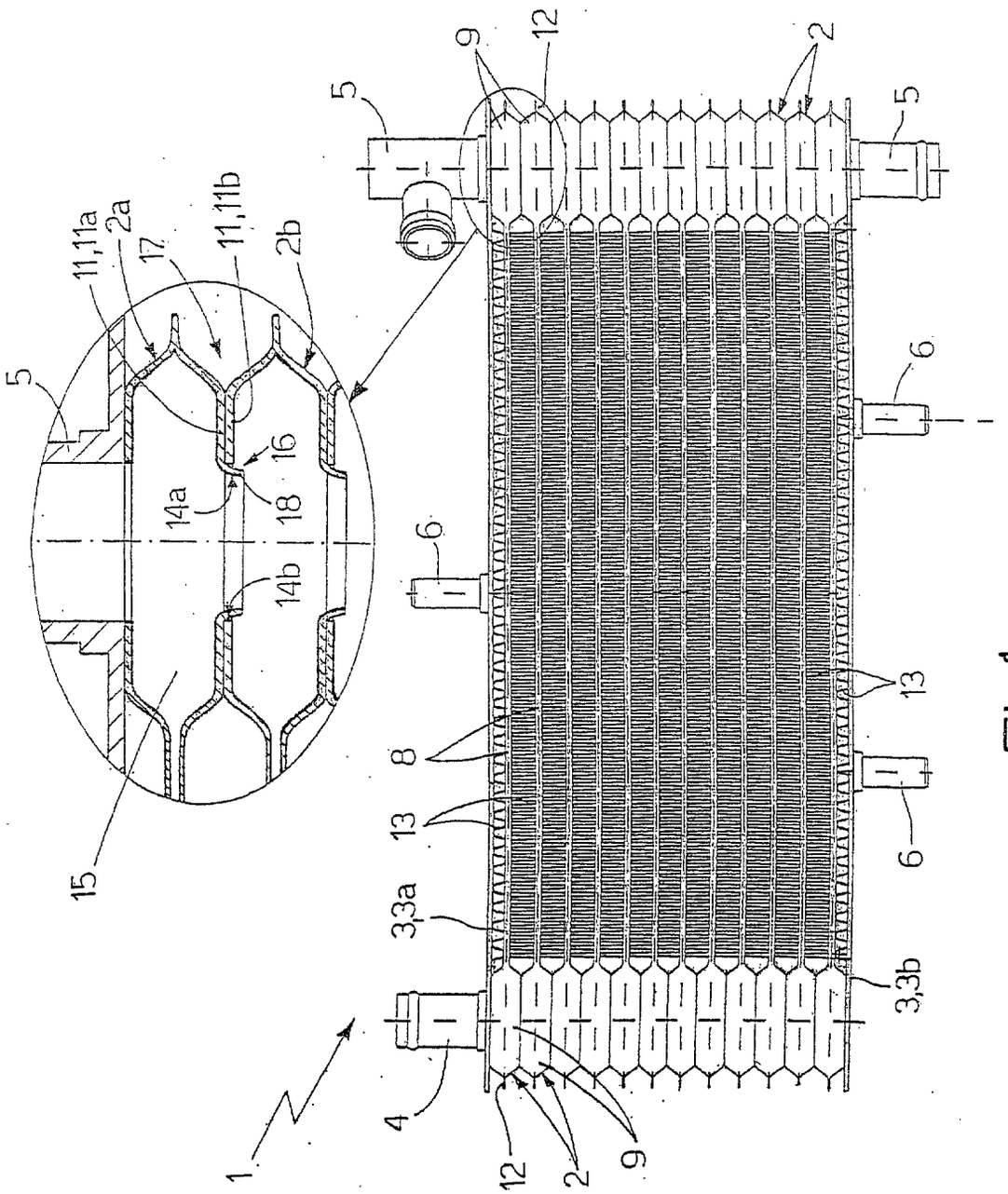
1
5
9
12
2
5
11,11a
2a
17
11,11b
2b
16
14a
18
14b
15
6
6
13
8
13
6
3,3a
3,3b
4
12
2
9

Fig.1

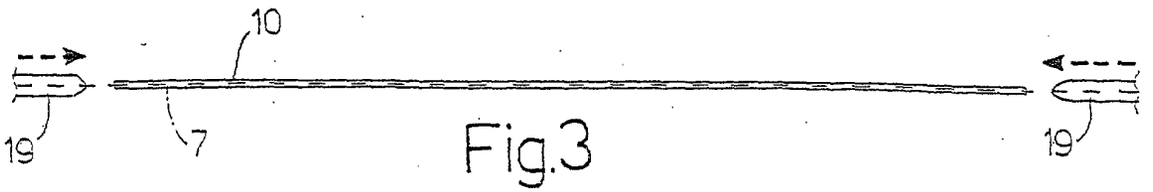

Fig.3

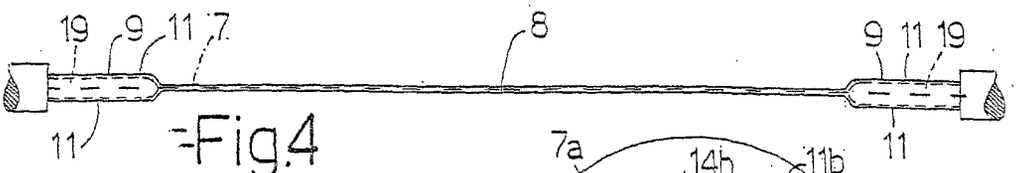

Fig.4

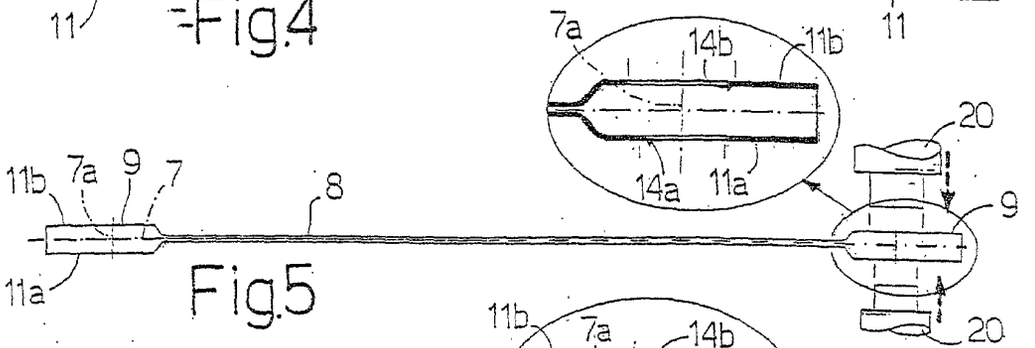

Fig.5

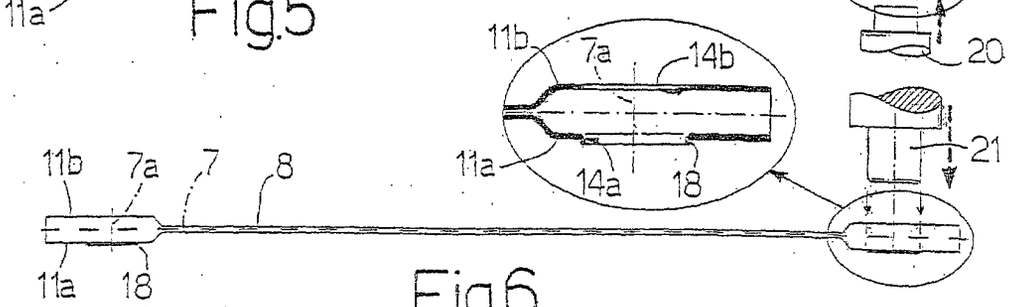

Fig.6

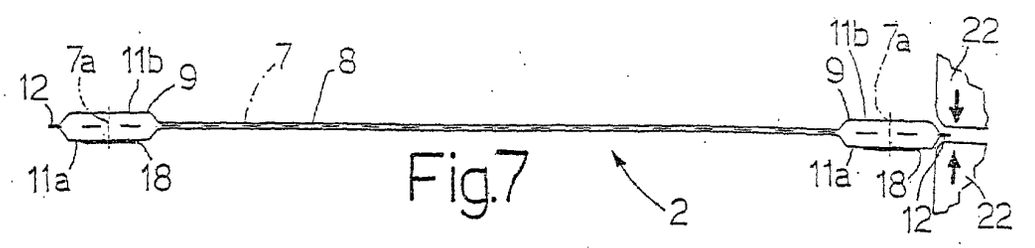

Fig.7

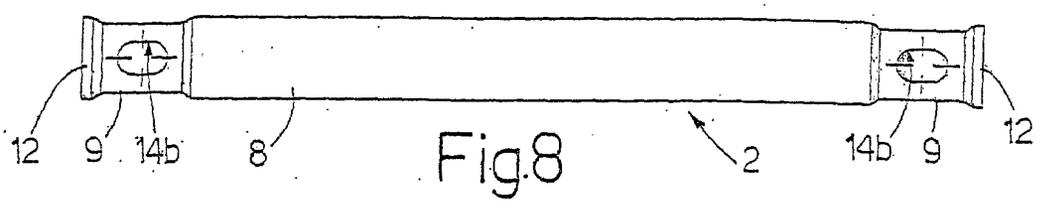

Fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 01 2205

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 0 692 691 A (VALEO ENGINE COOLING AB) 17 January 1996 (1996-01-17) * abstract; figures 11B,13 * ---	1-14	F28D1/053
X	BE 653 079 A (SILVIO SALA, GIUSEPPE SALA) 31 December 1964 (1964-12-31) * figures 4-11 * -----	1-14	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	15 October 2002	Bain, D

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 02 01 2205

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.

15-10-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0692691 A	17-01-1996	SE 515934 C2	29-10-2001
		DE 69514288 D1	10-02-2000
		DE 69514288 T2	31-08-2000
		EP 0692691 A1	17-01-1996
		SE 9402473 A	13-01-1996
BE 653079 A		NONE	

EPO FORM P0459

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