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File Number: T 174/91 - 3.4.2

Application No.: 84 112 474.6

Publication No.: 0 145 885

Title of invention: Filter element

Classification: B01D 46/52, B01D 27/06, B01D 29/06

D E C I S I O N
of 16 April 1992

Proprietor of the patent: NIPPONDENSO CO., LTD.

Opponent: Knecht Filterwerke GmbH

Headword:

EPC Articles 54, 56, 100(a)

Keyword: "Novelty (yes); inventive step (yes)"

Headnote



Case Number : T 174/91 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 16 April 1992

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Decision under appeal : Decision of Opposition Division of the European
Patent Office dated 13 November 1990 and posted
20 December 1990 rejecting the opposition filed
against European patent No. 0 145 885 pursuant
to Article 102(2) EPC.

Composition of the Board :

Chairman : E. Turrini
Members : M. Chomentowski
M.V.E. Lewenton

Summary of Facts and Submissions

- I. The Respondent is proprietor of European patent No. 0 145 885, which was granted on the basis of European patent application No. 84 112 474.6.
- II. Claims 1, 12 and 17 of the patent as granted read as follows:

"1. A filter element including a plurality of zigzag pleats (1b) of a filtering sheet material, said zigzag pleats being disposed so that spaces (2a, 2b) are defined between adjacent pleat sections (1a), first spaces (2a) being open at one side to a first space (4) and being closed at the other end by said filtering sheet material, whereas the adjacent second spaces (2b) are closed at this one end by said filtering sheet material, said first and second spaces being alternately arranged side by side so that a fluid to be filtered entering the filter element through one of said spaces has to flow through said filtering sheet material, characterized in that said filter element (8) has a generally ring-like structure including a plurality of generally radial sections (1a) each converging generally radially inwardly and having a plurality of generally circumferential zigzag pleats (1b), said radial sections being circumferentially arranged such that the radially inner ends thereof cooperate to define a central space (4) disposed substantially centrally of said structure, the zigzag pleats of each radial section (1a) having circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure, the respective circumferential ends of the zigzag pleats of each circumferentially adjacent pair of radial sections being disposed in circumferentially adjacent relationship so that generally radial first and

second spaces (2a, 2b) are defined between said radial sections, said first radial spaces (2a) being closed at the radially outer ends and being radially inwardly open whereas said second radial spaces (2b) are closed at the radially inner ends, wherein said radially inwardly open first radial spaces (2a) are closed at the axially opposite ends by end walls (6, 7)."

"12. A filter element including a plurality of zigzag pleats (1b) of a filtering sheet material, said zigzag pleats being disposed so that spaces (2a, 2b) are defined between adjacent pleat sections (1a), first spaces (2a) being open at one side to a first space (4) and being closed at the other end by said filtering sheet material, whereas the adjacent second spaces (2b) are closed at this one end by said filtering sheet material, said first and second spaces being alternately arranged side by side so that a fluid to be filtered entering the filter element (read: element) through one of said spaces has to flow through said filtering sheet material, characterized in that said filter element (8g) has a generally ring-like structure (10g) including a plurality of generally radial sections (1a-1) each converging generally radially inwardly and having a plurality of generally circumferential zigzag pleats (1b) and at least one substantially radially extending planar web (1g) of said filtering sheet material, said radial sections being circumferentially arranged such that the radially inner ends thereof cooperate to define a central space (4) disposed substantially centrally of said ring-like structure (8g), the zigzag pleats of each of said radial sections having circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure, the zigzag pleats of each radial section being disposed in circumferentially adjacent relationship to the planar

web (1g) of the radial section (1a-1) to cooperate therewith to define said first space (2a-1) which extends generally radially and is radially inwardly open to said central space (4), the zigzag pleats of each radial section (1a-1) being disposed in circumferentially adjacent relationship to the planar web (1g) of a circumferentially adjacent radial section to cooperate therewith to define said second space (2b-1) separated by said filtering sheet material from said central space (4), the axially opposite ends of said first space (2a-1) being closed by end walls (6g, 7g)."

"17. A filter element including a plurality of zigzag pleats (1b) of a filtering sheet material, said zigzag pleats being disposed so that spaces (2a, 2b) are defined between adjacent pleat sections (1a), first spaces (2a) being open at one side to a first space (4) and being closed at the other end by said filtering sheet material, whereas the adjacent second spaces (2b) are closed at this one end by said filtering sheet material, said first and second spaces being alternately arranged side by side so that a fluid to be filtered entering the filter element through one of said spaces has to flow through said filtering sheet material, characterized in that said filter element has a generally ring-like structure including a plurality of generally radial sections (1a-2) each converging generally radially inwardly of said ring-like structure and having two substantially radially extending and circumferentially spaced rows of circumferentially zigzag pleats (1b) and a substantially radially extending pleat (1g-1) extending between the two radial rows of the circumferentially zigzag pleats, said radial sections (1a-2) being circumferentially arranged such that the radially inner ends of said radial sections cooperate to define a central space (4) disposed

substantially centrally of said ring-like structure, the circumferentially zigzag pleats of each row having circumferential dimensions which are substantially gradually reduced radially inwardly of said ring-like structure, said radial pleat having legs connected to the radially outermost pleats of said two radial rows, said radial pleat defining therein a further radially outwardly open space and being disposed in circumferentially adjacent relationship to said two radial rows of circumferential zigzag pleats (1b, 1b) to cooperate therewith to define two of said first spaces which extend generally radially and are radially inwardly open thereby communicating with said central space."

Claims 2 to 11 and 13 to 16 are dependent claims.

III. The Appellant (Opponent) filed an opposition against the European patent, in particular on the grounds that the subject-matter of the claims of the opposed patent lacked novelty or an inventive step having regard inter alia to the disclosure in

D1 = DE-C-1 204 629,
D2 = DE-A-1 607 730,
D3 = DE-A-1 611 083 and
D4 = US-A-2 627 350.

IV. The Opposition Division rejected the opposition. According to the decision, the subject-matter of Claim 1 was novel and involved an inventive step because it included in particular the ring-like configuration of the pleats or pleated sections of the filter elements with circumferential pleats of gradually inwardly decreasing dimensions, i.e. the "Christmas tree

configuration" mentioned by the Opponent, which was not suggested in the prior art.

V. The Appellant (Opponent) filed an appeal against this decision. He requested that the decision under appeal be set aside and that the patent be revoked. In support of his request, he submitted that the skilled person, aiming, as usual in the art, at a relative increase of the filtering effectiveness of the ring-like filtering arrangement of D1 with its radial sections of circumferential filter elements and its separating radial sections of free space, would be incited to use the solutions disclosed in D4 or D3 for solving the same problem arising in radial filtering structures and would, in accordance with said solutions, provide supplementary pleats in the free space between radial filtering sections for obtaining a uniform occupancy of filtering material and would thus arrive at the structure of the arrangement of Claim 1 in suit.

VI. The Respondent requested that the appeal be dismissed and that the patent be maintained, either in the form as granted or, auxiliarily, in the text of a first or of a second auxiliary request. In support of his requests, he submitted that the filtering arrangement of Claim 1 in suit differed from the arrangement known from D1 and that, starting from D1, there was no incitation to use circumferential pleats, as in Claim 1 in suit, because the documents of the available prior art only indicated configurations wherein free space between adjacent radial sections was filled with radial pleats.

Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 Claim 1

2.1.1 Novelty

2.1.1.1 A filter element including a plurality of zigzag pleats of a filtering sheet material (1) is known from D1 (see Figures 1 to 2 and the corresponding text); said zigzag pleats are disposed so that spaces are defined between adjacent pleat sections, first spaces (delimited by the inner wall (2) on the one side and the filtering sheet material (1) on the other side) being open at one side to a first space (the central part of the cylindrical filter element) and being closed at the other end by said filtering sheet material (1), whereas the adjacent second spaces (delimited by the outer wall (3) on the one side and the filtering sheet material (1) on the other side) are closed at this one end by said filtering sheet material (1), said first and second spaces being alternately arranged side by side so that a fluid to be filtered entering the filter element through one of said spaces has to flow through said filtering sheet material;

said filter element has a generally ring-like structure including a plurality of generally radial sections (the rows (6) of filtering sheet material (1) folded at the locations (5) for forming the zigzag pleats) each converging generally radially inwardly;

said general radial sections have a plurality of generally circumferential zigzag pleats and are circumferentially arranged such that the radially inner ends thereof cooperate to define the central space disposed substantially centrally of said structure;

the respective circumferential ends (5) of the zigzag pleats of each circumferentially adjacent pairs of radial sections (6) are disposed in circumferentially adjacent relationship so that the first and second spaces are defined between said radial sections (6) and are generally radial, said first radial spaces (delimited by the cylindrical inner wall (2) on the one side and the filtering sheet material (1) on the other side) being closed at the radially outer ends and being radially inwardly open whereas said second radial spaces (delimited by the cylindrical outer wall (3) on the one side and the filtering sheet material (1) on the other side) are closed at the radially inner ends;

said radially inwardly open first radial spaces are closed at the axially opposite ends by end walls (4).

However, in the device known from D1, the zigzag pleats of each radial section (6) have not circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure.

2.1.1.2 The other documents of the available prior art do not disclose a filter structure with a plurality of generally circumferential zigzag pleats. For instance, D4 (see column 2, lines 4 to 25; Figures 1 to 6), D3 (see for instance Figure 2) and D2 (see Figures 1 to 3) only disclose cylindrical cartridges with pleats of filter sheet material which extend in the radial direction.

2.1.1.3 Therefore, the Board is of the opinion that the subject-matter of Claim 1 is novel in the sense of Article 54 EPC.

2.1.2 Inventive step

2.1.2.1 D1 (see column 1, lines 10 to 15 and 21 to 38) pertains to the technical field of filter elements including a plurality of zigzag pleats of a filtering sheet material. The device of D1 (see Figure 2 and corresponding text) comprises the space (8) between the rows (6), which is practically devoid of filter sheet material and wherein the rate (effective filtering surface area/ filtering volume) is apparently low as compared to that of the rows (6); this problem is known in the art, for instance from D3 (see in particular the last sentence of the first section of page 2 and page 3, second section). The skilled person generally aims at increasing the effective filtering surface area without increasing the volume of the element or, alternatively, decreasing the volume of the filtering element without decreasing the effective filtering surface area. Therefore, the Board is of the opinion that this object, also mentioned among other objects in the patent in suit (see column 1, lines 26 to 37), does not contribute to an inventive step of the subject-matter of Claim 1.

2.1.2.2 To solve the problem arising because of the void space, D3 (see page 3, third section to page 4, second section; Figure 2) teaches a solution wherein said void space is filled with further pleats of filter sheet material, but the pleats of filter sheet material extend in the radial direction, i.e. from the center to the external wall of the cylindrical element, and not in the circumferential direction, i.e. concentrically. The Appellant has submitted that, the person skilled in the art, aiming at

a relative increase of the filtering effectiveness in the filtering arrangement (see D1, column 1, lines 10 to 15 and 30 to 38), would be incited to use the solutions disclosed in D4 (see column 1, line 26 to column 2, line 25; Figures 1 to 6) or D3 (see the third section of page 3 and Figures 1 to 2) for solving the same problem arising in radial filtering structures and would, in accordance with said solutions, provide supplementary pleats for obtaining a uniform occupancy of filtering material. However, in accordance with D4 or D3, the person skilled in the art would provide radial pleats, and not circumferential pleats, and this step would not lead to the filtering device of Claim 1 in dispute.

2.1.2.3 Moreover, even if the person skilled in the art were incited for any reason, for instance for reasons of geometry related to the structure of the voids (8) of the filter of D1, to look for other supplementary pleat structures and would arrive at a circumferential structure thereof with non uniform circumferential dimensions, the provision of said supplementary pleat structures in the void spaces (8) of the filter of D1 would not result in the filtering device of Claim 1 in dispute, because the already present rows (6) of pleats would be composed of pleats of uniform dimensions and would thus not be such that the zigzag pleats of each radial section have circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure. Therefore, the Board is of the opinion that this argument is not convincing.

2.1.2.4 Thus, the Board is of the opinion that the subject-matter of Claim 1 implies an inventive step in the sense of Article 56 EPC.

2.2 Claim 12

2.2.1 Novelty

2.2.1.1 A filter element including a plurality of zigzag pleats of a filtering sheet material (1) is known from D1; however, in the known device, the zigzag pleats of each radial section have not circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure. It is also to be noted that the substantially radially extending web (9) of the filtering sheet material of the device of D1 is not substantially planar. The other documents of the available prior art do not disclose a filter structure with a plurality of generally circumferential zigzag pleats. Therefore, the Board is of the opinion that the subject-matter of Claim 12 is novel in the sense of Article 54 EPC.

2.2.2 Inventive step

2.2.2.1 The Appellant has not submitted any specific argument concerning Claim 12. Since Claim 12, which relates in particular to the embodiment illustrated by Figure 31 of the patent in suit, also mentions that the zigzag pleats of each radial section have circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure, and since this feature is not derivable from the available prior art, the Board is of the opinion that the subject-matter of Claim 12 implies an inventive step in the sense of Article 56 EPC for the same reasons as those mentioned in relation to Claim 1.

2.3 Claim 17

2.3.1 Novelty

2.3.1.1 A filter element including a plurality of zigzag pleats of a filtering sheet material (1) is known from D1; however, in the known device, the circumferentially zigzag pleats of each row (6) have not circumferential dimensions which are substantially gradually reduced radially inwardly of the ring-like structure. The other documents of the available prior art do not disclose a filter structure with a plurality of generally circumferential zigzag pleats. Therefore, the Board is of the opinion that the subject-matter of Claim 17 is novel in the sense of Article 54 EPC.

2.3.2 Inventive step

2.3.2.1 The Appellant has not submitted any specific argument concerning Claim 17. Since Claim 17, which relates in particular to the embodiment illustrated by Figure 38 of the patent in suit, also mentions that the zigzag pleats of each radial section have circumferential dimensions which are substantially gradually decreased radially inwardly of said ring-like structure, and since this feature is not derivable from the available prior art, the Board is of the opinion that the subject-matter of Claim 17 implies an inventive step in the sense of Article 56 EPC for the same reasons as those mentioned in relation to Claim 1.

2.4 Claims 2 to 11 and 13 to 16 are dependent claims concerning particular embodiments of the invention defined in the independent claims and they are thus also allowable for the same reasons.

2.5 Therefore, the grounds of opposition mentioned in Article 100 EPC do not prejudice the maintenance of the patent unamended (Article 102(2) EPC).

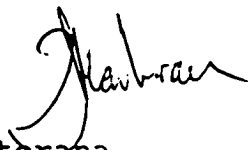
3. Thus, the Board is of the opinion that, since both parties have withdrawn their request for oral proceedings, a decision may be taken and that, since the main request of the Respondent is allowable, it is not necessary to examine his auxiliary requests.

Order

For these reasons, it is decided that:

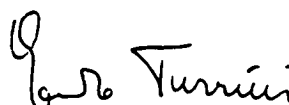
The appeal is dismissed.

The Registrar:



P. Martorana

The Chairman:



E. Turrini

