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File No.: T 0708/92 - 3.4.2

Application No.: 87 905 819.6

Publication No.: 0 381 666

Classification: B01D 13/01

Title of invention: Filter cartridge

**D E C I S I O N**

of 9 July 1993

Applicant: Minntech Corporation

Proprietor of the patent:

Opponent:

Headword:

**EPC:** Art. 56

Keyword: "Inventive step (after amendments, yes)"

**Headnote**  
**Catchwords**



**Case Number:** T 0708/92 - 3.4.2

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.2**  
**of 9 July 1993**

**Appellant:** Minntech Corporation  
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**Representative:** Davies, Jonathan Mark  
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**Decision under appeal:** Decision of the Examining Division of the European Patent Office dated 24 March 1992 refusing European patent application No. 87 905 819.6 pursuant to Article 97(1) EPC.

**Composition of the Board:**

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



## Summary of Facts and Submissions

- I. European patent application No. 87 905 819.6 (publication No. 0 381 666) was refused by the Examining Division on the grounds that the subject-matter of the submitted Claim 1 lacked an inventive step having regard to
- D1: US-A-4 547 289 and  
D2: WO-A-84 01522.
- II. The Appellant (Applicant) lodged an appeal against this decision.
- III. During the oral proceedings of 9 July 1993 which had been auxiliarily requested by the Appellant, it filed new Claims 1 to 7 and requested that the decision under appeal be set aside and that a patent be granted on the basis of said claims, of the description to be adapted and of the drawings as originally filed.
- IV. Claim 1 reads as follows:
- "1. A replaceable hollow fiber cartridge filter for use in a standardized housing comprising:
- a) at least one a (read "at least one") bundle of fluid permeable hollow fibers (17);
- b) a supportive porous sleeve member (18) surrounding said at least one bundle of hollow fibers substantially throughout their length for supporting and confining said fibers;
- c) a cap member (20) joined to said sleeve member at one end thereof;

wherein the filter is adapted for use in a standardized filter housing capable of receiving a filter cartridge of about 6.35 cm O.D. and about 25.4 cm to 32.0 cm overall length, the filter having; (read ":")

d) said cap member (20) being provided with coupling means (21, 22, 23) for one of a -020 Style (2.54 cm diameter), a -222 Style (4.45 cm diameter) or an -226 Style (5.72 cm diameter) fitting;

e) encapsulating means (29) sealing at least the end of said fibers at the coupling means end to one another and to the sleeve member (18) in a gas- and liquid-tight arrangement including sealing (25) between the cap member (20) and the sleeve member (18) at the coupling means end which sealing is formed as a continuous flat-surface joint; while leaving at least the interior of the ends of said hollow fibers adjacent said coupling means open (24), and;

f) said bundle of hollow fibers being of effective length of approximately 20.32 cm to 27.94 cm of effective filtering surface and having filter surface area greater than about 1.40 m<sup>2</sup>;

wherein the packing density of said fibers is from about 40 to 75%; and

wherein said cartridge filter will pass at least 7.57 ml/s of water at a pressure differential across the fiber wall of 6.89 x 10<sup>3</sup> N/m<sup>2</sup>."

Claims 2 to 7 are dependent claims.

V. The Appellant submitted the following arguments in support of its request:

The filter cartridge known from Figure 1 of D1 comprises a hollow frustum-shaped cap member (4) which

is coupled at the wide, base portion thereof to the collected and fixed end of the bundle of hollow fibres, but only along an edge of the upper surface of the collecting and fixing portion (5). Thus, the joining of the cap with the sleeve and the fibres is weak. The present invention solves this problem by using a sealing means (25) between the cap member (20) and the sleeve member (18) which is formed as a continuous flat-surface joint. Such a feature is not suggested in the prior art. In particular, the filter cartridges for filtration of parenteral solutions of D2 are of another type as the filter cartridges of the present application, which are for high differential pressure. Therefore, the presently claimed filter cartridge involves an inventive step.

### **Reasons for the Decision**

1. The appeal is admissible.
2. *Allowability of the amendments*
  - 2.1 The features of present Claim 1 concerning the packing density of the fibres and the water passing capability of the cartridge filter, are based on the original dependent Claims 2 and 3, respectively; the feature that the filter cartridge comprises at least one bundle of fibres is based on original dependent Claims 6 and 7 and Figures 7 and 8, which disclose a plurality of bundles. A second cap member, at the opposite end of the sleeve member, which was comprised in original Claim 1, is not mentioned in present Claim 1, but is shown in all the embodiments either as a second cap

member (19) or as a joining collar or sleeve (32) bonded to the encapsulant joining the ends of the fibres and the sleeve (8) to make a liquid-tight seal, which was also disclosed originally (see page 13, line 34 to page 14, line 14; Figure 7 and 8). The particular feature that the sealing (25) between the cap member (20) and the sleeve member (18) at the coupling means end, which sealing is formed as a continuous flat-surface joint, is disclosed originally in the drawings in relation with all the illustrated embodiments.

Therefore, the European patent application has not been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC).

### 3. *Clarity*

- 3.1 Present Claim 1 does not mention any member at the second, opposite end of the sleeve member in the form of a second cap member (19) or of a joining collar or sleeve (32) bonded to the encapsulant ends of the fibres and the sleeve (18) to make a liquid-tight seal. However, this feature, which is necessary for completing the sealed arrangement of the filter cartridge for isolating the interior of the sleeve (18) from the space in housing (10) surrounding it, is disclosed in all the embodiments (see Figure 4, 7 and 8; see also page 13, line 34 to page 14, line 14) and is thus also implicitly comprised.

Therefore, since Claim 1 comprises all the essential features of the invention and is consistent with the

description and the drawings, it is clear in the sense of Article 84 EPC.

4. *Novelty*

4.1 No replaceable hollow fibre cartridge filter comprising all the features of present Claim 1 is known from the prior art. Therefore, the subject-matter of present Claim 1 is novel in the sense of Article 54 EPC.

5. *Closest prior art*

5.1 A replaceable hollow fibre cartridge filter for use in a housing (1) is known from D1 (see column 1, lines 7 to 17; column 2, lines 28 to 32; column 3, lines 8 to 60; column 4, line 1 to column 5 line 51; column 11, lines 45 to 63; Figure 1); the cartridge filter comprises:

- (a) a bundle (3) of fluid permeable hollow fibres (3');
- (b) a supportive porous sleeve member (6) surrounding said bundle (3) of hollow fibres (3') substantially throughout their length for supporting and confining said fibres;
- (c) a cap member, i.e. the tubular cap member (4) joined to said sleeve member (6) at one end thereof;

the filter is adapted for use in a filter housing capable of receiving a filter cartridge and has:

- (d) said cap member (4) provided with coupling means (the projecting portion (9) of the tubular cap member (4); the O-rings (15) in the projecting portion (9); the portion of the cover (2) of the housing accommodating the projection portion (9)) for a fitting in an opening of the cover (2) of the housing;
  
- (e) encapsulating means (5) fixing and collecting one end of the fibres (3') at the cap member (4) end to one another and to the sleeve member (6); at least the interior of the ends of said hollow fibres (3') adjacent said collecting and fixing portion (5) are left open; a cast moulding material comprising an epoxy material is used in the device of D1 for fixing and collecting the gap formed at the end portion of the hollow fibres (3') and it is thus derivable that it results in a sealing, gas- and liquid-tight assembly in the sense of the present application.

It is also to be noted that the second, bottom ends of the hollow fibres (3') of D1 (see column 1, lines 7 to 9) are closed and that, thus, the fluid can circulate between the exterior and the interior of the fibres only through the lateral walls thereof, as in the present application (see Figure 4, 7 and 8) wherein a second cap member or a joining sleeve is used.

5.2 However, contrary to the presently claimed device wherein in particular the sealing (25) between the cap member (20) and the sleeve member (18) is formed as a continuous flat-surface joint, such a feature is not

derivable in relation with the example illustrated by Figure 1 of D1.

Indeed, there is no indication about the specific coupling means at the location of the cap member; in particular, it is not derivable from D1 that the necessary sealing of sleeve (6) and cap member (4) is formed as a continuous flat-surface joint while leaving at least the interior of the ends of said hollow fibres adjacent the coupling means (5) open.

On the one hand, taking into account Figure 2 of D1, it is derivable that a flat joint between the second cap member (36) and the fixing and collecting means (5'), used for the bottom ends of the fibres, is shown as such with one part (36) partially surrounding the other part (5'). On the other hand, the fixing and collecting portion (5) is shown in Figures 10 to 15 as a generally plain cylindrical part with no protruding part to be inserted in the cap member (20) or cavity for the cap member (20) to be inserted therein. Moreover, it is to be noted that the examples of filters of D1 (see column 5, line 64 to column 6, line 39; Figure 4 to 9) showing a different type of joining between the joining and collecting portion (5) and the cover (2) of the filter use O-rings (15) around said portion (15) for sealing or use an intermediate ring (24) united with a ring-like plate (25) fixedly connected with the housing, and not with the cover.

A continuous flat-surface sealing joint between the fixing and collecting portion (5) and the cover (2) or cap member (4) is thus not derivable from D1. Therefore, the Appellant's argument that the hollow

frustum-shaped cap member (4) is coupled at the wide, base portion thereof to the collected and fixed end of the bundle, only along an edge of the upper surface of the collecting and fixing portion (5), can be accepted.

5.3 Incidentally, it can also be noted that the dimensional requirements for standardized fittings and the filtering capabilities of the presently claimed device corresponding to the use with standard filter housings, are not directly derivable from D1.

5.4 It is to be noted that, since in view of the differences between the claimed subject-matter and the prior art a main claim consisting of a statement and of a characterising portion would result in a complicated text, said form of the claim is not appropriate (Rule 29(1) EPC).

5.5 The filter known from D2 (see page 4, line 1 to page 6, line 10; see also Figures 1 to 6) includes a longitudinal central tube (18, 44) and longitudinal hollow fibres (20, 46), all open at both ends; the bundle of hollow fibres (20, 46) is surrounded by a cylindrical housing (12; 42), said housing having either a plurality of perforations (13) or inlet and outlet connections (60, 62); there is no sleeve surrounding the fibres (20, 46); the open tube is for "shunting" between the chambers at both ends of the filter. Thus, the filter has no means for adapting it to a standardized filter housing in the sense of the present application and, therefore, D2 is less relevant.

6. *Problems of the prior art and objects of the invention*

6.1 As convincingly argued by the Appellant, since in the device of Figure 1 of D1 (see also Claim 1 and column 4, lines 19 to 30) the hollow frustum-shaped cap member (4) is coupled at the wide, base portion thereof to the collected and fixed end of the bundle only along an edge of the upper surface of the collecting and fixing portion (5), the attachment between cap member (4) and collecting and fixing portion (5) has a limited tension-loading capability and is weak; thus, the joint can break or separate easily when subjected to a longitudinal pulling force. Therefore, the following drawbacks may result:

- the cap member (4) and fixing portion (5) can break apart easily during shipping due to shipping movements such as rocking and stress;
- in addition, during a filtration process, differential pressure must be applied in order to cause the unfiltered fluid to penetrate the hollow fibres and rise toward the exit chamber (20); frequently, too much pressure is applied and the cap member (4) will separate or "blow" from the fixing portion (5) resulting in inefficient filters;
- furthermore, since the bond between the cap member (4) and the fixing portion (5) is inherently weak, there is a likelihood that contaminated fluid from the water chamber (19) will "seep" through a fissure in the seal between the parts (4) and (5) thus mixing unfiltered fluid with filtrate.

The present invention credibly solves these problems by using a continuous flat surface sealed joint between

the cap member and the sleeve member surrounding the opened hollow fibres.

- 6.2 It is also to be noted that the problem mentioned in the present application (see page 1, line 14 to page 3, line 9; Figures 1, 2, 3A and 3B) in relation with other prior art cartridges comprising pleated membranes with void space between the pleats and thus with only a limited filtering capability, is also credibly solved by the present invention which uses bundles of hollow fibres having a higher packing density.

7. *Inventive step*

- 7.1 As convincingly argued by the Appellant, D1 is mainly concerned with the problem of avoiding drawbacks due to the weak sealing capabilities of "mechanical sealing means" such as O-rings (15) between the housing and the cap member, and not with the problem of sealing between sleeve and cap member. Moreover, the flat joint shown in the example of Figure 2 of D1 (see column 5, lines 42 to 51) is for connecting to a supporting member (36) and is not derivable as being a sealing joint because in the context of D1, with sealed bottom ends of the hollow fibres, this is not necessary.

Indeed, in the device known from D2 (see in particular page 1, lines 2 to 15; page 10, line 18 to page 11, line 30; Figure 6), the lower manifold (50) covers first end (48) of the filter; upper manifold (54) covers the second end (50) of the filter to define a closed chamber (58) enclosing said second end; from Figure 6 it is derivable that the mechanical connection between the manifolds and the housing (42) is between

flat surfaces thereof; however, this microfilter is for filtration of medical fluids and there is no derivable need for a sealant at said connecting location in said low pressure technique.

- 7.2 The other prior art documents are less relevant.
- 7.3 Therefore, since in particular there is no obvious suggestion from the prior art for a filter cartridge comprising a continuous flat surface sealing and joining between the cap member and the sleeve, the subject-matter of present Claim 1 involves an inventive step in the sense of Article 56 EPC.
8. Thus, present Claim 1 is allowable (Article 52(1) EPC).
9. Therefore, since Claims 2 to 7 are dependent claims, they are also allowable.
10. Since the application and the invention to which it relates meet the requirements of the EPC, a European patent can be granted (Article 97(2) EPC).

## Order

### For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Examining Division with the order to grant a patent on the basis of the Appellant's request, consisting of Claims 1 to 7 filed during the oral proceedings of 9 July 1993, a description to be adapted and the drawings as originally filed.

The Registrar:

The Chairman:

E. Görgmaier

E. Turrini