

**(12) STANDARD PATENT**  
**(19) AUSTRALIAN PATENT OFFICE**

(11) Application No. **AU 2006209162 B2**

(54) Title  
**Gasket assembly for plate heat exchanger**

(51) International Patent Classification(s)  
**F28F 3/10** (2006.01)

(21) Application No: **2006209162** (22) Date of Filing: **2006.01.13**

(87) WIPO No: **WO06/080874**

(30) Priority Data

(31) Number	(32) Date	(33) Country
<b>0500216-7</b>	<b>2005.01.28</b>	<b>SE</b>

(43) Publication Date: **2006.08.03**

(44) Accepted Journal Date: **2010.06.03**

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(56) Related Art  
**EP 1001240**  
**EP 0864837**  
**JP 2003-106782**  
**JP 06-300475**  
**WO 1999/035457**  
**GB 809886**

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
3 August 2006 (03.08.2006)

PCT

(10) International Publication Number  
**WO 2006/080874 A1**

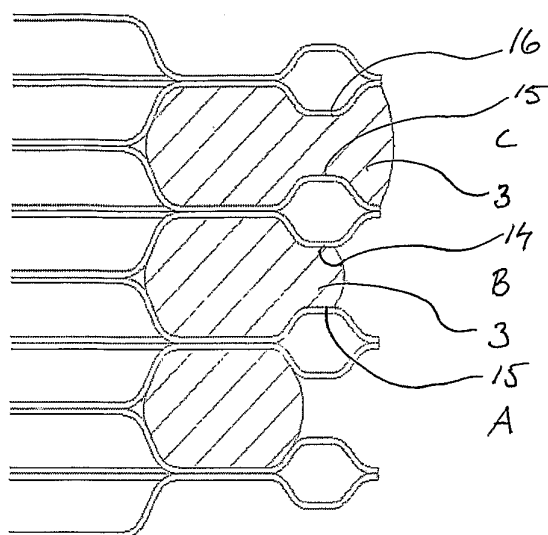
- (51) International Patent Classification:  
*F28F 3/10* (2006.01)
- (21) International Application Number:  
PCT/SE2006/000049
- (22) International Filing Date: 13 January 2006 (13.01.2006)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
0500216-7      28 January 2005 (28.01.2005)    SE
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**  
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: GASKET ASSEMBLY FOR PLATE HEAT EXCHANGER



(57) Abstract: The invention relates to a gasket assembly of a plate heat exchanger, comprising at least one gasket (3) and a package of heat exchanger plates (2) which are provided with inlet and outlet ports (4,5,6,7) which constitute channels through the package and between the heat exchanger plates, whereby the heat exchanger plates are permanently joined in pairs to constitute cassettes (1), the gasket is disposed between the cassettes in a groove (12) in the heat exchanger plates and delimits in combination with the cassettes in every second space between plates a first flow passage for a first fluid, and the cassettes delimit a second flow passage for a second fluid. The gasket in the area around the ports comprises along its side facing the porthole a circumferential protruding bead (14). The invention also relates to a plate heat exchanger comprising the gasket unit, a heat exchanger plate and a gasket according to the invention.

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## GASKET ASSEMBLY FOR PLATE HEAT EXCHANGER

### Field of the invention

The present invention relates to a gasket assembly of a plate heat  
5 exchanger, comprising at least one gasket and a package of heat  
exchanger plates which are provided with inlet and outlet ports which  
constitute channels through the package and between the heat  
exchanger plates, whereby the heat exchanger plates are permanently  
joined in pairs to constitute cassettes, the gasket is disposed between the  
10 cassettes in a groove in the heat exchanger plates and delimits in  
combination with the cassettes, in every second space between plates, a  
first flow passage for a first fluid, and the cassettes delimit a second flow  
passage for a second fluid. The invention also relates to a plate heat  
exchanger comprising the gasket assembly, a heat exchanger plate and  
15 a gasket according to the invention.

### Background to the invention

Food manufacture is typically characterised by the need to process and  
treat highly viscous products, e.g. concentrates for carbonated  
20 beverages, juices, soups, dairy products and other products of fluid  
consistency. For natural reasons, the hygiene aspirations and  
expectations in this context are extremely high to enable the  
requirements of various authorities to be met.

25 Plate heat exchangers are used in the food industry for a number of  
different purposes. Problems with regard to so-called dead zones, the  
accumulation of fibres and other solid material which may be contained in  
products, and the possibility of flexible and effective cleaning, are  
extremely important factors in this context. The design of heat  
30 exchangers therefore plays a crucial part in making it possible for

effective heat transfer and hygiene to be achieved while at the same time preventing so-called dead zones in which products may be caught and hence become fertile ground for bacteria growth.

- 5 In this context it is advantageous to use so-called semiwelded plate heat exchangers, i.e. heat exchangers comprising a number of cassettes formed by welding heat exchanger plates together in pairs. The weld seam normally runs along the side edges of the cassettes and around the portholes. A gasket is disposed between the respective cassettes and is
- 10 normally made of a rubber material and situated in a groove of the heat exchanger plate. One fluid flows inside the cassettes, and another fluid between the cassettes. Semiwelded plate heat exchangers tolerate relatively high pressures and make it possible to open the plate package and clean the spaces between pairs of welded heat exchanger plates.
- 15 The welds which replace the gaskets in every second space between plates round the heat exchange surface of the heat exchanger plates reduce the need for gasket replacement and enhance safety.

The material and configuration of the heat exchanger plates, the design

20 of the heat transfer surfaces with regard to pattern and press depth, etc., are important factors in hygienic applications. A critical region of heat exchangers and particularly of heat exchanger plates with regard to dead zones is at the portholes, which are normally provided with a number of so-called nibs, i.e. alternating ridges and valleys, evenly distributed about

25 the porthole in the form of a wave pattern. These nibs constitute contact points and have the important function of absorbing forces and supporting the structure against the high pressures which occur in the heat exchanger. When two or more heat exchanger plates are placed adjacent to one another, however, the nibs result in the formation of

30 spaces in the actual flow passage, i.e. dead zones in which flowing liquid

may become stationary and solid material contained in the liquid may be trapped and accumulate.

5 The gaskets currently used with heat exchanger plates of this type joined together to constitute cassettes take the form of, for example, so-called "clip-on" gaskets, i.e. gaskets locked firmly at the periphery of the heat exchanger plates and around the portholes by protruding locking means disposed in the gasket which are clamped firmly around the edge of the heat exchanger plate. These protruding locking means may also make it  
10 more likely that fibres etc. are caught, especially at the portholes.

GB 809 886 describes a plate heat exchanger for two heat-exchanging fluids whereby the portholes are made circular and plain in order to avoid the problem of fibres and particles being caught. That solution is achieved  
15 by the edge of the porthole being pressed outwards to form a flange or collar. The flanges of opposite portholes are so disposed as to abut against one another, thereby forming a smooth channel through the plate package. That solution does however involve manufacturing difficulties.

20 Any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material formed part of the prior art base or the common general knowledge in the relevant art in Australia on or before the priority date of the claims herein.

25

### **Summary of the invention**

According to an aspect of the present invention there is provided a gasket assembly of a plate heat exchanger, comprising at least one gasket and a package of heat exchanger plates which are provided with through inlet  
30 and outlet ports which constitute channels through the package and

- between the heat exchanger plates, whereby the heat exchanger plates are permanently joined in pairs to constitute cassettes, a said gasket being disposed between the cassettes in a groove in the heat exchanger plates and delimits in combination with the cassettes in every second space
- 5 between plates a first flow passage for a first fluid, and the cassettes delimit a second flow passage for a second fluid, wherein said gasket in the area around the ports comprises along its side facing the port a circumferential protruding bead which is so configured that the gasket in the area around the ports comprises along its side facing the port opposite recesses on the
- 10 upper and lower sides of the gasket and that the heat exchanger plate has around the ports a circumferential ridge provided on the outside of the cassette between the port and the gasket groove, and that the bead of the gasket abuts against the circumferential ridge around the port.
- 15 Further preferred features of this invention may be as defined in the dependent claims 2 to 6 annexed hereto, which claims are hereby made part of the disclosure of this invention.

20 Comprises/comprising and grammatical variations thereof when used in this specification are to be taken to specify the presence of stated features, integers, steps or components or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

25 **Brief description of the drawings**

The invention is explained in more detail below by describing various embodiments cited by way of examples with reference to the attached drawings, in which

Fig. 1 depicts schematically a plan view of a gasket assembly comprising a gasket and a heat exchanger plate according to the invention,

Fig. 2 depicts schematically a plan view on a larger scale of the gasket assembly according to the invention,

Fig. 3 depicts schematically a cross-sectional view of various gaskets, whereby the gasket according to A represents a known gasket and the gaskets according to B and C are two alternative embodiments of the gasket according to the invention which are disposed at the porthole of a plate heat exchanger according to the invention, and

Fig. 4 depicts a perspective view of the porthole of a gasket assembly according to the invention.

#### Detailed description of preferred embodiments of the invention

Figs. 1 and 2 depict a cassette 1 comprising two heat exchanger plates 2 permanently joined together and a gasket 3 according to the invention. The plates have at least four ports constituting inlet and outlet ports 4, 5, 6, 7 and a heat transfer surface 8 with ridges 9 and valleys 10. The cassette 1 may be made by welding or brazing, whereby the two plates 2 are joined together permanently along their periphery and around at least two of ports 4, 5.

Configuring the heat exchanger plates 2 in such a way that as few contact points as possible occur between two mutually adjacent cassettes prevents fibres and solid materials which may be contained in the fluid being caught in the space between the cassettes. According to the invention, the plates are also so designed that contact points for necessary mechanical support occur largely only on the inside, between two plates which are to be joined together to form a cassette, by opposite ridges abutting against one another. In contrast, at portholes 4 and 5 the plates abut completely against one another and are joined together



permanently so as to form a seal against the fluid which is intended to flow through the portholes. Portholes 6 and 7, which constitute the inlet and outlet to the cassettes, are provided instead with nibs 11 which are necessary for providing necessary mechanical support at the porthole.

5

The gasket 3, which is preferably made of an elastic material, e.g. rubber material, is disposed in a groove 12 which extends along the periphery of the constituent plates of the cassette and around ports 4 and 5. There is a ring gasket 13 round ports 6 and 7. The purpose of the gasket 3 is to seal the space between two cassettes, and it has in the area around ports 10 4 and 5, along its side facing the porthole, a circumferential protruding bead 14 which may have a cross-sectional configuration such as represented, for example, by the gaskets according to B and C in Fig. 3. The gasket may possibly comprise a metal or be surrounded by a second 15 material, e.g. metal, PTFE, etc.

To ensure that the gasket 3 is firmly disposed at the porthole and is not pressed or does not slip out of the groove 12 at high pressures and temperatures, a circumferential ridge 15 is formed in the plate about the 20 port on the outside of the cassette between porthole 4 or 5 and the gasket groove 12. The height of the ridge 15 is such that there is a gap between two opposite ridges when two cassettes are disposed adjacent to one another. In the case of the gasket assembly according to the invention, the gasket 3 is thus situated in the groove 12 in such a way 25 that the bead 14 abuts against the ridge 15 of the constituent plates of the cassettes at portholes 4 and 5. This arrangement results in the gasket being held securely in position while at the same time a tight, plain and smooth surface is formed in porthole 4 or 5 and in the port channel, as clearly indicated in Fig. 4.

30

Fig. 3 shows how the volume of the dead zone is affected by the cross-sectional configuration of the gasket. When the gasket 3 has a configuration according to A, i.e. is provided with no bead 14, there is a large space bounded by the gasket A and the heat exchanger plate at the porthole, which is normally surrounded by nibs. This so-called dead zone traps fluid, whereby fibres and other solid materials are caught and thus constitute fertile ground for growth of bacteria.

In contrast, if the cross-sectional configuration of the gasket is in accordance with the invention according to B, i.e. so that the gasket in the area around the ports comprises along its side facing the porthole a circumferential protruding bead 14, the volume of the dead zone will be greatly reduced. The fact that the bead 14 abuts against the ridge also results in a smoother surface in the port channel. In another embodiment of the invention, the gasket has a cross-sectional configuration according to C, whereby the bead 14 is so configured that the gasket 3 in the area around the ports comprises, along its side facing the porthole, opposite recesses 16 on the upper and lower sides of the gasket. In this case the whole space at the portholes between two cassettes is largely filled by the gasket, the dead zone is eliminated and a plain smooth surface is formed in the port channel.

A gasket assembly configured according to the invention whereby a ridge around the porthole in a heat exchanger plate cooperates with a bead of the gasket results in a port channel with maximum possible smoothness of surface, with greatly reduced or no dead zones. This is of great significance, particularly in plate heat exchanger applications where there are strict hygiene requirements, but also in other applications where obstruction and so-called fouling are normally a problem. The gasket assembly and the heat exchanger comprising the gasket assembly

according to the invention make it possible to achieve a plate heat exchanger which meets high hygiene requirements and is easy to clean.

It should be noted that other embodiments not here cited of the invention  
5 are also possible without departing from the scope of the invention which  
is indicated in the attached claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A gasket assembly of a plate heat exchanger, comprising at least one gasket and a package of heat exchanger plates which are provided with through inlet and outlet ports which constitute channels through the package and between the heat exchanger plates, whereby the heat exchanger plates are permanently joined in pairs to constitute cassettes, a said gasket being disposed between the cassettes in a groove in the heat exchanger plates and delimits in combination with the cassettes in every second space between plates a first flow passage for a first fluid, and the cassettes delimit a second flow passage for a second fluid, wherein said gasket in the area around the ports comprises along its side facing the port a circumferential protruding bead which is so configured that the gasket in the area around the ports comprises along its side facing the port opposite recesses on the upper and lower sides of the gasket and that the heat exchanger plate has around the ports a circumferential ridge provided on the outside of the cassette between the port and the gasket groove, and that the bead of the gasket abuts against the circumferential ridge around the port.
2. A gasket assembly according to claim 1, wherein the bead is so configured that the cassettes in combination with the gasket at the ports provide a substantially smooth channel through the package.
3. A gasket assembly according to any one of claims 1 or 2, wherein the heat exchanger plates are permanently joined in pairs by welding.
4. A gasket assembly according to any one of claims 1 or 2, wherein the heat exchanger plates are permanently joined in pairs by brazing.

5. A plate heat exchanger comprising at least one gasket assembly according to any one of claims 1-4.
6. A gasket for a gasket assembly according to any one of claims 1-4.
7. A gasket assembly substantially as herein described with reference  
5 to the accompanying drawings.

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P28947AU00

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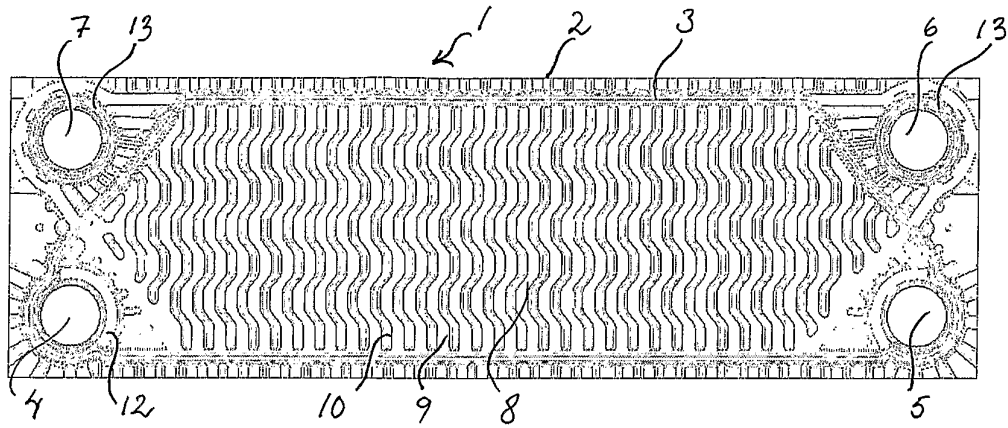


FIG 1

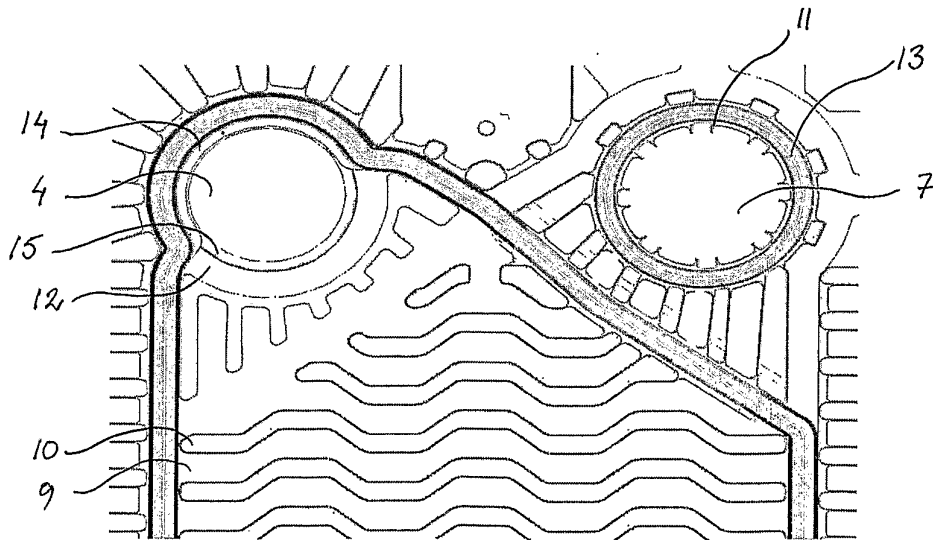


FIG 2

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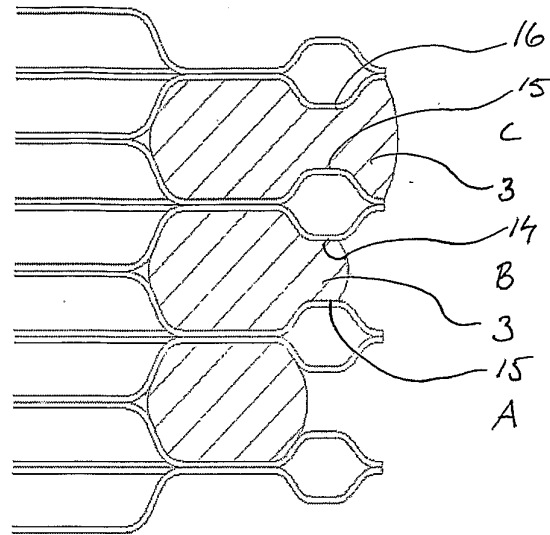


FIG 3

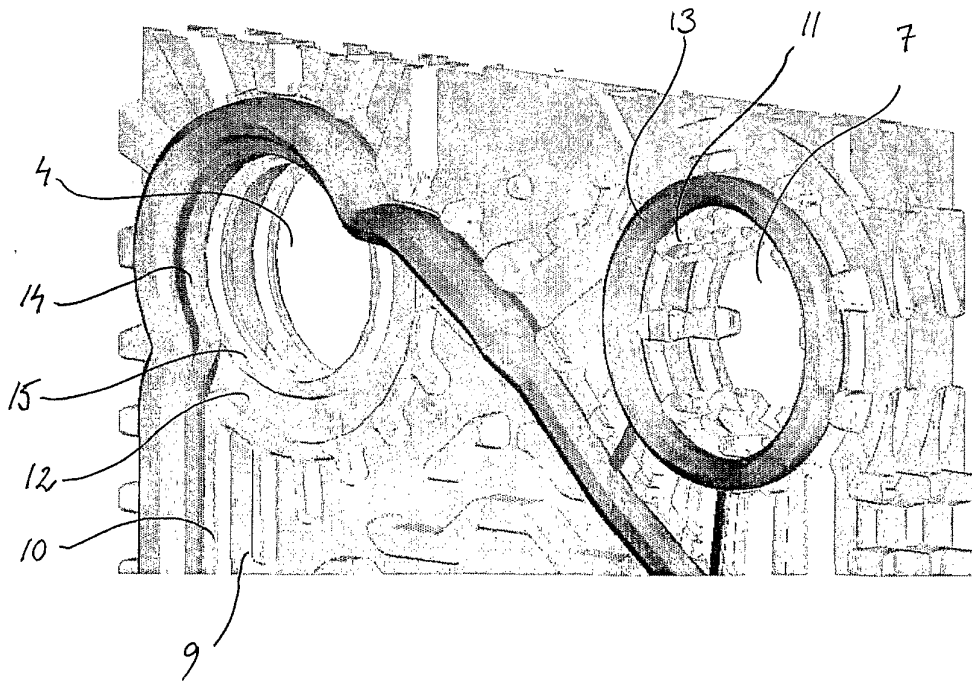


FIG 4