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(54) **GASKET FOR A PLATE HEAT EXCHANGER.**

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Description

This invention relates to a plate heat exchanger having a gasket sealing between two adjacent plates, the space between the plates forming a passage for a heat exchanging medium.

A plate heat exchanger comprises several plates, usually mounted in a frame and substantially rectangular. The plates are sealed to each other by means of edge gaskets and between the plates are formed heat transfer areas in the form of parallel-connected heat exchanging passages for through-flow of heat exchanging media. These media are conducted to and from the heat exchanger via inlets and outlets arranged at one of its ends, the plates at their corner regions being provided with openings for forming inlet channels and outlet channels for the heat exchanging media.

Such plate heat exchangers are manufactured in different sizes of plates, the heat transfer areas of which can range from a few square decimeters to several square meters. The plate material is chosen with regard to the field of use but usually comprises stainless or acid-resistant steel. For certain purposes titanium is used, which has excellent resistance against salt water but is very expensive.

The edge gaskets sealing between the plates generally consist of rubber of varying qualities. The sealing pressure of the rubber gaskets is applied when the plate package is clamped within the frame by means of tie bolts, and is maintained by the elasticity of the rubber.

A plate heat exchanger can be easily dismantled and inspected or cleaned and thereafter reassembled again as long as the gaskets maintain their elasticity and their form. At moderate temperatures, below 70—80°C, the gaskets have as long a life as 5—8 years. At higher temperatures, more than 100°C, however, the gaskets tend to collapse and lose their original form and by that their sealing capability is impaired. Under such circumstances the gaskets have to be exchanged once per year or even more often, which is an expensive procedure. The limitation of the gasket as to temperature and life makes it the weak link of the plate heat exchanger.

According to a known gasket shown in DE—B—1.149.027, the gasket between the plates of the heat exchanger consists of an elastic gasket of a round cross section. In order to prevent the gasket being compressed too strongly two harder elements of round cross section are located one on each side of the gasket, to contact the plates and limit the compressive loading on the softer sealing element.

This known gasket assembly suffers several drawbacks. Firstly, it is unnecessarily complicated and expensive, since it contains three separate elements. Secondly, the apparatus requires a broad gasket groove, i.e. a large, lateral space, which reduces the surface areas of the heat exchanger plates available for heat exchange. Thirdly, the sealing capability of the gasket assembly will still deteriorate rapidly if the heat exchanging medium has a high temperature, since the elastic sealing gasket will lose its elasticity as explained above.

In DE—B—1.207.947 there is disclosed a sealing arrangement consisting of elastic elements which are put into a holder of an inelastic material, which follows the outer edges of the heat exchanger plates. Even this apparatus occupies a relatively large, lateral space and limits in that way the heat surface of heat exchanger plates. Further, the apparatus is of such a nature that one type of holder is required for each size of the heat exchanger plate, which means a great cost for this sealing arrangement. Moreover, the elastic elements in the holder are subjected to external influence when using hot heat exchanging media, which means short life for these elements under hard conditions.

This invention aims at avoiding the problems of the known techniques, and in accordance with a first proposal provides a plate heat exchanger comprising a gasket sealing between two adjacent plates, a space between the plates forming a passage for a heat exchange medium, and the gasket comprising a wire of hard, essentially inelastic material, bridging a major part of the distance between the two plates, characterised in that the wire forms a seal between the adjacent plates, and the wire at least at certain places along the length thereof cooperates with an adjacent plate through an intervening layer of sealing material interposed between an outermost limiting surface of the wire and the adjacent plate so that the heat exchange medium cannot pass between the wire and plate, said sealing material being softer than the material of the wire.

According to an alternative proposal the invention provides a plate heat exchanger comprising a gasket sealing between two adjacent plates, a space between the plates forming a passage for a heat exchange medium, and the gasket comprising a wire of hard, essentially inelastic material bridging a major part of the distance between the two plates, characterised in that the wire is of metallic material and forms a seal between the adjacent plates, and the wire is connected with an adjacent plate at least at certain places by means of solder or welding.

The invention shall hereafter be described in more detail with reference to the accompanying drawing which shows some exemplary embodiments of the invention.

In the drawing there are shown heat exchanger plates 1 provided with grooves 2 in which a sealing element 3 is located. The sealing element 3 forms a seal between the two adjacent plates 1 for preventing leakage of a medium streaming in the channel 4 between these plates 1.

The sealing element 3 comprises a round wire which is preferably made of the same metallic material as the plates, and serves as a bridging component between the plates 1.

During assembly the metal wire 3 is put into the gasket groove 2 and is formed to follow the path

of the groove in the plate. The round metal profile allows itself to be easily bent without having its cross section deformed. The ends of the metal wire 3 are joined to provide the final form, preferably by butt welding, whereafter the weld joint is ground.

The material metal is mentioned but another hard and resistant material can be used. Likewise, the wire profile can have another form than round.

A thin-walled metal tube is preferably used, and can be somewhat more flexible than a solid metal wire.

The bridging metal wire 3 has a diameter that substantially corresponds to the distance between two adjacent plates 1.

The wires in the different channels in a plate package support each other over most of the gasket grooves, but not at the ports, where every second gasket is omitted so that liquid can stream into the channels.

Thus, the sealing pressure metal wire-plate surface may be low in certain parts of the sealing length, and, therefore, in case the metal wire cannot independently manage the sealing against the plates, the sealing function of the metal wire is improved, at least in these places.

This sealing function can be arranged in several ways:

A) Co-operation of the wire with the plates through layers of a soft material, for instance rubber and/or plastics material, the wire being coated with the soft material;

B) Co-operation of the wire with the plates through layers of a soft material, for instance rubber and/or plastics material, the sealing surfaces of the plates being coated with the soft material;

The coating with the soft material according to A) and B) is preferably made in such a way that when applying the wire between the plates the wire is attached to the plates.

C) Connection of the wire with the plates by means of

I) a temperature and liquid resistant glue;

II) soldering;

III) welding.

The different ways A—C are shown in the drawing, where the coating layer is denoted by the numeral 5 and the joint connections in the form of glued joint, soldered seam or weld joint by the numeral 6.

In certain applications the metal wire is connected with the plates along all its length.

In those cases when the whole metal wire is connected with the plates by means of soldering the connection is preferably made in the following way:

The metal wire is put into the gasket groove of the plate, whereafter the plate with wire is covered by a solder sheet. On the top of this is put another plate with wire and a solder sheet and so on. When heated in a suitable way the solder sheets melt and through influence of the capillary force the solder flows into the spaces between the metal wires and the plates.

The metal wires need not lie in the same plane and support each other, but can be displaced in relation to each other in the gasket grooves, the material of the plate being able to yield and take up movements when the wires expand during heating.

There are several advantages connected with the described sealing arrangements of the invention. Firstly, they are very simple and cheap both to produce and apply. Secondly, only a narrow gasket groove is required, whereby only a very small reduction of the heat surface of the heat exchanger plates is suffered. Thirdly, in contrast to conventional rubber gaskets, the gaskets of the invention are suitable for use in heat exchangers for hot and aggressive media, because the main component of the gasket comprises a wire that bridges the distance between the plates, which wire is preferably made of metal and at least at certain places co-operates with a plate through a sealing layer or is connected to the plate by soldering or welding.

Claims

1. A plate heat exchanger comprising a gasket sealing between two adjacent plates (1), a space (4) between the plates forming a passage for a heat exchange medium, and the gasket comprising a wire (3) of hard, essentially inelastic material, bridging a major part of the distance between the two plates (1), characterised in that the wire forms a seal between the adjacent plates, and the wire (3) at a continuous line along the length thereof co-operates with an adjacent plate through an intervening layer (5, 6) of sealing material interposed between an outermost limiting surface of the wire (3) and the adjacent plate (1) so that the heat exchange medium cannot pass between the wire (3) and plate, said sealing material (5, 6) being softer than the material of the wire.

2. A plate heat exchanger according to claim 1, wherein the wire (3) is flexible and put into a groove (2) of one plate (1), the wire being formed to follow the path of the groove.

3. A plate heat exchanger according to claim 1 or 2, wherein in place of the wire (3) a thin-walled metal tube is used.

4. A plate heat exchanger according to any one of the preceding claims, wherein the cross section of the wire (3) has the form of a circle.

5. A plate heat exchanger according to any one of the preceding claims, wherein the wire (3) is coated with the sealing material.

6. A plate heat exchanger according to any one of claims 1 to 4, wherein the sealing surfaces of the plates (1) are coated with the sealing material.

7. A plate heat exchanger according to claim 5 or 6, wherein the sealing material comprises rubber and/or plastics material.

8. A plate heat exchanger according to any one of claims 1 to 4, wherein said sealing material (6) is glue connecting the wire (3) with the plates (1).

9. A plate heat exchanger according to claim 1, wherein the layer of sealing material (5, 6) is interposed between the plate and wire along the

whole length of the wire (3).

10. A plate heat exchanger according to claim 1 or 8, wherein layers of the sealing material are interposed between the wire (3) and each of the two plates (1) between which the wire is disposed.

11. A plate heat exchanger comprising gasket sealing between two adjacent plates (1), a space (4) between the plates forming a passage for a heat exchange medium, and the gasket comprising a wire (3) of hard, essentially inelastic material, bridging a major part of the distance between the two plates (1), characterised in that the wire is of metallic material and forms a seal between the adjacent plates, and the wire (3) is connected with an adjacent plate (1) at least at certain places by means of solder or welding.

12. A plate heat exchanger according to claim 11, wherein the wire is connected by a solder joint (6) or a weld joint (6) to each of the two adjacent plates along the whole length of the wire.

Patentansprüche

1. Plattenwärmetauscher, mit einer zwischen zwei benachbarten Platten (1) abdichtenden Dichtung und einem Raum (4) zwischen den Platten, der einen Kanal für ein Wärmetauschermedium ausbildet, wobei die Dichtung einen Draht (3) aus hartem, im wesentlichen unelastischem Material aufweist, der einen größeren Teil des Abstandes zwischen den beiden Platten (1) überbrückt, dadurch gekennzeichnet, daß der Draht eine Dichtung zwischen den benachbarten Platten ausbildet und der Draht (3) über eine kontinuierliche Strecke seiner Länge mit einer benachbarten Platte durch eine eingeschaltete Schicht (5, 6) aus Dichtungsmaterial kooperiert, welches zwischen einer äußersten Grenzfläche des Drahtes (3) und der benachbarten Platte (1) angeordnet ist, so daß das Wärmetauschermedium nicht zwischen dem Draht (3) und der Platte hindurchtreten kann, wobei dieses Dichtungsmaterial (5, 6) weicher ist als das Material des Drahtes.

2. Plattenwärmetauscher nach Anspruch 1, bei dem der Draht (3) flexibel ist und in eine Nut (2) einer Platte (1) eingesetzt ist, wobei der Draht so geformt ist, daß er dem Verlauf der Nut folgt.

3. Plattenwärmetauscher nach Anspruch 1 oder 2, bei dem an Stelle des Drahtes (3) eine dünnwandige Metallröhre verwendet wird.

4. Plattenwärmetauscher nach einem der voranstehenden Ansprüche, bei dem der Querschnitt des Drahtes (3) die Form eines Kreises hat.

5. Plattenwärmetauscher nach einem der voranstehenden Ansprüche, bei dem der Draht (3) mit dem Dichtungsmaterial überzogen ist.

6. Plattenwärmetauscher nach einem der Ansprüche 1 bis 4, bei dem die Dichtflächen der Platten (1) mit dem Dichtungsmaterial überzogen sind.

7. Plattenwärmetauscher nach Anspruch 5 oder 6, bei dem das Dichtungsmaterial Gummi und/oder Kunststoffmaterial umfaßt.

8. Plattenwärmetauscher nach einem der Ansprüche 1 bis 4, bei dem das Dichtungsmaterial (6) Klebstoff ist, der den Draht (3) mit der Platte (1) verbindet.

9. Plattenwärmetauscher nach Anspruch 1, bei dem die Schicht aus dem Dichtungsmaterial (5, 6) zwischen der Platte und dem Draht über die ganze Länge des Drahtes (3) eingesetzt ist.

10. Plattenwärmetauscher nach Anspruch 1 oder 8, bei dem die Schichten aus dem Dichtungsmaterial zwischen dem Draht (3) und jedem der zwei Platten (1) ingesetzt sind, zwischen denen der Draht angeordnet ist.

11. Plattenwärmetauscher, mit einer zwischen zwei benachbarten Platten (1) abdichtenden Dichtung und einem Raum (4) zwischen den Platten, die einen Kanal für ein Wärmetauschermedium ausbilden, wobei die Dichtung einen Draht (3) aus hartem, im wesentlichen unelastischem Material aufweist, der einen größeren Teil des Abstandes zwischen den zwei Platten (1) überbrückt, dadurch gekennzeichnet, daß der Draht aus metallischem Material besteht und eine Dichtung zwischen den benachbarten Platten ausbildet, wobei der Draht (3) mit einer benachbarten Platte (1) zumindest an bestimmten Orten mittels Lötung oder Schweißung verbunden ist.

12. Plattenwärmetauscher nach Anspruch 11, bei dem der Draht durch eine Lötverbindung (6) oder eine Schweißverbindung (6) mit jedem der zwei benachbarten Platten über die gesamte Länge des Drahtes verbunden ist.

Revendications

1. Echangeur thermique à plaques comprenant un joint d'étanchéité situé entre deux plaques contiguës (1), un espace (4) entre les plaques formant un passage pour un agent caloporteur, et le joint comprenent un fil (3) en matière dure, essentiellement non élastique, comblant une majeure partie de la distance entre les deux plaques (1), caractérisé en ce que le fil forme un joint d'étanchéité entre les plaques contiguës, et le fil (3), sur une ligne continue sur sa longueur coopère avec une plaque contiguë par une couche intermédiaire (5, 6) de matière d'étanchéité interposée entre la surface limite la plus extérieure du fil (3) et la plaque contiguë (1), de sorte que l'agent caloporteur ne peut passer à travers le fil (3) et la plaque, la matière d'étanchéité (5, 6) étant plus molle que la matière du fil.

2. Echangeur thermique à plaques selon la revendication 1, caractérisé en ce que le fil (3) est flexible et placé dans une rainure (2) d'une plaque (1), le fil étant formé de façon à suivre le parcours de la rainure.

3. Echangeur thermique à plaques selon la revendication 1 ou 2, caractérisé en ce qu'à la place du fil (3) on utilise un tube métallique à parois minces.

4. Echangeur thermique à plaques selon l'une quelconque des revendications précédentes, caractérisé en ce que la section transversale du fil (3) a la forme d'un cercle.

5. Echangeur thermique à plaques selon l'une

quelconque des revendications précédentes, caractérisé en ce que le fil (3) est revêtu de la matière d'étanchéité.

6. Echangeur thermique à plaques selon l'une quelconque des revendications 1 à 4, caractérisé en ce que les surfaces d'étanchéité des plaques (1) sont revêtues de la matière d'étanchéité.

7. Echangeur thermique à plaques selon la revendication 5 ou 6, caractérisé en ce que la matière d'étanchéité comprend du caoutchouc et/ou une matière plastique.

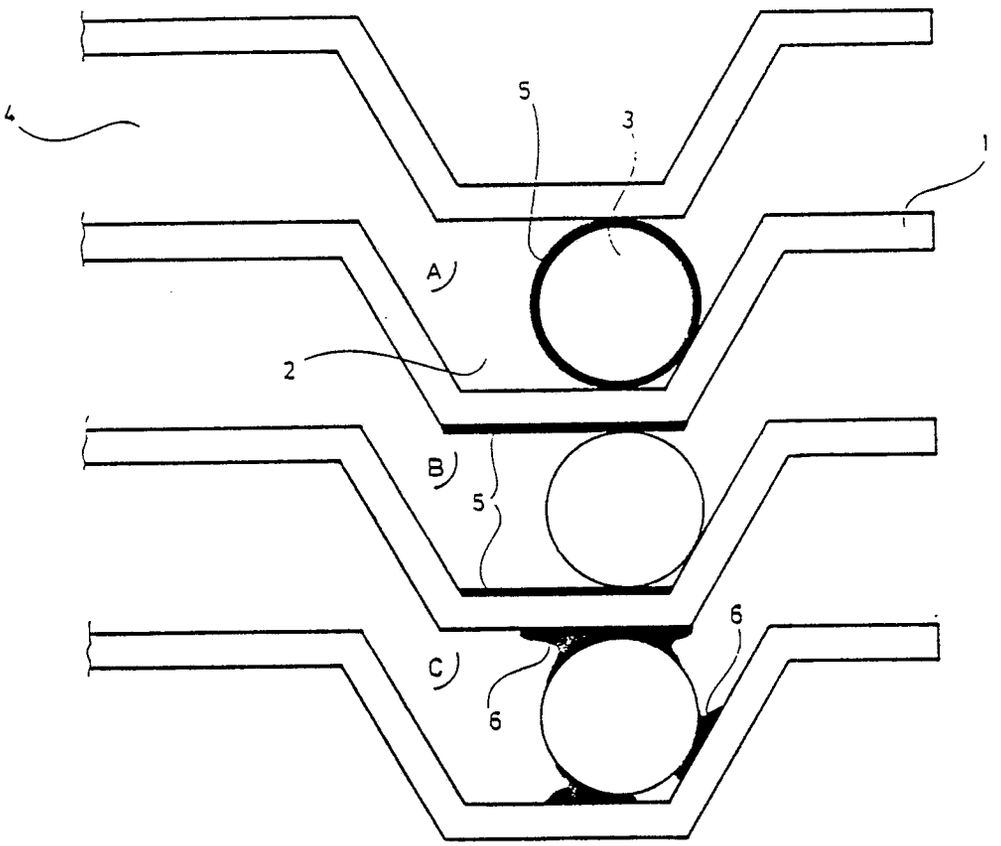
8. Echangeur thermique à plaques selon l'une quelconque des revendications 1 à 4, caractérisé en ce que la matière d'étanchéité (6) est constituée par de la colle raccordant le fil (3) aux plaques (1).

9. Echangeur thermique à plaques selon la revendication 1, caractérisé en ce que la couche de matière d'étanchéité (5, 6) est interposée entre la plaque et le fil sur toute la longueur du fil (3).

10. Echangeur thermique à plaques selon la revendication 1 ou 8, caractérisé en ce que les couches de la matière d'étanchéité sont interposées entre le fil (3) et chacune des deux plaques (1) entre lesquelles est disposé le fil.

11. Echangeur thermique à plaques comprenant un joint d'étanchéité entre deux plaques contiguës (1), un espace (4) entre les plaques formant un passage pour un agent caloporteur, et le joint comprenant un fil (3) en matière dure, essentiellement non élastique, reliant une majeure partie de la distance entre les deux plaques (1), caractérisé en ce que le fil est en matière métallique et forme une étanchéité entre les plaques contiguës, et le fil (3) est relié à une plaque contiguë au moins en certains endroits au moyen de brasage ou de soudage.

12. Echangeur thermique à plaques selon la revendication 11, caractérisé en ce que le fil est raccordé par un joint de brasage (6) ou un joint de soudure (6) sur chacune des deux plaques contiguës sur toute la longueur du fil.


4
5
3
1
A)
2
B)
5
6
C)
6