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(54) Sealing device for heat exchanger plate and heat exchanger provided with such device.

(57) Seal device (10) for heat exchanger plate (13), said device (10) comprising a gasket (11) made of a rubber-like material and suitable for being placed within a first peripheral groove (12) of said plate (13), said gasket further comprising a series of projections (15) extending transversally, when installed, towards outside of said plate (13), said plate (13) further comprising, along its periphery, a series of surfaces which are suitable for housing said projections (15), said device (10) further comprising clamping means (20) which may be temporally constrained to said plate (13) and to said projections (15) whereby said projections (15) comprise a portion (16) forming a second groove and cooperating with a projecting ridge (18) formed in the upper part of said plate (13), said projection (15) comprising, at one end thereof, a third groove (17) and whereby second (16) and third (17) grooves are suitable for cooperating with said clamping means (20).

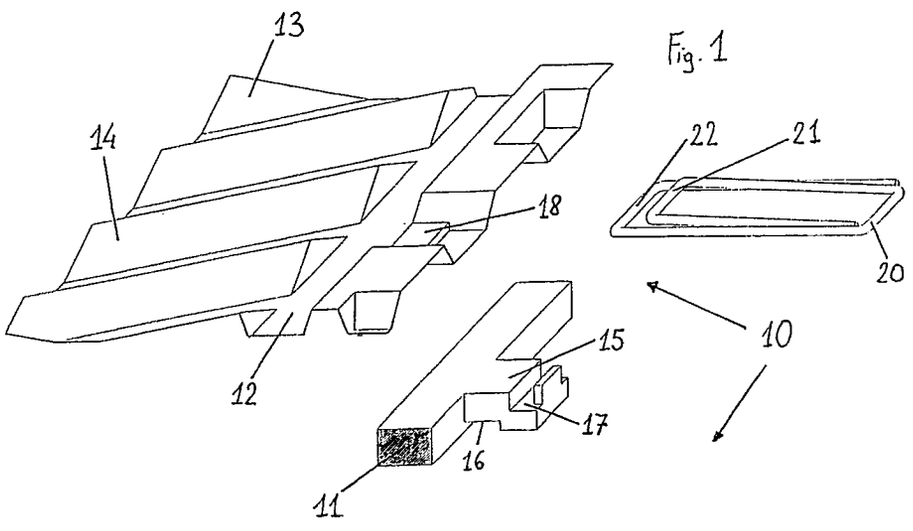

Fig. 1

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The present invention relates to a sealing device for heat exchanger plate and to a heat exchanger provided with plates having such device.

More particularly, the present invention relates to a sealing device for heat exchanger plates which may very easily placed or removed, and to a heat exchanger provided with plates provided with this kind of sealing device.

The invention may be mainly applied in the field of the thermo-mechanical industry.

Plate-type heat exchanger devices are well known.

These devices are constituted by a fixed and a movable endplate, one or both of them being provided, according to different applications, with inlet and outlet connections for fluids, and with a pack of metallic plates, generally stainless steel plates, disposed between said endplates.

Said metallic plates, which are bored close to their angled edges in order to allow the circulation of the fluids, constitute the surface of thermal exchange between the fluids and are provided with a seeries of ribs, in order to increase the surface and the fluid turbulence; said ribs generally disposed according to a herringbone or a so-called laundress-board pattern.

Furthermore, the periphery of such plates is provided with seals made of an elastic, rubber-like, material, which delimit and physically separate the pair of channels formed inside of the heat exchanger and within which the fluids circulate.

This type of device is generally used in applications of various kinds, e.g. for instantaneously producing sanitary hot water by means of a boiler, with or without buffers, or for heating with a geothermal exploitation, or for swimming-pool heating by means of a boiler, or for teleheating.

Obviously, in accordance with the particular applications, the devices are differently dimensioned in what concerns the surface and the number of plates, and are provided with different feeding circuits.

The peripheral seals play a determinant role for the functionality of plate-type heat exchangers.

In fact, it is necessary that said seals are realised with high quality materials, allowing said seals to carry out their functions at high temperatures and pressures; the seals must conserve their reliability even after thousands of working hours.

Furthermore, they must be made perfectly fit to their suitable grooves, which should allow the seals to be positioned on walls which are as much as possible vertical in order to assure an optimum support for the thrust which the seal undergoes from inside, particularly in proximity of the fluid inlets.

Several solutions to the problem of how correctly placing the seal in the groove are known in the art.

A classic solution provides for glueing the seal against the groove bottom by means of suitable bonding agents.

Said solution has several drawbacks and disadvantages, which are mainly due to the high material and labour costs involved by the glueing operation and to the fact that the plate mantainance is extremely difficult in case of the substitution of a seal.

In fact, the substitution of a glued seal should be carried out by removing, by means of a suitable solvent, the old bonding agent, and this should be done taking the greatest care for avoiding to damage the plate.

Successively, the groove should be carefully cleaned, and a new layer of bonding agent is placed in the same; a new seal is then placed within the groove and a certain time must pass before the seal perfectly adheres to its seat.

This operations involves considerable costs and loss of time.

According to another known embodiment (see document EP-A-0 134 155), which does not utilize a bonding agent, the seal is provided, along its periphery, with a series of essentially cylindrically-shaped extensions which are suitable for being pressure-housed within corresponding bores provided along the external periphery of the plate.

However, this embodiment has also some drawbacks, since it requires the seal to be extremely precisely placed on the plate, in such a way as each extension is exactly placed in front of a plate bore.

Furthermore, it requires the use of special plates provided with the suitable bores for anchoring the seal, and may be therefore not universally used.

A further embodiment known in the art (see document WO 85/00052) provides for a series of tongue-like projections, made in the same rubber-like material constituting the seal, to be formed along the external peryphery of the seal itself.

These projections are inserted, when installed, in notches formed between the upper and lower surfaces of the plate, and allow the seal to be sufficiently rapidly placed in the groove.

Also this solution involves some drawbacks, since the seal is rather approximatively placed in respect of the groove; furthermore, since the fixing projections are necessarily made of rubber, they may only scarcerly resist to the thermal and mechanical stresses which an installed seal continuously undergoes; therefore, the seal is often pushed out of its seat, thereby causing leakages in the heat exchanger.

Finally, document EP-A-0 039 229 discloses the use of elements which are external relative to

the seal and which are used for keeping the seal in touch with the plate.

According to the description of said EP document, said elements push an extension which is provided in the seal against the plate and allow, therefore, the heat exchanger to be easily assembled and dis-assembled without using any bonding agents between the seal and the plate.

However, since these elements act on completely flat surfaces of both the plate and the seal, their holding effectiveness is rather small and they are often released from their position cause of the relative movements between the seal and the plate, which are due to the action of pressure and heat during the heat exchanger operation.

The main purpose present invention is that of obviating to the disadvantages and drawbacks which are typical of the background art, and to provide therefore for a seal device for a plate-type heat exchanger which may be rapidly placed on the plate or easily removed from it, which is at the same time solidly fixed to the plate, in such a way as to resist to thermal and/or mechanical stresses, and which is cheap and of easy production.

This is achieved by means of a seal device having the features disclosed in claim 1.

The dependent claims outline advantageous forms of embodiment of the invention.

The seal according to the present invention comprises, along its external periphery, a series of tongue-like projections made in the same elastic material constituting the seal itself.

Each of these projections has a notch suitable for cooperating with a corresponding groove which is provided in the plate; furthermore, said projection is provided with a groove suitable for housing a first portion of a resilient, clip-shaped, clamping element, another portion of said clamping element being suitable for cooperating with said groove provided in the plate.

Placing and fixing of a seal on a plate may be in this way extremely simply carried out, since it is enough to place the seal on the plate and to apply the clips in correspondence with the projections for achieving a sound clamping of the seal on the plate.

Furthermore, when substituting or mantaining a seal, it suffices to remove the clips for istantaneously releasing the seal from the plate.

Other advantages and features of the invention will become apparent from reading the following description, of a form of embodiment of the invention, given as a non-limiting example, with the help of the figures shown in the attached drawing, in which:

- figure 1 shows a perspective schematical view of a seal according to the present invention;
- figure 2 shows a side section of the seal according to the invention, as placed on a heat exchanger plate.

In the figures, reference sign 10 generally indicates a seal device for a plate-type heat exchanger according to the present invention.

The device 10 comprises a gasket 11 made of a resilient material, generally of rubber, which is suitable for being housed within a first groove 12 formed along the peryphery of a plate 13 of a plate-type heat exchanger, said plate 13 being provided with ribs 14 suitable for increasing the thermal exchange between the two fluids circulating in the channels formed by a plurality of superposed plates.

The gasket 11 comprises a series of projections 15 which are regularly disposed in respect of each other, and which are transversally extended towards the outside.

Each of said projections 15 has a step shape and defines a second lower groove 16 and a third upper groove 17.

Furthermore, the plate 13 comprises, along its external periphery, a series of notches having projecting ridges 18 forming, at the same time, a fourth groove 19 in the lower part of the plate 13 and a supporting surface for the step-shaped projections 15 belonging to the gasket 11.

Said third (17) and fourth (19) grooves cooperate, when installed, with an element 20 for clamping the gasket 11 on the plate 13.

Said element 20, which may be formed in a metallic or a plastic material, is substantially clip-shaped and includes an upper portion 21, suitable for being housed within said third groove 17, and a lower portion 22, suitable for being housed within said fourth groove 19.

When installed, the gasket 11 is placed within said first groove 12, with the projections 15 resting on the notches provided along the periphery of the plate 13.

Successively, the lower portion 22 of element 20 is placed within said fourth groove 19 and the upper portion of the same element 20 is placed within said third groove 17.

As it may be clearly seen in figure 2 the two portions 21, 22 of element 20 exert on the plate 13 and on the gasket 11 a force which keeps the gasket 11 clamped on the plate 13, thus achieving the purposes of the invention.

In fact, the resilient forces exerted, respectively, by the portions 21 and 22 of element 20 are opposed to each other and keep the projections 15 clamped against the periphery of the plate 13.

In this way, any glueing operation of the gasket 11 on the plate appears to be redundant and, further, for carrying out a plate mantainance it is enough to remove the elements 20 for easily sub-

stituting or cleaning either of the gasket and the plate, without incurring the risk of damaging any of them, as in the background art embodiments.

Finally, since the clamping operation is carried out by an element which is not made of rubber, the keeping in place of the seal is assured for any pressure or temperature functioning condition of the heat exchanger.

Claims

1. Seal device (10) for heat exchanger plate (13), said device (10) comprising a gasket (11) made of a rubber-like material and suitable for being placed within a first peripheral groove (12) of said plate (13), said gasket further comprising a series of projections (15) extending transversally, when installed, towards outside of said plate (13), said plate (13) further comprising, along its periphery, a series of surfaces which are suitable for housing said projections (15), said device (10) further comprising clamping means (20) which may be temporally constrained to said plate (13) and to said projections (15) characterised in that said projections (15) comprise a portion (16) forming a second groove and cooperating with a projecting ridge (18) formed in the upper part of said plate (13), in that said projection (15) comprises, at one end thereof, a third groove (17) and in that said second (16) and third (17) grooves are suitable for cooperating with said clamping means (20).

2. Device (10) according to claim 1, characterised in that said projecting ridge (18) defines, in the lower part of said plate (13), a fourth groove (19) suitable for cooperating with said clamping means (20).

3. Device (10) according to claim 2, characterised in that said clamping means comprise a clip-shaped element (20) of a metallic or plastic material which has a first portion (21) suitable for cooperating with said third groove (17) and a second portion (22) suitable for cooperating with said fourth groove (19), said first (21) and second (22) portions of said element (20) exerting a resilient force for keeping said gasket (11) in close contact with said plate (13).

4. Plate-type heat exchanger device characterised in that it comprises at least one device according to one of the preceding claims.

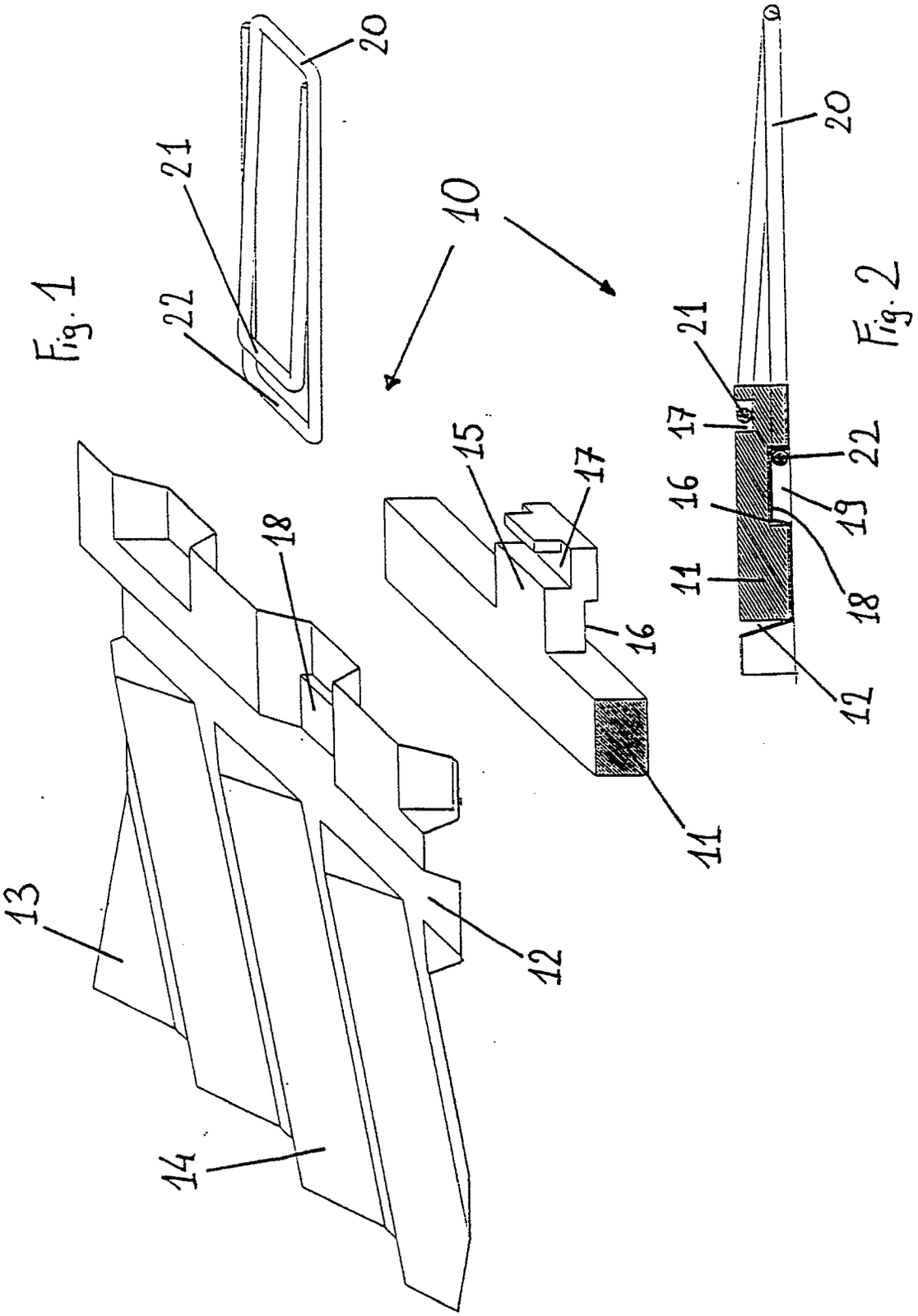
Fig. 1
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Fig. 2
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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 12 5226

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.5)
D,A	EP-A-0 134 155 (APV) * figures 6,7 *	1	F 28 F 3/10
D,A	EP-A-0 039 229 (ALFA) * the whole document *	1	
D,A	WO-A-8 500 052 (ALFA) * the whole document *	1	
A	US-A-4 905 758 (MATHUR ET AL.) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 28 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	07 June 91	SMETS E.D.C.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
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
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