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SEALED PLATE HEAT EXCHANGER

The invention concerns a plate heat exchanger with a sealed design

5 Background of the invention

Various designs of plate heat exchangers are known. These include, in particular, sealed, soldered and welded plate heat exchangers. What is common to the various designs is that they usually comprise a stacked assembly with a front and a back end plate, between which a plurality of heat exchanger plates are incorporated and stacked, such that cavities, which receive a plurality of heat exchanger media or fluids during operation, are formed between the heat exchanger plates. The heat exchanger media usually flow through the cavities.

While in the soldered and welded design the cavities are sealed by a soldered or welded joint, for plate heat exchangers with a sealed design, sealing elements are provided, which are arranged sealing the cavities in the stacked assembly. Sealed plate heat exchangers then have a clamping device, which is configured to pretension the stacked assembly with end plates and heat exchanger plates, as well as sealing elements, by exerting an external clamping pressure with the aid of the clamping device. Fig. 1 shows a perspective view of a known plate heat exchanger with a sealed design, wherein a stack 3 with heat exchanger plates is arranged between two pressure frame plates 1, 2. The clamping device for pretensioning the stacked assembly comprises tie rods 4, which connect the two end plates 1, 2 in overlapping areas 5. The tie rods 4 are provided with screw threads such that external pressure is adjustable.

A plate heat exchanger is known from document GB 2 151 347 A. A stack of heat exchanger plates is arranged between a base and a closing component. Locking screws are used to tension the stack of heat exchanger plates.

Document US 6 098 701 discloses a plate heat exchanger, which has a stack of heat exchanger plates. To reduce the pressure in the edge region of a clamping device, the front and back end plates each comprise an outer curve.

Summary of the invention

30 The aim of the invention is to create an improved plate heat exchanger with a sealed design, which can be produced more cost-effectively and with an optimised design.

This aim is achieved according to the invention by a plate heat exchanger with a sealed design according to independent claim 1. Advantageous embodiments of the invention form the subject of dependent subclaims.

5 The cross-section of the clamping device on the inside, namely the side facing the stacked assembly, is adapted to the outer contour of the stacked assembly at least within the framework of usual manufacturing tolerances in the at least one corner region. Provision may also be made for interlocking in several or even all corner regions. This is, for example, the case when the clamping device encloses the stacked assembly in an entirely interlocking manner.

10 A preferred embodiment of the invention may provide for the clamping device to lie essentially continuously on the outer surface of an assigned section of the stacked assembly in the at least one interlocking enclosed section of the stacked assembly.

15 With the aid of the proposed plate heat exchanger, a heat exchanger is first created, which has a smaller size compared to the prior art, as it is not necessary to guide the tie rods laterally past the stacked heat exchanger plates, in order to connect laterally projecting sections of the end plates for the clamping device. Rather, the clamping device encloses the stacked assembly in an interlocking manner, at least in one corner region, such that, in this case, there is a reduced or even no requirement for space to the side of the stacked assembly, in particular for clamping elements.

20 The clamping device comprises a plurality of closed profile elements and, optionally, one or more flexible tension bands, which each enclose the stacked assembly. The tension bands are preferably made from a material from the following group of materials: steel, plastics and thermoplastic materials. When producing the plate heat exchanger, the one or more tension bands are mounted on the stacked assembly by means of mechanical tensioning and / or shrinking.

25 The plurality of closed profile elements may be formed from e.g. square profile or tube. Profile elements in this or other embodiments are available inexpensively as such in different variants. Thus, overall production costs are minimised.

When producing the plate heat exchanger, the closed profile elements are pushed from the front onto the stacked assembly with end plates and heat exchanger plates arranged between them. This is performed with the connections not yet installed at least on one side. The connections can then be installed after the closed profile elements have been pushed on.

30 The clamping device may comprise a continuous closed profile element, which extends around the stacked assembly over an area of at least 50% of the length of the section of the stacked assembly between connections on the connection plate. In this embodiment, which is not part of the invention, the continuous closed profile element forms a kind of "waist belt" in the region of

the stacked assembly between the connections. A preferred further embodiment provides for the continuous closed profile element to extend over an area of at least 75% of the length of the stacked assembly between the connections. It is more preferable for the continuous closed profile element to cover a length of at least 90% of the area between the connections. The section of the stacked assembly between the connections may be entirely or partially enclosed by one or more closed profile elements.

Likewise, not part of the invention is an embodiment, wherein the clamping device comprises a continuous closed profile element, which extends around the stacked assembly over the entire length of the plate heat exchanger.

A practical embodiment of the invention may provide for the plurality of closed profile elements to all, or at least in pairs, have a substantially equal width in the longitudinal direction of the stacked assembly.

An advantageous embodiment of the invention provides for the closed profile elements to be formed from a standard profile element. The use of standard profile elements supports a further cost reduction, as profile elements of this kind are available inexpensively as frequently produced products in various designs.

A development of the invention preferably provides for the wall sections of the plurality of closed profile elements to be formed as flat profiles. A flat design of the wall sections of the closed profile elements further supports the plate heat exchanger's reduced requirement for space.

The clamping device comprises adjustable biasing elements, which are arranged on the one or more closed profile elements. The adjustable biasing elements are formed from screw elements, which are screwed into assigned threaded sections in the one or more closed profile elements. The screw elements can then be screwed in so far that they eventually press against the stacked assembly. These kinds of screw elements are preferably only provided on the front or only on the back of the stacked assembly on the closed profile elements. On the opposite side, the stacked assembly is then pressed flat against the inside of the closed profile element.

The adjustable biasing elements are configured to apply the external clamping pressure to the stacked assembly, preferably essentially centrally symmetrically.

A practical embodiment of the invention may provide for the adjustable biasing elements on one or all closed profile elements to be formed spaced apart from one another in the transverse direction of the stacked assembly.

A development of the invention preferably provides for the plurality of closed profile elements to be formed such that connection regions, in which connections are arranged on the

connection plate, are left free.

Description of preferred embodiments of the invention

The invention is explained in greater detail below with the aid of preferred exemplary
5 embodiments with reference to the figures of a drawing. These show:

- Fig. 1 a perspective view of a plate heat exchanger with a sealed design in accordance with the prior art,
- Fig. 2 a perspective view of a plate heat exchanger with a sealed design, wherein a clamping
10 device with a plurality of closed profile elements is formed,
- Fig. 3 a view of the plate heat exchange in Fig. 2 from the side,
- Fig. 4 a view of the plate heat exchanger in Fig. 2 from the front,
- Fig. 5 a view of the plate heat exchanger in Fig. 2 from behind,
- Fig. 6 a perspective view of a closed profile element of the clamping device for the plate
15 heat exchanger in Figs. 2 to 5 and
- Fig. 7 a perspective view of a plate heat exchanger with a sealed design, wherein a clamping device with a continuous closed profile element is formed over the entire length of the plate heat exchanger.

20 Fig. 2 shows a perspective view of a plate heat exchanger 20 with a sealed design, wherein stacked heat exchanger plates 24 are arranged in a stacked assembly 21 between a front end plate 22 and a back end plate 23, which is designed as a connection plate. The stacked assembly 21 is arranged in a plate 22 and a back end plate 23, which is designed as a connection plate, stacked heat exchanger plates 24. The stacked assembly 21 is enclosed by a plurality of closed profile
25 elements 28 in a region 25 between connections 26, 27. The plurality of closed profile elements 28 are a substantially equal distance from each other. Other embodiments (not shown and not part of the invention) may provide for the section between the connections 26, 27 to be entirely or partially enclosed by a single closed profile element. Provision may also be made for a plurality of closed profile elements together to completely enclose the area between the connections 26, 27.

30 According to the view in Fig. 2, screws 29, 30, which are screwed into the associated threaded sections, are provided on each of the plurality of closed profile elements 28 such that the screws 29, 30 press against the back end plate 23, thereby generating a pretension. In other embodiments (not shown) further screws may be provided in the closed profile elements 28.

Standard profiles, which preferably comply with the usual DIN standards, can be used to form the plurality of closed profile elements 28.

Figs. 3 to 5 show a schematic representation of the plate heat exchanger 20 in Fig. 2 from the side, from the front and from behind.

5 Finally, Fig. 6 shows a perspective view of the closed profile elements 28 used with the plate heat exchanger in Figs. 2 to 5.

Fig. 7 shows a perspective view of a plate heat exchanger 20 with a sealed design, wherein a continuous closed profile element 31 extends over the entire length of the plate heat exchanger 20. This embodiment is not part of the invention.

10 The characteristics of the invention disclosed in the above description, the claims and the drawing may be important both individually and in any combination for implementing the invention in its various embodiments.

Patentkrav

1. Forseglet pladevarmeveksler (20) med:

- en stablet anordning (21) omfattende:
- 5 - en forside- og en bagsideendeplade (22, 23), af hvilke mindst en endeplade er udformet som en forbindelsesplade,
- varmevekslerplader, som er optaget og stablet mellem forside- og bagsidepladerne (22, 23) således, at der mellem varmevekslerpladerne er dannet hulrum til at optage en flerhed af varmevekslermedier, og
- 10 - tætningselementer, som er indrettet til at tætne hulrummene, og
- en spænde-anordning (28, 29, 30), som er konfigureret til at udøve et udvendigt spændetryk på den stablede anordning (21), som skal spændes, idet spænde-anordningen er udformet til at omslutte den stablede anordning (21) på en formluttende måde i det mindste i sektioner, nemlig i det mindste i et
- 15 hjørneområde af den stablede anordning (21),

kendetegnet ved, at spænde-anordningen er udformet med en flerhed af lukkede profilelementer (28), som hver omslutter den stablede anordning (21), og at spænde-anordningen er udformet med indstillelige forspændingselementer (29, 30), som er udformet med skrueelementer, og som er indrettet på flerheden af

20 profilelementer (28), og som er konfigureret til at påføre det udvendige spændetryk på den stablede anordning (21), således at forspændingselementerne (29, 30) trykker mod bagsideendepladen (23) for at generere en forspænding.

2. Pladevarmeveksler (20) ifølge krav 1, **kendetegnet ved, at** flerheden af

25 lukkede profilelementer (28) i længderetning af den stablede anordning (21) alle eller mindst parvist har den i alt væsentligt samme bredde.

3. Pladevarmeveksler (20) ifølge et af kravene 1 eller 2, **kendetegnet ved, at** flerheden af lukkede profilelementer (28) er dannet af et standardprofilelement.

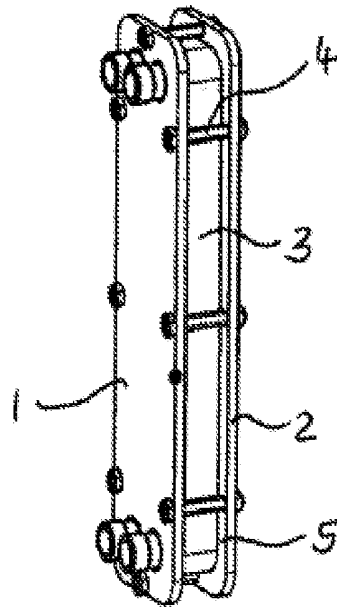
30

4. Pladevarmeveksler (20) ifølge et af kravene 1 til 3, **kendetegnet ved, at** vægsektioner af flerheden af lukkede profilelementer (28) er udformet som flade profiler.

5. Pladevarmeveksler (20) ifølge et af kravene 1 til 4, **kendetegnet ved, at** de indstillelige forspændingselementer (29, 30) er udformet og anbragt med afstand til hinanden i den tværgående retning af den stablede anordning (21) på et eller alle de lukkede profilelementer (28).

5

6. Pladevarmeveksler ifølge et af kravene 1 til 5, **kendetegnet ved, at** flerheden af lukkede profilelementer (28) er udformet således, at forbindelsesområder, hvor forbindelser (26, 27) er indrettet på forbindelsespladen, er frie.



Prior art

Fig. 1

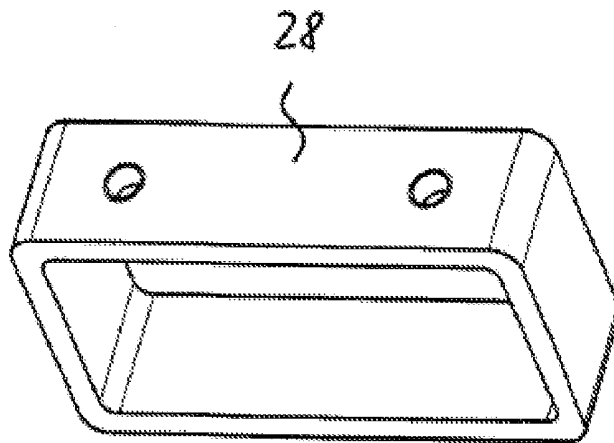


Fig. 6

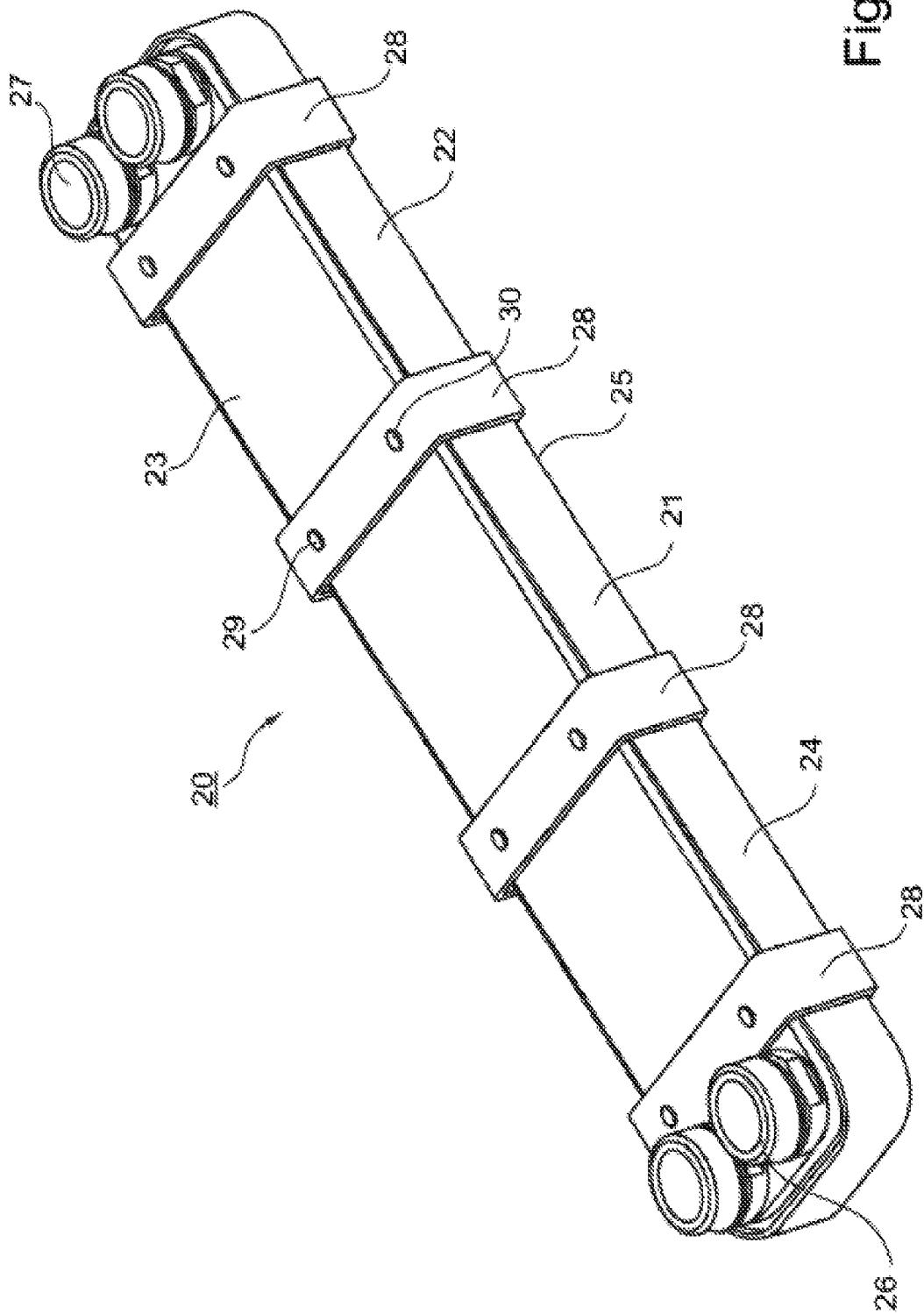
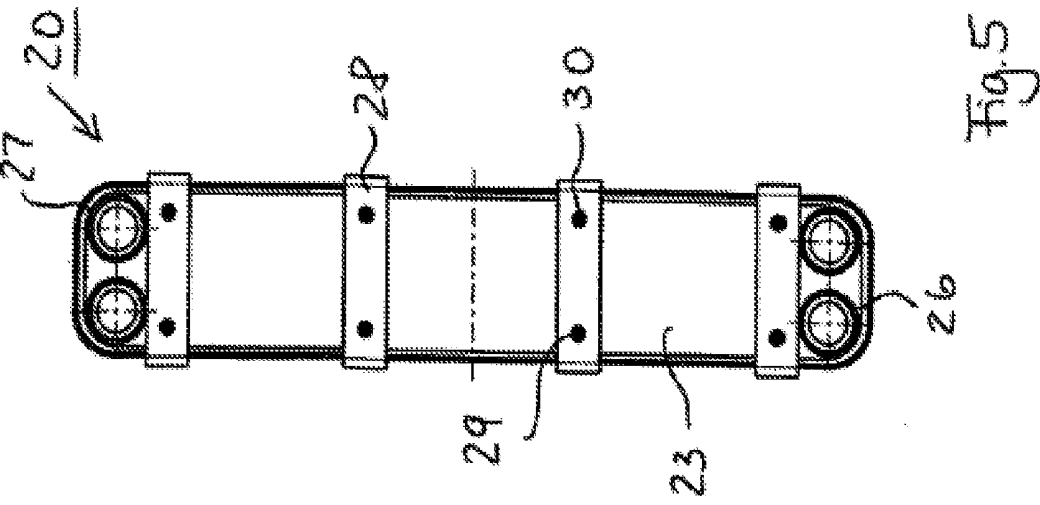
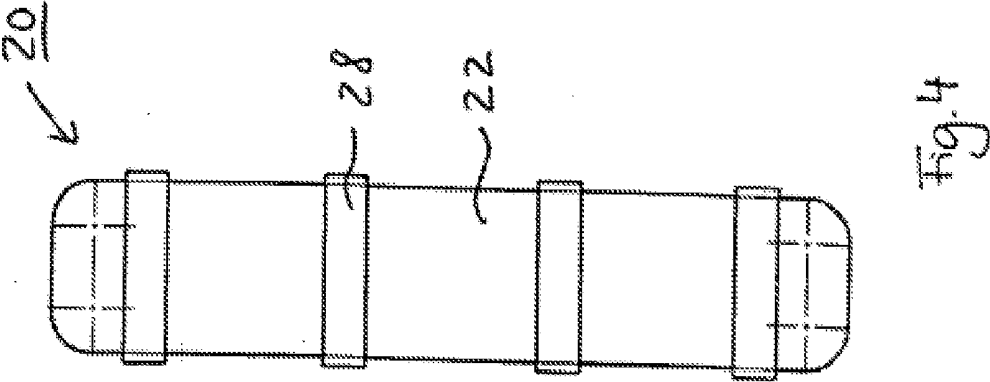
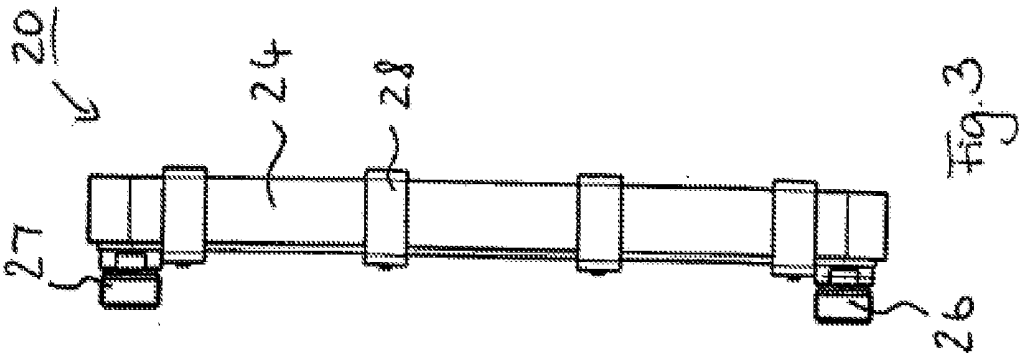


Fig. 2



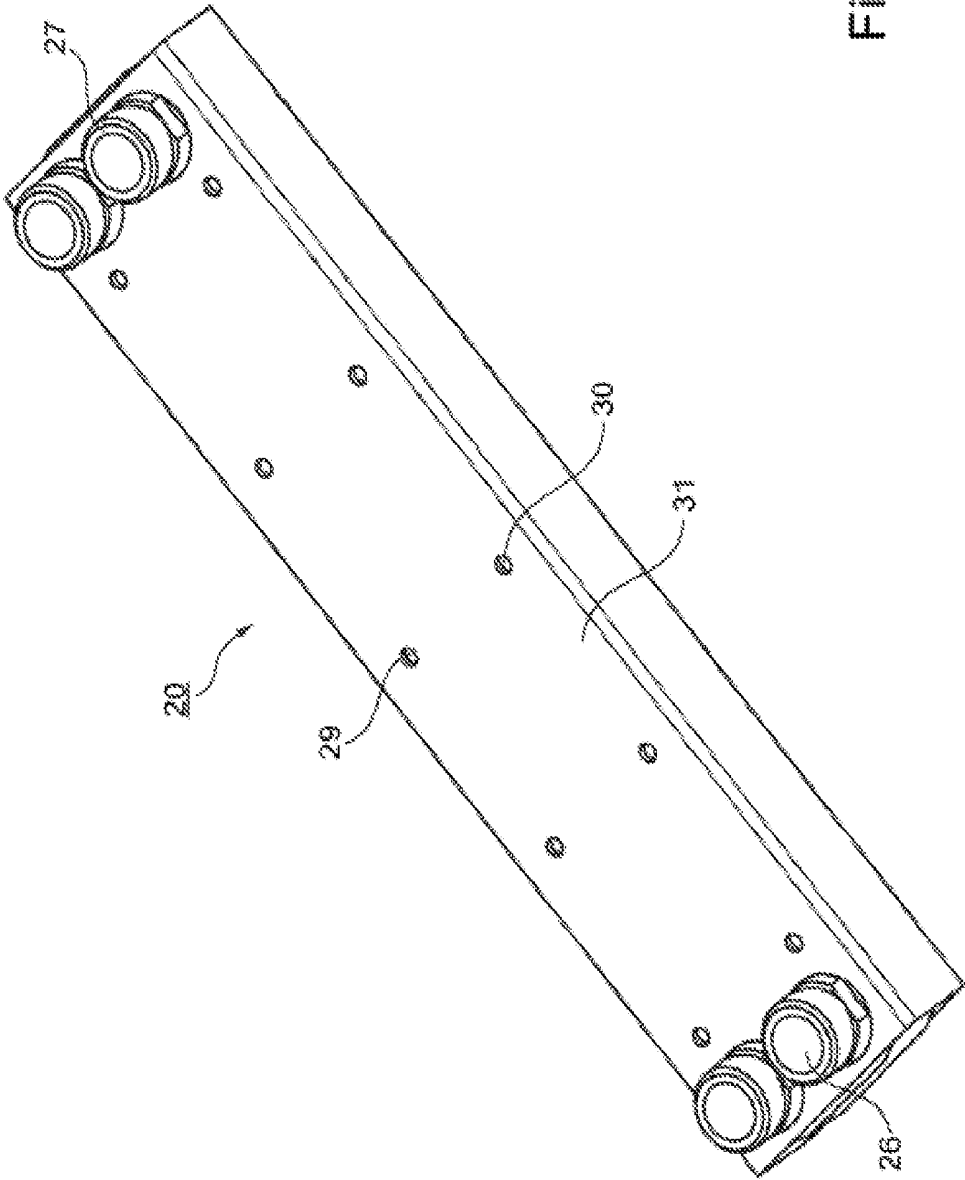


Fig. 7