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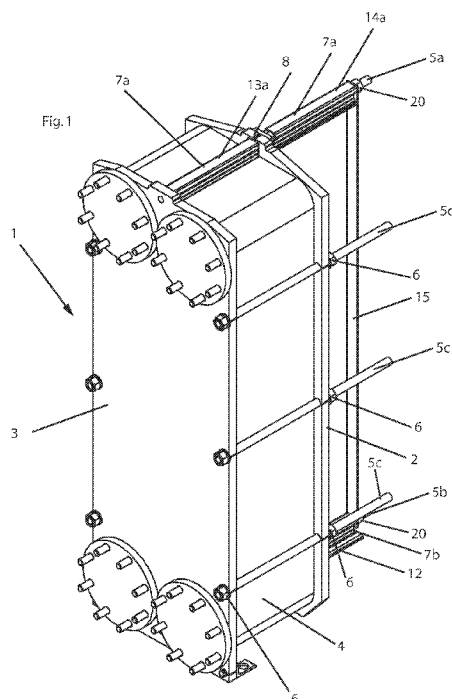
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(54) Title: PLATE HEAT EXCHANGER



(57) Abstract: The invention relates to a plate heat exchanger (1) including a first and second end plate (2, 3), and a core of heat exchanger plates (4) arranged between the first and second end plate (2, 3), whereby a plurality of threaded tightening bolts (5a, 5b, 5c) extend between the first and second end plate (2, 3) and are arranged, with the aid of nuts (6) or the like, to hold these plates at a desired distance from each other in order to hold the core of heat exchanger plates together, wherein at least one guiding element (7, 7a, 7b) for guiding the first end plate (2) and the heat exchanger plates (4) relatively the second end plate (3) is releasably arranged on at least one of the threaded tightening bolts (5a, 5b), which guiding element (7a) extends through an aperture (8) in the first end plate (2), where the at least one guiding element (7a, 7b) is provided with a through-hole (9) to receive the at least one of the threaded tightening bolts (5a, 5b) and an external geometry (10) corresponding to a cut-out (11) of the heat exchanger plates (4) and the first end plate (2).



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PLATE HEAT EXCHANGER

AREA OF INVENTION

The present invention refers generally to plate heat exchangers allowing a heat transfer between two fluids at different temperature for various purposes. Specifically, the invention relates to a plate heat exchanger comprising a first end plate, a second end plate and a package of heat exchanger plates placed between the frame plate and the pressure plate. A plurality of threaded tightening bolts extend between the first end plate and the second end plate and are arranged to hold with the aid of nuts or the like these plates at a desired distance from each other in order to hold the package of heat exchanger plates together.

BACKGROUND OF INVENTION

Plate heat exchangers are normally provided with a frame plate, a pressure plate, also called end plates, and a package of heat exchanger plates disposed adjacent to one another and placed between the frame plate and the pressure plate. Gaskets are disposed between the heat exchanger plates. The gaskets are accommodated in gasket grooves on the heat exchanger plate, which are formed during the form-pressing of the heat exchanger plates. Plate heat exchangers further comprise inlet and outlet ports, which extend through the plate package, for handling two or more media in the plate heat exchanger. A plurality of threaded tightening bolts extend between the frame plate and the pressure plate and are arranged to hold with the aid of nuts or the like these plates at a desired distance from each other in order to hold the package of heat exchanger plates together and to ensure that the plate heat exchanger does not leak.

Heat exchanger plates are normally made by form-pressing of sheet metal and are disposed in the plate package in such a way as to form first plate intermediate spaces, which communicate with the first inlet port and the first outlet port, and second plate intermediate spaces which communicate with the

second inlet port and the second outlet port. The first and second plate intermediate spaces are disposed alternately in the plate package.

5 The design of heat exchanger plate for plate heat exchangers aims to use as much as possible of heat transfer or heat exchange area for the heat exchange between two or more media, but it also needs take in account how the gaskets can be applied on the heat exchanger plate to be securely fastened and to fulfil its seal functionality. The location of the threaded tightening bolts are preferably selected to achieve a plate heat exchanger not exposed too much stresses.

10 SE-C-171 499 shows a plate heat exchanger with a frame plate, a pressure plate, a package of heat exchanger plates, two tie bars as well as a special supporting device. The frame plate and the supporting device are both provided with feet. Through influence from among other things the yokes a pressure is created on the pressure plate and the package of plates is kept
15 together. The construction shows the disadvantage that both the supporting device and the pressure plate with necessity are created in the form of a very strong construction. Further on the auxiliary carrying bar to support plates in connection with mounting and demounting of the heat exchanger constitutes an unnecessary complication.

20 In EP-B1-1 027 571 is shown another plate heat exchanger, where tightening bolts have been integrated into the carrying bar and the guide bar, and creates a guiding element for the pressure plate and the heat exchanger plates. The localization of the tightening bolts is thereby more optimal to resist the forces laid onto the plate heat exchanger during operation. The guiding
25 element is surrounded by a protecting sleeve extending from the frame plate to the pressure plate and protecting the threads of the guiding element from engagement with the heat exchanger plates. The guiding element is also arranged to be connected to a supporting device situated at a substantial distance from the pressure plate.

30 The drawbacks with the above solutions are that the stresses are and forces are too great if the solutions are applied on larger plate heat exchangers.

DISCLOSURE OF INVENTION

The object of the present invention is to create a construction which is gives an optimal load distribution over the plate heat exchanger still being cheaper and less complicated to manufacture than the one described above.

5 The advantages are attained by using at least one guiding element for guiding the first end plate and the heat exchanger plates relatively the second end plate, and where the guiding element is releasably arranged on at least one of the threaded tightening bolts. The guiding element extends through an aperture and the at least one guiding element is provided with a through-hole to
10 receive the at least one of the threaded tightening bolts and an external geometry corresponding to a cut-out of the heat exchanger plates and the first end plate.

 According to another aspect of the invention the plate heat exchanger is provided with two guiding elements, a first guiding element arranged in an
15 upper portion of the plate heat exchanger and a second guiding element arranged in a lower portion of the plate heat exchanger. The first and second guiding element can have an identical cross section profile.

 According to yet another aspect of the invention the second guiding element further is provided with a guiding rail for movably receiving the second
20 guiding element.

 According to still another aspect of the invention the guiding rail for movably receiving the second guiding element is fully or partially supported by the ground.

 According to a further another aspect of the invention the at least one
25 guiding element includes two separate parts, and the at least one guiding element and the guiding rail is made of an extrudable material.

 According to a further another aspect of the invention a supporting device is releasably arranged at a considerable distance from the first end plate at the end of the upper and lower tightening bolts, and extending between the
30 upper and lower tightening bolts.

 According to still another aspect of the invention the at least one guiding element is movable along the tightening bolts and where one part of the

guiding element can be removed as the heat exchanger plates are pressed together by the first end plate to form the operating plate heat exchanger, where after the removed one part of the guiding element can be arranged on a free portion of the tightening bolt outside the plate heat exchanger.

- 5 According to another aspect of the invention the object is attained by a plate heat exchanger where the heat exchanger plates rest on the at least one guiding element and where the first end plate rests on a guiding rail, upon which guiding rail the at least one guiding element is movably received.

Further aspects of the invention are defined in the dependent claims.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention is now to be explained more closely by means of a description of various embodiments and with reference to the drawings attached hereto.

- Fig. 1 discloses a perspective view of a plate heat exchanger according to an embodiment of the invention;

Fig. 2 shows a side view of a plate heat exchanger according to an embodiment of the invention;

Fig. 3 discloses a partial view of a plate heat exchanger according to an embodiment of the invention;

- Fig. 4 discloses a cross section view A-A of a plate heat exchanger according to an embodiment of the invention;

Fig. 5 discloses a first partial detailed view B of the plate heat exchanger of Fig. 4 according to an embodiment of the invention;

- Fig. 6 discloses a second partial detailed view C of the plate heat exchanger of Fig. 4 according to an embodiment of the invention;

Figs. 7a-b show different views of a guiding element according to the invention; and

Figs. 8a-b show different views of a guiding rail according to the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

Heat exchangers are used for transferring heat between two fluids separated by a solid body. Heat exchangers can be of several types, the most common are spiral heat exchangers, tubular heat exchangers and plate heat exchangers. Plate heat exchangers are used for transferring heat between a hot and a cold fluid that are flowing in alternate flow passages formed between a set of heat exchanger plates. The arrangement of heat exchanger plates defined above is enclosed between end plates that are relatively thicker than the heat exchanger plates. The inner surface of each end plate faces the heat transfer plates.

Figs. 1-2 disclose a schematic view of a plate heat exchanger 1 comprising a number of compression-molded heat exchanger plates 4, which heat exchanger plates 4 are provided in parallel to each other and successively in such a way that they form a plate package. The plate package is provided between a first end plate 2, also called pressure plate, and a second end plate 3, also called frame plate. Between the heat exchanger plates 4, first plate interspaces and second plate interspaces are formed. The end plates 2 and 3 are pressed against the plate package and against one another by tightening bolts or tie bars 5a-c, which extend through the end plates 2 and 3, and which tightening bolts 5a-c are kept in place by nuts 6, 20.

The plate heat exchanger 1 comprises a first inlet port and a first outlet port for a first medium, and a second inlet port and a second outlet port for a second medium. The inlet and outlet ports extend through the second end plate 3 and the plate package. It is of course also possible for the inlet and outlet ports to be disposed on both sides of the plate heat exchanger 1, i.e. on both end plates 2 and 3. The two medium may be led in the same or in opposite directions relative to one another.

The heat exchanger plates 4 in the shown embodiment are disposed in such a way in the plate package as to form first plate intermediate spaces which communicate with the first inlet port and the first outlet port, and second plate intermediate spaces, which communicate with the second inlet port and the second outlet port. The first and second plate intermediate spaces are disposed

alternately in the plate package. The separation of the plate intermediate spaces may be by gaskets extending in gasket grooves formed during the form-pressing of the heat exchanger plates. The gaskets are usually made of a rubber or polymer material. The heat exchanger plates 4 are provided with a
5 corrugated pattern to improve the heat exchange between the two fluids.

To guide the heat exchanger plates 4, to protect the threaded tightening bolts 5a, 5b from wear of the heat exchanger plates 4, to simplify the construction and to make the construction cheaper, there has been provided guiding elements 7, 7a, 7b on the uppermost and lowermost of the tightening
10 bolts 5a, 5b.

Compared with state of the art plate heat exchanger the uppermost and lowermost of the tightening bolts 5a, 5b replace the traditional carrying and guiding bar, which otherwise serve to enable the opening/closing of the plate heat exchanger by enabling the first end plate 2 and the heat exchanger plates
15 4 to be moved along the carrying bar and the guiding bar while the plate heat exchanger is standing. By providing upper and lower guiding elements 7a, 7b that arranged on the tightening bolts 5a-5b, respectively, and where the guiding elements 7a, 7b has an outer cross section geometry (see Figs. 7a-b) similar to the traditional carrying bar the heat exchanger plates 4, having a cut-out profile
20 11 corresponding to an lower portion of the guiding element 7a, 7b having an external geometry 10, can be guided along the upper guiding element 7a. The tightening bolts 5a, 5b are received in an aperture or through hole 9 of the guiding element 7a, 7b, which through hole 9 extends along the entire longitudinal length of the guiding element 7a, 7b. The guiding element 7a, 7b is
25 made of an extrudable material to make cheaper to manufacture and to lighten the construction. The extrudable material can be plastic, aluminum or any other suitable construction material.

Further tightening bolts 5c are present in a usual way between the second end plate 3 and the first end plate 2, and are placed in notches or
30 recesses at the edges of the second end plate 3 and the first end plate 2.

Since the guiding element 7a, 7b is made of an extrudable material it cannot withstand the same load as a corresponding metal construction.

Therefore the load of the heat exchanger plates 4 and the first end plate 2 will be transferred to the ground via a second or lower guiding element 7b and a guiding rail 12. The upper guiding element 7a and the lower guiding element 7b are preferably identical to reduce manufacturing costs, but different shapes are also possible. In the shown embodiment, see e.g. Fig. 6, the lower external geometry 10 of the guiding element 7b corresponds to an internal shape 16 of the guiding rail 12 enabling the guiding element 7b to be secured to the guiding rail 12 and to be movable along the guiding rail 12. In some applications the plate heat exchanger 1 is arranged on frame, which fully or partially supports the guiding rail 12.

The upper guiding element 7a extends through an aperture 8 of uppermost portion of the first end plate 2 so that the first end plate 2 can be movable relative to the upper guiding element 7a. Similarly extends the lower guiding element 7b through an aperture 17 of the lowermost portion of the first end plate 2. Both the lower guiding element 7b and the upper guiding element 7a only guides the first end plate 2, whereas the load of the first end plate 2 is carried by the guiding rail 12 upon which the first end plate 2 rests. The heat exchanger plates 4 rest on the lower guiding element 7b and is guided laterally by the upper guiding element 7a.

Each guiding element 7a, 7b comprise two parts 13a, 13b; 14a, 14b (see Fig. 3) to enable the guiding of the heat exchanger plates 4 during the opening and closing process of the plate heat exchanger 1 and thus enabling an outer guiding element part 14a, 14b to be removed when the heat exchanger plates 4 and the first end plate 2 are tighten together to form the operational plate heat exchanger 1, and applying nuts 6 onto the tightening bolt 5a, 5b to keep the first end plate 2 in place and the heat exchanger plates 4 tighten together between the first end plate 2 and the second end plate 3. The length of the inner guiding element part 13a, 13b is preferably slightly less than the length corresponding to the total thickness of all the heat exchanger plates 4 in the package of plates and the first end plate 2. The length of the outer guiding element part 14a, 14b is preferably slightly less than the remaining free end of

the tightening bolt 5a, 5b when the inner guiding element part 13a, 13b has been arranged onto the tightening bolt 5a, 5b.

The upper guiding element 7a can be provided with wear protection arrangement to reduce the wear from the heat exchanger plates 4. The wear
5 protection arrangement can be of a plate or rubber material or any other suitable material, and is preferably clamped onto the upper guiding element 7a.

The guiding element 7a, 7b has an upper portion formed as an external geometry 19 having a width corresponding to the opening width of the cut-out
11 of the heat exchanger plates 4 and the apertures 8, 17 of the first end plate
10 2. Thereby both the upper guiding element 7a and the lower guiding element 7b can guide the first end plate 2 laterally, whereas the load of the first end plate 2 is carried by the guiding rail 12. The upper guiding element 7a and the lower guiding element 7b will also guide the heat exchanger plates 4 laterally by the external geometry 19 of the guiding elements 7a, 7b and the lower guiding
15 element 7b will carry the load of the heat exchanger plates 4. The load is transferred directly to the guiding rail 12 and further to the ground. The external geometry 10 of the lower portion of the upper guiding element 7a guides the heat exchanger plates 4 and serves a tilting protection for the heat exchanger plates 4, when the plate heat exchanger 1 is open.

20 It is also possible that the upper guiding element 7a fully or partially carries the load of the heat exchanger plates 4 by the external geometry 10.

In Figs. 5-6 the guiding element 7a, 7b and the guiding rail 12 is shown in more details, partial enlargement B and C of Fig. 4, as they are arranged in the plate heat exchanger 1. One advantage of the suggested guiding profile 7a,
25 7b is that the same component can be used both as a carrying and guiding bar in the upper section of the plate heat exchanger 1 as well as carrying and guiding bar in the lower section of the plate heat exchanger 1. The guiding rail 12 serves as a weight transferring element, which also enables that the lower outer guiding element 14b can be removed when the heat exchanger plates 4
30 and the first end plate 2 are tighten together so that a nut 6 can be arranged on the lowermost tightening bolt 5b in abutment with the first end plate 2 and to keep the plate heat exchanger 1 in the closed operational mode.

As shown in Fig. 1-2 the plate heat exchanger 1 can also be provided with a support device 15 to enable the plate heat exchanger 1 to be opened in an easy way, which support device 15 is provide at the free end of the tightening bolts 5a, 5b and kept in place by nuts 20. The support device 15
5 extends between the two tightening bolts 5a and 5b, and ensures that distance between the two tightening bolts 5a and 5b is invariable and that forces affecting the upper tightening bolt 5a are transferred to the ground. The further details of function and operation of the support device 15 will be described in connection with the description of the opening and closing process of the plate
10 heat exchanger 1.

Now the opening of the plate heat exchanger 1 will be described. In Fig. 1 and 2 the plate heat exchanger 1 is operational mode. For enabling maintenance such as cleaning, repairing, replacing heat exchanger plates etc., the plate heat exchanger 1 can be opened. The nuts 20 are screwed off and the
15 supporting device 15 and the outer guiding elements 14a, 14b are taken away of the tightening bolts 5a, 5b. The nuts 6 arranged to the tightening bolts 5a, 5b are screwed off and the outer guiding elements 14a, 14b are again arranged onto the free parts of the tightening bolts 5a, 5b and pushed abutment against the inner guiding elements 13a, 13b. The package of heat exchanger plates 4
20 and the first end plate 2 is still kept together by the further tightening bolts 5c. The supporting device 15 is once again mounted onto the free parts of the upper and lower tightening bolts 5a, 5b. The supporting device 15 is supported to the ground via the outer guiding element 14b and the guiding rail 12. The nuts 20 are brought upon the tightening bolts 5a, 5b and tightened. The further
25 tightening bolts 5c are demounted. As the tightening bolts 5c are released the first end plate 2 and the heat exchanger plates 4 may thereafter be moved along the guiding elements 7a, 7b. Hereby an open mode of service of the plate heat exchanger 1 is attained, when the heat exchanger plates 4 are situated between the end plates 2, 3 may be separated for cleaning and one or several
30 heat exchanger plates 4 may be taken out and eventually new ones put in without the need for demounting of the rest of heat exchanger plates 4. Closing

or tighten together the plate heat exchanger 1 into operational mode is executed in an analogous reversed way.

5 The supporting device 15 is a bar, a plate iron or the like with a sufficient length to be able to hold the uppermost and lowermost tightening bolts 5a, 5b at a correct distance in relation to each other and at the same time in the open mode of service for the plate heat exchanger 1 to be able to serve as a supporting device 15 for the whole plate heat exchanger 1 together with the second end plate 2. It further ensures that forces affecting the upper tightening bolt 5a are transferred to the ground via the lower tightening bolt 5a.

10 The guiding element 7a, 7b and the guiding rail 12 are preferably made of an extrudable material such as a plastic or aluminum profile, but can also be made of any other suitable manufacturing method or material.

The invention is not limited to the embodiments described above and shown on the drawings, but can be supplemented and modified in any manner
15 within the scope of the invention as defined by the enclosed claims.

CLAIMS

1. A plate heat exchanger (1) including a first and second end plate (2, 3), and a core of heat exchanger plates (4) arranged between the first and second end plate (2, 3), whereby a plurality of threaded tightening bolts (5a, 5b, 5c) extend between the first and second end plate (2, 3) and are arranged, with the aid of nuts (6, 20) or the like, to hold these plates at a desired distance from each other in order to hold the core of heat exchanger plates (4) together, wherein at least one guiding element (7a, 7b) for guiding the first end plate (2) and the heat exchanger plates (4) relatively the second end plate (3) is releasably arranged on at least one of the threaded tightening bolts (5a, 5b), which guiding element (7a) extends through an aperture (8) in the first end plate (2), **characterized in that** the at least one guiding element (7, 7a, 7b) is provided with a through-hole (9) to receive the at least one of the threaded tightening bolts (5a, 5b) and that the at least one guiding element (7, 7a, 7b) has an external geometry (10) corresponding to a cut-out (11) of the heat exchanger plates (4) and the first end plate (2).

2. A plate heat exchanger (1) according to claim 1, wherein the plate heat exchanger (1) is provided with two guiding elements (7a, 7b), a first guiding element (7a) arranged in an upper portion of the plate heat exchanger (1) and a second guiding element (7b) arranged in a lower portion of the plate heat exchanger (1).

3. A plate heat exchanger (1) according to claim 1 or 2, wherein the first and second guiding elements (7a, 7b) have an identical cross section profile.

4. A plate heat exchanger (1) according to claim 2 or 3, wherein the second guiding element (7b) further is provided with a guiding rail (12) for movably receiving the second guiding element (7b).

5. A plate heat exchanger (1) according to claim 4, wherein the guiding rail (12) for movably receiving the second guiding element (7b) is fully or partially supported by the ground.

5 6. A plate heat exchanger (1) according to any preceding claim, wherein the at least one guiding element (7a, 7b) includes two separate parts (13a, 13b, 14a, 14b).

7. A plate heat exchanger (1) according to any preceding claim,
10 wherein the at least one guiding element (7a, 7b) and the guiding rail (12) is made of an extrudable material.

8. A plate heat exchanger (1) according to any preceding claim, wherein the at least one guiding element (7, 7a, 7b) is movable along the
15 tightening bolts (5a, 5b) and where one part (14a, 14b) of the guiding element (7a, 7b) can be removed as the heat exchanger plates (4) are tighten together by the first end plate (2) to form the operating plate heat exchanger (1), where after the removed one part (14a, 14b) of the guiding element (7a, 7b) can be arranged on a free portion of the tightening bolt (5a, 5b) outside the first end
20 plate (2).

9. A plate heat exchanger (1) according to any preceding claim, wherein a supporting device (15) is releasably arranged at a considerable distance from the first end plate (2) at the end of the tightening bolt (5a, 5b),
25 and extending between the tightening bolts (5a, 5b).

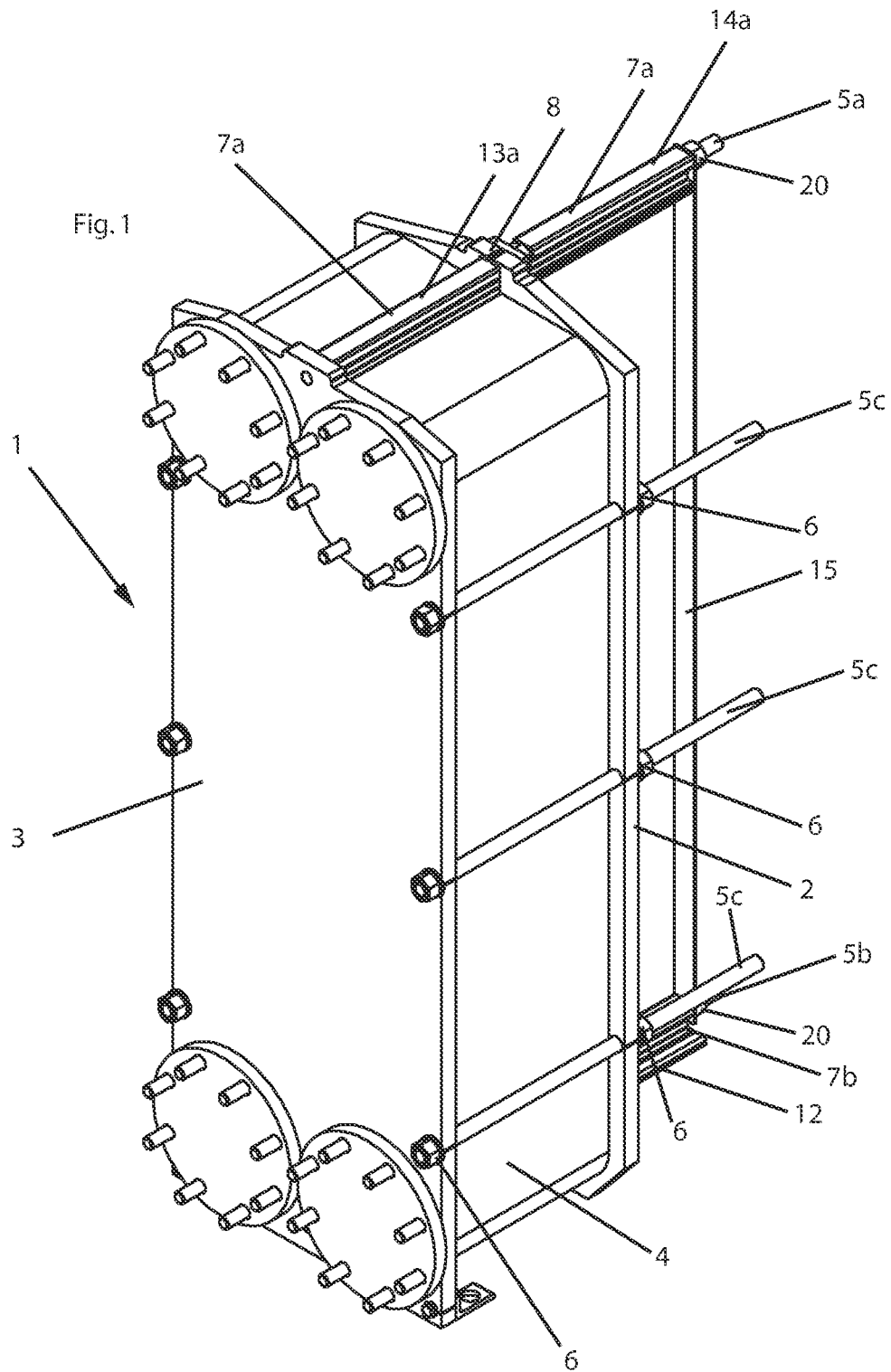
10. A plate heat exchanger (1) including a first and second end plate (2, 3), and a core of heat exchanger plates (4) arranged between the first and second end plate (2, 3), whereby a plurality of threaded tightening bolts (5a, 5b,
30 5c) extend between the first and second end plate (2, 3) and are arranged, with the aid of nuts (6, 20) or the like, to hold these plates at a desired distance from each other in order to hold the core of heat exchanger plates together, wherein

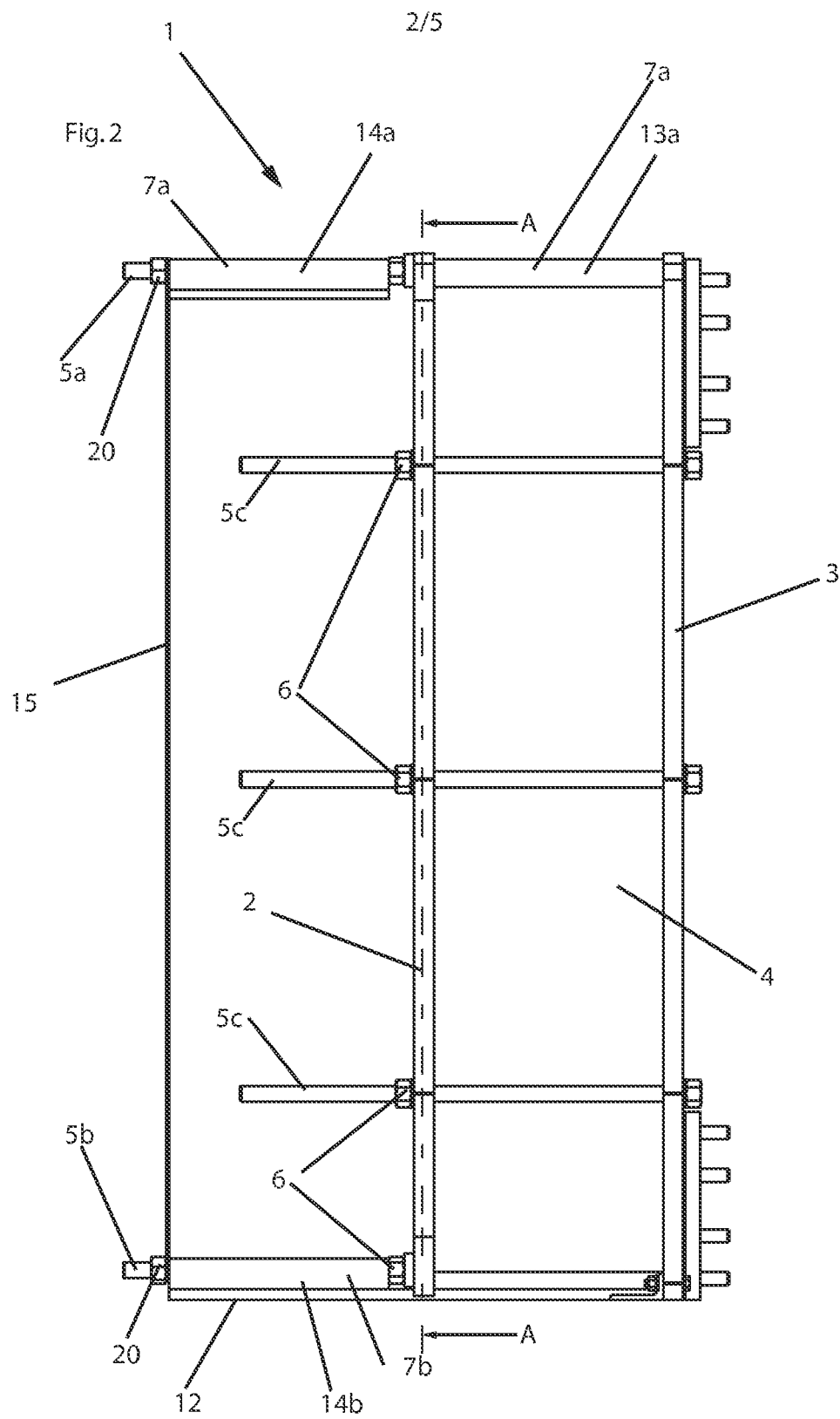
at least one guiding element (7a, 7b) for guiding the first end plate (2) and the heat exchanger plates (4) relatively the second end plate (3) is releasably arranged on at least one of the threaded tightening bolts (5a, 5b), which guiding element (7a) extends through an aperture (8) in the first end plate (2),

- 5 **characterized in that** the heat exchanger plates (4) rest on the at least one guiding element (7b) and where the first end plate (2) rests on a guiding rail (12), upon which guiding rail (12) the at least one guiding element (7b) is movably received.

- 10 11. A plate heat exchanger (1) according to claim 10, wherein an upper located guiding element (7a) only guides the heat exchanger plates (4) and the first end plate (2).

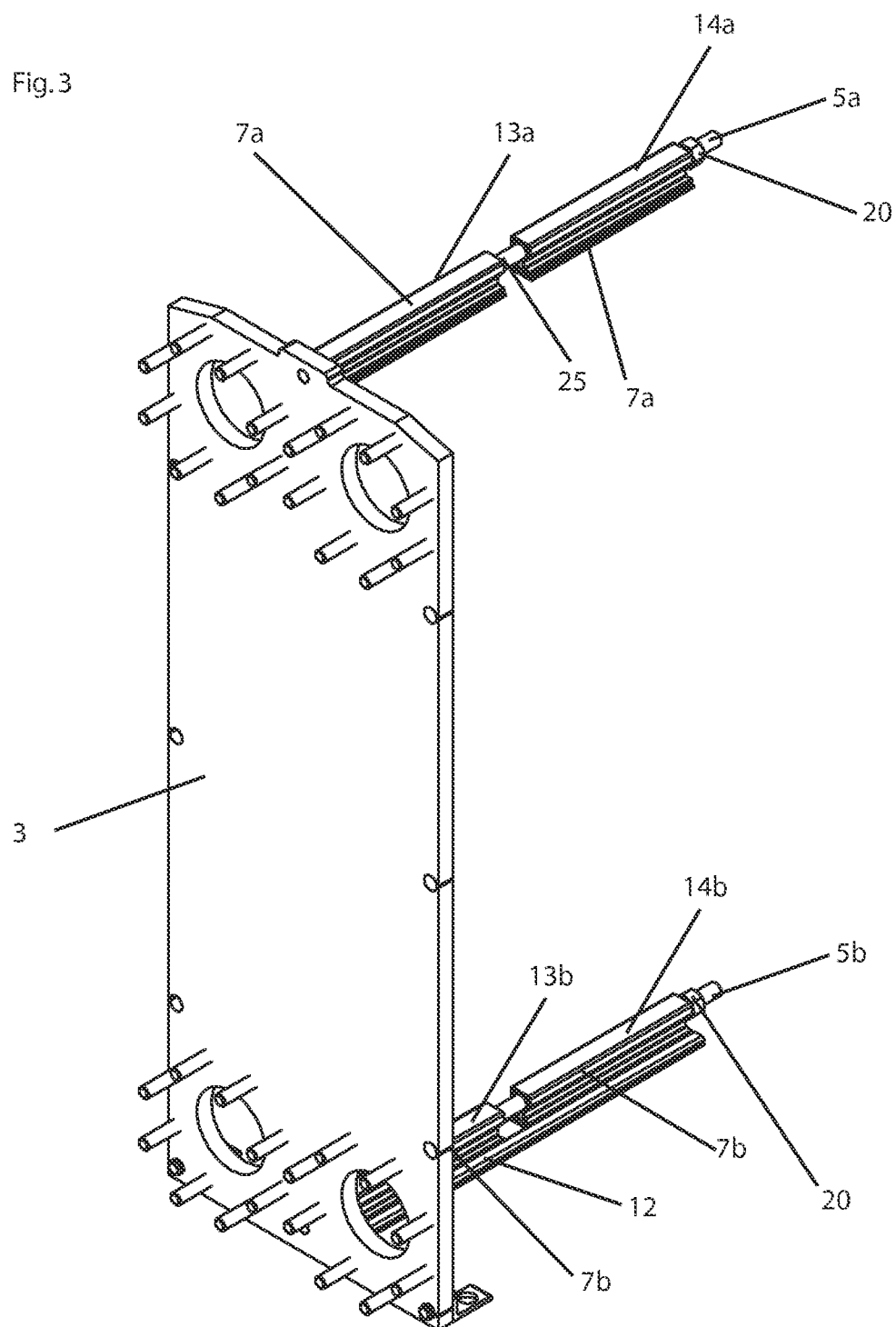
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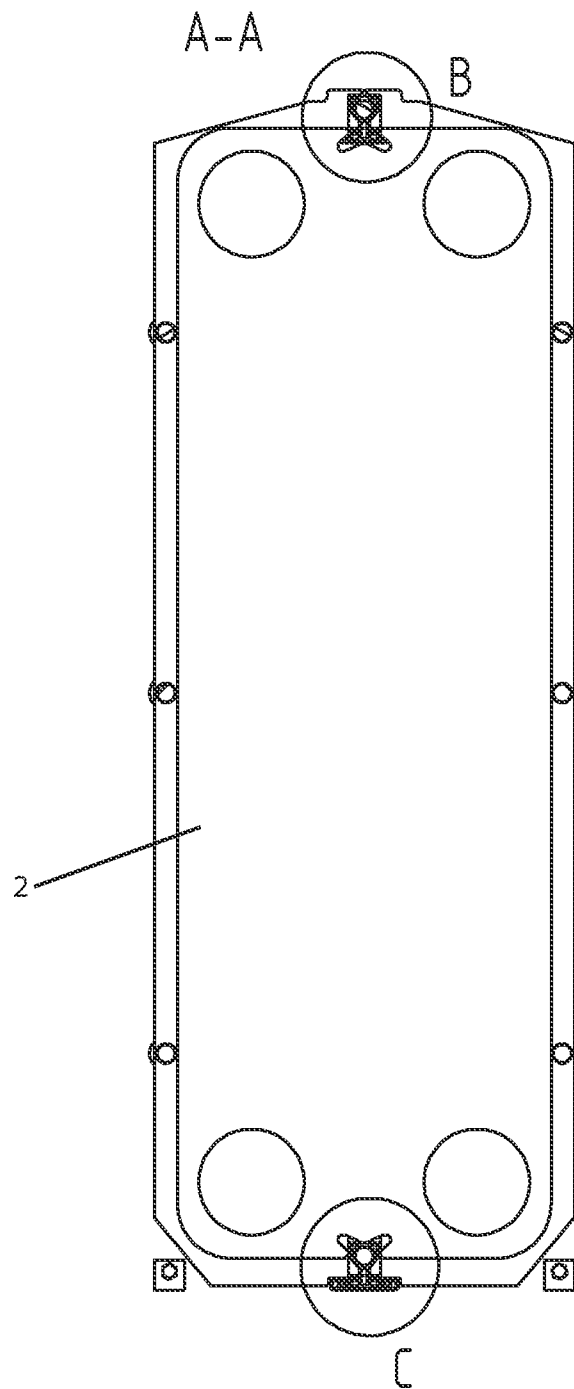
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Fig. 3



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Fig. 4



5/5

Fig. 7a

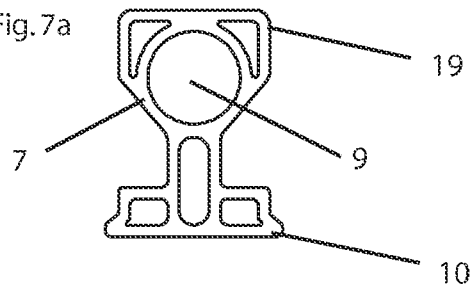


Fig. 7b

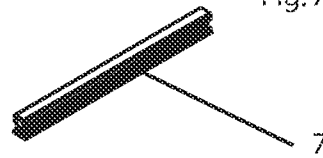


Fig. 8a

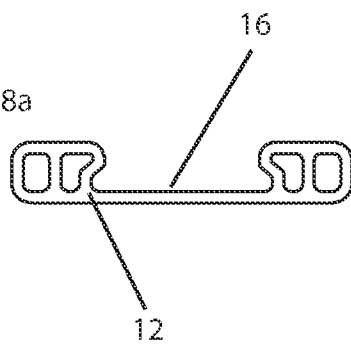


Fig. 8b

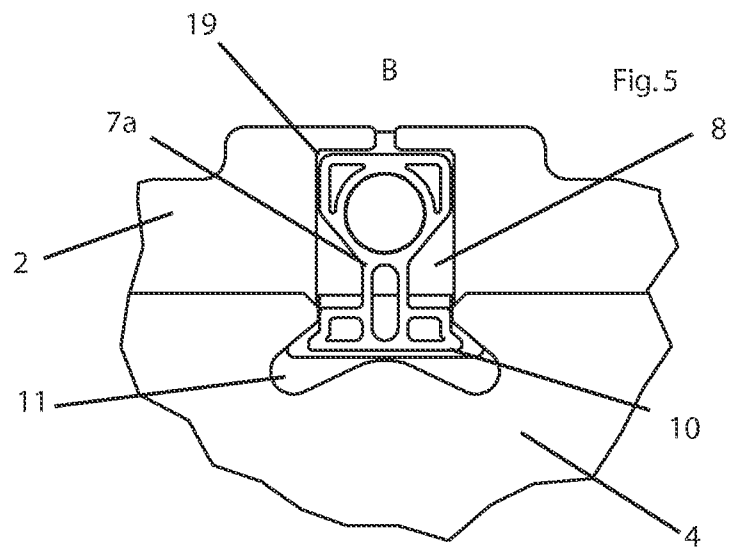
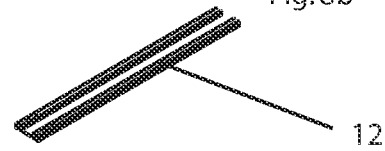
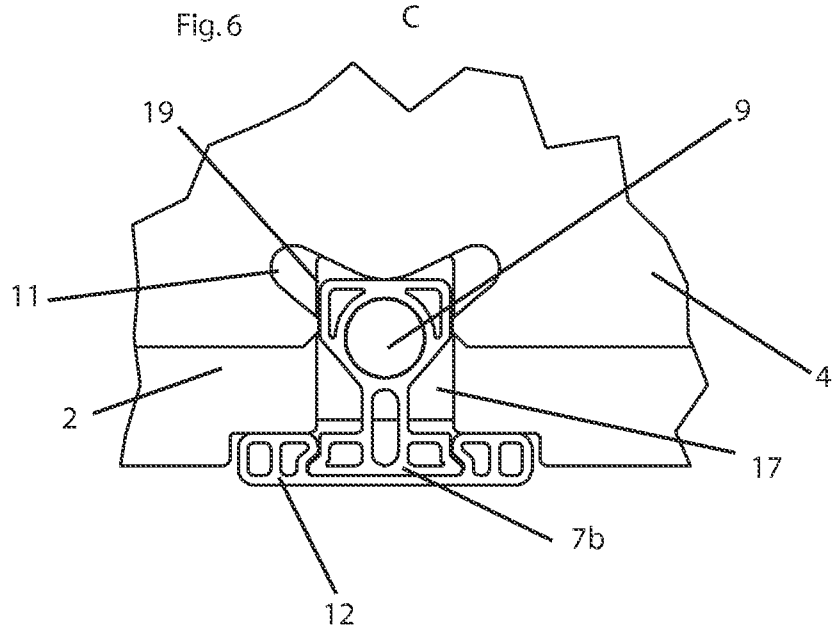


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2010/050206

A. CLASSIFICATION OF SUBJECT MATTER

INV. F28F3/08 F28F9/007
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F28F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 312 042 A (APV CORP LTD [GB]) 15 October 1997 (1997-10-15) page 6, line 4 - line 7; figures 1,6 -----	1,2,4
X	GB 674 032 A (CHERRY BURRELL CORP) 18 June 1952 (1952-06-18) figure 1 -----	1,2
A	GB 2 107 845 A (SCHMIDT W GMBH & CO) 5 May 1983 (1983-05-05) figure 1 -----	1-9
A	JP 10 103889 A (HISAKA WORKS LTD) 24 April 1998 (1998-04-24) * abstract; figures 1-6 -----	1-11

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☒ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search

26 July 2010

Date of mailing of the international search report

11/08/2010

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2010/050206

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

This invention refers to a plate heat exchanger having guiding elements provided with a through-hole to receive bolts in order to tighten and hold the plates together. The features of this invention defined in claims 1, 2 and 4 are known from GB-A-2 312 042 and GB-A-674 032. The additional features included in the dependent claims seem to provide the advantage of an open service mode of the heat exchanger. Due to the fact that the guiding element can be moved along the bolts and that one part of the guiding element can be removed, an open mode of service of the heat exchanger is attained in which the plates can be separated for cleaning (see page 9, line 11 to page 10, line 2). Therefore, the problem posed by the present invention is to enabling maintenance such as cleaning or repairing. Other details of the dependent claims may lead to further objective problems.

2. claims: 10, 11

This invention refers to a plate heat exchanger having heat exchanger plates and end plates and comprising a guiding element in which the heat exchanger plates rest and a guiding rail in which one of the end plates rests, the guiding element being movably received upon the guiding rail. No through-hole is provided in the guiding element of used in this invention. By means of these features the load of the end plate is transmitted to the rail. Therefore, the problem posed by this invention is to optimize the load distribution.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/SE2010/050206

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