Lining of non-metallic material for inlet ports and outlet ports of a frame plate and/or a pressure plate of a plate heat exchanger. The lining comprises a cylindrical part (10) and at least one but preferably two flanges (11, 12). In this connection the flange (11) that is intended to be positioned between a heat exchanger plate and a frame plate and/or a pressure plate is so thin that no machining of the latter needs to be done.
FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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Lining of non-metallic material

This invention relates to a lining of non-metallic material for lining of inlet ports and outlet ports of a frame plate and/or a pressure plate of plate heat exchangers and comprising a cylindrical part and at least one but preferably two flanges which at the use of the lining are positioned on each side of the frame plate and/or the pressure plate.

A plate heat exchanger comprises a number of heat exchanger plates which are fastened between a frame plate and a pressure plate. In the frame plate and/or the pressure plate there are made inlet ports and outlet ports for the heat exchanging media. In these inlet ports and outlet ports there are often linings inserted which can be made of different materials. The insertion of such linings implies that the frame plate and/or the pressure plate will not come into contact with the heat exchanging medium which can be corrosive. Due to that fact the frame plate and/or the pressure plate can be made of a cheap material.

The use of conventional linings, however, has involved machining of the inlet ports and the outlet ports of the frame plate and/or the pressure plate, because the thickness of the flange of the lining has been so large that without machining in the form of recesses round the inlet ports and the outlet ports of the frame plate and/or the pressure plate the flange should have encroached too much upon the structural measure of the heat exchanger. Moreover, problems should have arisen regarding the contact between a heat exchanger plate and the frame plate and/or the pressure plate.

The British patent No. 1,041,805 discloses a lining that is made of an elastic material and that is intended to be inserted into an inlet port or an outlet port of a frame plate or a pressure
plate. The lining comprises a cylindrical part having a flange in each end. In this connection the flange that is intended to rest against the heat exchanger plate is so thick that machining in the form of a recess round the inlet ports and the outlet ports has had to be done in the frame plate. Such a machining is both expensive and time-consuming.

German patent publication No. 23 57 059 also discloses a lining made of an elastic material for use in a plate heat exchanger.

In Fig. 3 of the patent publication there is shown a schematic sketch of the position of the lining in a frame plate. In this case a relatively thick flange of the lining has been outlined between the frame plate and the first heat exchanger plate, the frame plate appearing to be unmachined. This will, however, probably depend on the fact that the drawing is of a schematic nature, because the apparatus according to the drawing would hardly function with such a large distance between the frame plate and the heat exchanger plate.

That the drawing only shows a schematic and not a realistic picture of the apparatus is clear from the specification, which states that for increasing the sealing effect a recess for the flange of the lining should be done in the frame plate. That means that this patent publication discloses an apparatus that is impaired by the same problems as that according to the British patent No. 1.041.805.

This invention intends to remove the problems that are connected with known technics. This is made possible by the fact that the flange that is positioned between the frame plate and/or the pressure plate on one hand and a heat exchanger plate on the other hand is made so thin that it does not require recesses round the inlet ports and the outlet ports of the frame plate and/or the pressure plate, and that the flange is provided with a bulge,
which functions as a seal between the heat exchanger plate on one hand and the frame plate and/or the pressure plate on the other hand.

A preferred embodiment of the invention shall be described more closely in connection with the accompanying drawings, in which Fig. 1 is a section through a lining divided into halves and

Fig. 2a-c disclose different connections between the one flange of the lining and the flange of a connecting tube.

The lining is made of a non-metallic material and comprises a cylindrical part 10 with a flange 11, 12 on each side of the cylindrical part.

The flange 11 that is intended to rest against a heat exchanger plate is so thin that it can be applied on the outside of the side surface of the frame plate or the pressure plate without encroaching materially upon the structural measure of the heat exchanger. This is of extremely great importance, since due to that the usual machining in the form of a recess in the side surface of the frame plate and/or the pressure plate is eliminated.

The flange 11 discloses at its periphery a part that is thicker than the remaining part of the flange. This thick part comprises a bulge 13 that extends round the flange 11 and functions as a ring gasket of the closest heat exchanger plate. In this connection the heat exchanger plates are oriented such that the gasket grooves with the gasket are directed towards the frame plate. Thus, the ring gasket 13 is intended to fit into the pressed gasket groove of the first heat exchanger plate and functions as a seal between the heat exchanger plate and the frame plate. By this arrangement the flange 11 is locked in radial direction at the same time as
the lining is centered in the right position in the hole cut out in the frame plate, which hole of tolerance reasons must be made with a certain excess.

5 The device can be provided with an annular disc 14, preferably a sheet made of steel, that rests against and protects the thin flange 11. In this connection the plate 14 is provided with a circular opening which essentially corresponds to the hole section of the lining 10.

10 The plate 14 is kept in place by the fact that its outer part projects a bit in under the bulge 13 and as an extra security measure can be glued or vulcanized onto the flange 11.

15 The other flange 12 of the lining 10 is intended to rest against a connecting flange of a connecting tube. In order to prevent that the flange 12 is compressed too much and runs the risk of being crushed during the mounting of the connecting tube, at least one distance means can be applied between the connecting tube flange on one hand and the frame plate and/or the pressure plate on the other hand (see Figs. 2a-c).

This distance means may comprise a loose or glued washer 21 on at least some of the pin bolts that connect the connecting tube 22 with the frame plate and/or the pressure plate 23 (Fig. 2a). In this case the diameter of the flange gasket 24 has to be coordinated with the diameter of the washer such that the distance means 21 gives the intended effect.

30 Another distance means may comprise a number of pins 25 inserted in the flange 24. In this connection the pins are suitably applied at the mounting procedure by gluing or press fit. Alternatively the pins can be vulcanized into the rubber. In the embodiment according to Fig. 1 the distance means comprises pins 15 fastened in the flange 12.
A third distance means comprises a metal ring 26 that is applied in a groove in the peripheral part of the flange 24. The ring that can be made of round iron, square iron or hexagon iron can be open and resilient or closed. The ring is fastened in the groove of the flange in a suitable way, for instance by means of vulcanization.

In order to make a reasonable compression of the outer part 16 of the flange 12 possible this part may have a larger wall thickness than the inner part.

The lining is preferably made of an elastic material, for instance rubber, the two flanges of the lining being made in one piece with the remaining part of the lining.
Claims

1. Lining of non-metallic material for lining of inlet ports and outlet ports of a frame plate and/or a pressure plate of plate heat exchangers and comprising a cylindrical part and at least one but preferably two flanges which at the use of the lining are positioned on each side of the frame plate and/or the pressure plate, characterized in that the flange (11) that is positioned between the frame plate and/or the pressure plate on one hand and a heat exchanger plate on the other hand is made so thin that it does not require recesses round the inlet ports and the outlet ports of the frame plate and/or the pressure plate, and that the flange (11) is provided with a bulge (13), which functions as a seal between the heat exchanger plate on one hand and the frame plate and/or the pressure plate on the other hand.

2. Lining according to claim 1, characterized in that the bulge (13) is formed as a ring gasket that is intended to fit into a gasket groove of the heat exchanger plate.

3. Lining according to claim 1 or 2, characterized in that an annular disc (14) of metallic material and disclosing an opening essentially corresponding to the hole section of the lining (10) is fastened onto the top side of the flange (11).

4. Lining according to claim 3, characterized in that the peripheral part of the plate (14) projects in under the bulge (13).

5. Lining according to anyone of the preceding claims, characterized in that the other flange (12) is provided with distance means.

6. Lining according to claim 5, characterized in that the distance means comprises a washer (21) that is applied
on at least some of the bolts that connect the connecting tube (22) with the frame plate and/or the pressure plate (23).

7. Lining according to claim 5, characterized in that the distance means comprises pins (25) fastened in the flange (12; 24).

8. Lining according to claim 5, characterized in that the distance means comprises a metal ring (26) that is applied in a groove in the peripheral part of the flange (24).

9. Lining according to anyone of the claims 5-8, characterized in that a part (16) of the flange (12; 24) has a larger wall thickness than another part.

10. Lining according to anyone of the preceding claims, characterized in that it is made of rubber.
INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE83/00317

I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC:

- F 28.F 9/00

II. FIELDS SEARCHED

Minimum Documentation Searched:

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III. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>Y</td>
<td>DE, B2, 2357 059 (EDVARD AHLBOM GMBH) 21 September 1978</td>
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<td>Y</td>
<td>GB, A, 813 344 (BAYNE SPEDDING) 13 May 1959</td>
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<td>Y</td>
<td>GB, A, 1 079 071 (ESSO RESEARCH AND ENGINEERING COMPANY) 9 August 1967</td>
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* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier document but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search: 1983-11-14

International Searching Authority: Swedish Patent Office

Date of Mailing of this International Search Report: 1983-11-28

Signature of Authorized Officer: Sune Söderling
### FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

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### V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE

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

1. **Claim numbers ..........**, because they relate to subject matter not required to be searched by this Authority, namely:

2. **Claim numbers ..........**, 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:

### VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

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

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. 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 claim numbers:

4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- The additional search fees were accompanied by applicant's protest.
- No protest accompanied the payment of additional search fees.