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(54) Heat transfer plate having a gasket groove and method of forming such a groove.

(57) In heat transfer apparatus of the plate type, gaskets around the plates are normally elastomeric gaskets fixed by adhesive into pressed recesses in the plates. These gaskets are expensive and the technique of fixing and replacing them is time consuming. In accordance with the present invention, a pressed groove 2 in a plate 1 is filled with a body 4 of plastics material having the capacity of adherence to the metal of the plate 1. This body 9 of plastics material is then formed with an accurate groove 10 to receive and mechanically retain a seal 11.

The groove 10 and gasket 11 may be duplicated to form a double seal.

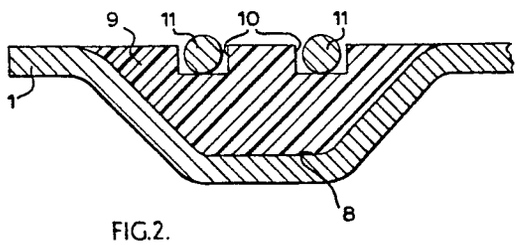

FIG.2.

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TITLE MODIFIED
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Title: Gasketing of Plate Heat Transfer apparatus

This invention relates to the gasketing of plate heat transfer apparatus.

A plate heat transfer apparatus, i.e. either a plate heat exchanger or a plate evaporator, consists of a series of plates arranged spaced face-to-face relationship to form flow spaces between the plates. The boundaries of the flow spaces are formed and sealed by gaskets which are normally mounted in grooves pressed into the plates. The gaskets are normally of a rubber or rubber-like material and are retained in their respective grooves by adhesive. The initial mounting of the gaskets in the grooves is a fairly time consuming process involving surface preparation, application of adhesive, location of the gasket in the groove and probably curing of the adhesive. When the gasket needs to be replaced, the old gasket has to be stripped out, the metal surface cleaned of old adhesive and then the new gasket has to be mounted with all that entails.

If, instead of being pressed, the gasket recesses were precision machined grooves, the sealing could be more easily obtained by using preformed O-ring, lip or other similar seals which would be a close mechanical fit in the grooves and would therefore not need to be retained by adhesive. However, when using the usual metal thickness (e.g. 0.7mm) of plate heat transfer apparatus, precision machining of grooves is not practicable and for many

years the use of adhesive has been the normal practice in the industry.

According to the present invention there is provided a heat transfer plate having a pressed gasket groove which is at least partially filled with a plastics material which adheres to the plate metal and which is formed with an accurate groove adapted to receive, or receiving, a preformed seal of O-ring, lip or other appropriate type.

According to a second aspect of the invention, there is provided a method of forming an accurately profiled gasket recess in a pressed metal plate comprising the steps of forming a pressed recess in the metal plate, at least partially filling the pressed recess with a plastics material which adheres to the metal of the plate, and accurately forming a gasket recess in the plastics material

The gasket recess may be formed by moulding or by machining the plastics material.

By using an intermediate filling of plastics material permanently attached to the plate metal, no adhesive is required to attach the sealing gasket, conventional commercially available gasket forms may be used, the gasket loading may be reduced, which leads to easier tightening of the frame of the heat transfer apparatus, the application of the gasket can be automated more

easily and the replacement of gaskets is facilitated.

The invention will be further described with reference to the accompanying drawings, in which :

Figure 1 is an elevation of a form of heat exchanger plate in accordance with a form of the present invention and having a double seal gasket;

Figure 2 is a section on the line II-II of Figure 1; and

Figures 3 and 4 are each diagrammatic sections similar to Figure 1 showing a form of single seal applied according to the techniques of the present invention.

Turning first to Figure 1, a heat exchanger plate is illustrated at 1 and as having four corner ports 2, 3, 4 and 5. The line of a peripheral gasket, of double seal form is indicated at 6, and it will be noted that the corner ports 4 and 5 also have port gaskets 7, also of double seal nature.

Figures 2 to 4 each show a portion of the heat exchanger plate 1 as being provided with a pressed in gasket recess 8.

In order that this recess 8 may be converted to a form sufficiently accurate for a preformed seal 6, it is filled with a plastics material 4 which has the property of adhering to the metal of

the plate 1 and which is formed, either by pressure moulding or by machining, or a combination of both, with an accurately formed recess 10 to receive the seal.

The plastics material may for instance be that sold as 'keebush' or 'keeglass'. These materials have the property of adhering to the plate metal, are as flexible as the plate pressing and will withstand attack from a wide range of chemicals over a wide range of temperatures. In addition, these materials are hard and machinable. The plastics material is mixed and positioned in the groove 2 and can be moulded under pressure so as simultaneously to fix it in the rubber groove and to form a suitably profiled recess 10, for the seal. Alternatively, the plastics material can be roughly sculptured and, when cured, machined to form the final shape of the recess 10.

In Figure 3 the seal is shown in the form of a single O ring seal 12.

In Figure 4, the O-ring seal 12 is shown as being replaced by a lip seal 13.

In accordance with a preferred form of the present invention, Figure 2 shows a construction in which the filling 9 is formed with a pair of such recesses 10, each of which is shown as receiving an O-ring seal 11 to form the double seal. The configurations of the port gaskets 7 may be similar.

It will be appreciated that when dealing with hazardous fluids, a seal of this nature is beneficial, especially if the space between them is monitored for leakage of the hazardous fluid so that this leakge is detected before the hazardous fluid leaks passed the second seal into the ambient atmosphere. For this purpose, the space between the two seals 11 may have an appropriate fluid pumped through it and in circuit with a detector to detect the presence of the hazardous fluid in the diluent. Suitable micro-bore piping may be used to make the connections.

Various modifications may be made within the scope of the invention. Thus, although the grooves 10 of Figure 2 are shown as receiving O-ring seals, lip or other seals could be used instead.

CLAIMS:

1. A heat transfer plate having a pressed groove, characterised in that the said pressed groove is at least partially filled with a plastics material which adheres to the plate metal and which is formed with an accurate recess adapted to receive, or receiving, a preformed seal of O-ring, lip or other appropriate type.

2. A heat transfer plate as claimed in claim 1, characterised in that the plastics material is formed with two or more accurate recesses to receive seals so as to provide a double or multifold seal between the flow spaces and the ambient.

3. A heat transfer plate as claimed in claim 2, characterised in that the space between the gaskets of the double seal is monitored for leaking fluid.

4. A heat transfer plate as claimed in claim 3, characterised in that the monitoring is achieved by circulating a gas or liquid through the space.

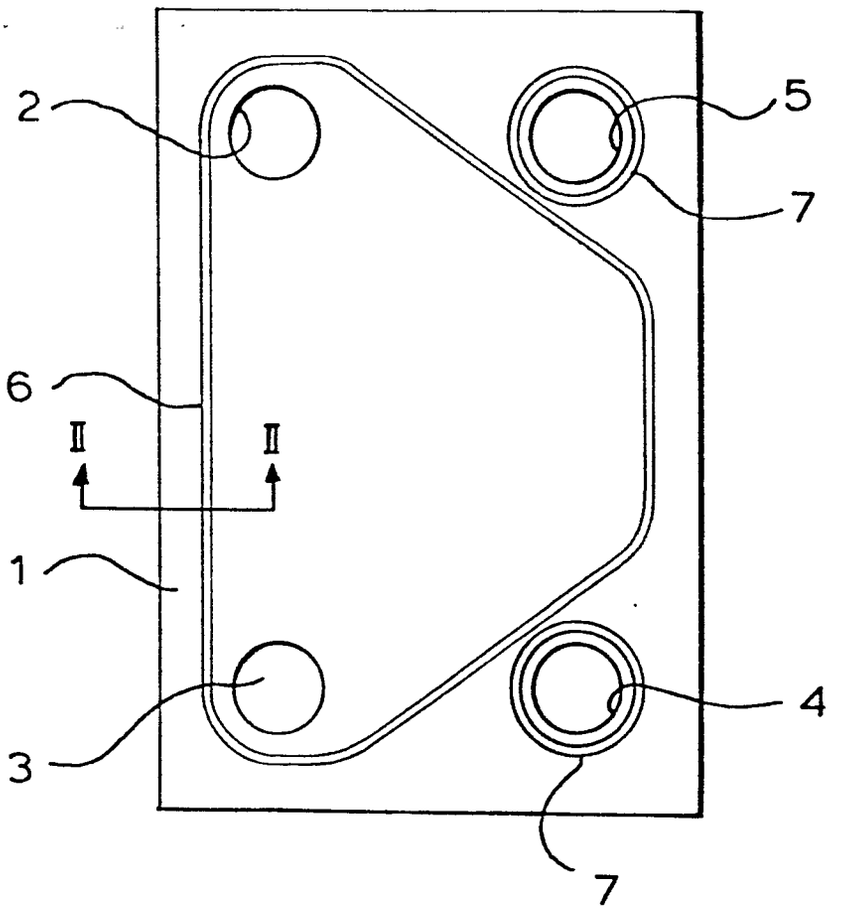
5. A method of forming an accurately profiled gasket recess in a pressed metal plate, characterised by comprising the steps of forming a pressed groove in the metal plate, at least partially filling the pressed groove with a plastics material which adheres to the metal of the plate,and accurately forming a gasket recess in the plastics material.

6. A method as claimed in claim 5, characterised in that two or more parallel gasket recesses are formed in the plastics material.

7. A method as claimed in claim 5 or 6, characterised in that the or each gasket recess is formed by moulding the plastics material.

8. A method as claimed in claim 5 or 6, characterised in that the or each gasket recess is formed by machining the plastics material.

FIG.1.



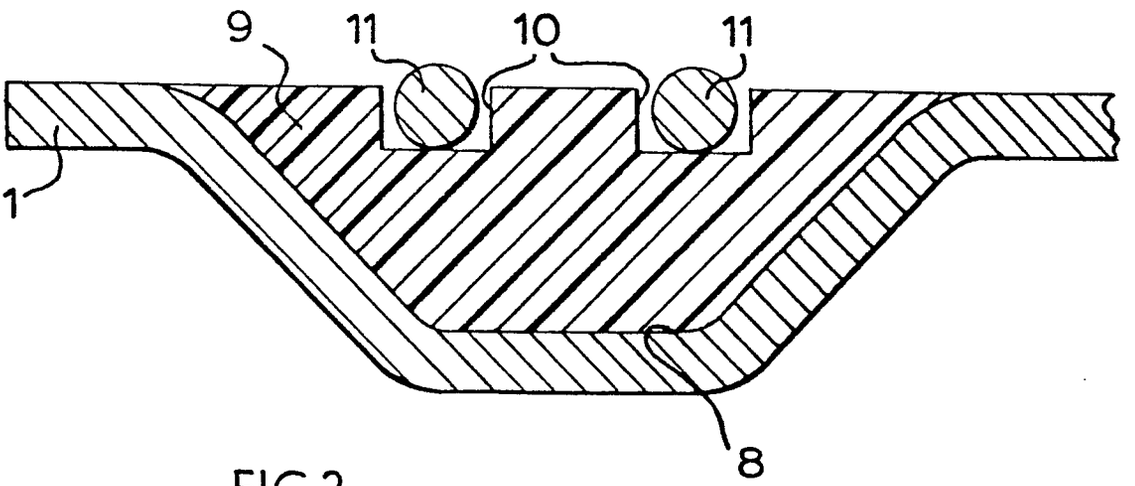


FIG.2.

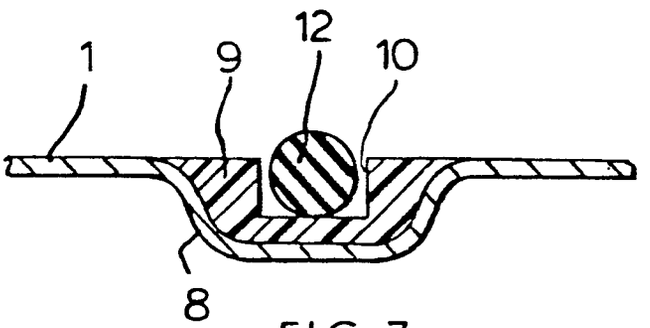


FIG.3.

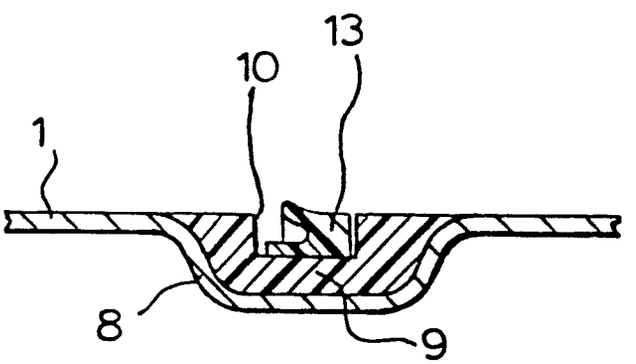


FIG.4.