June 10, 1969 J. D. USHER 3,448,796

PLATE HEAT TRANSFER APPARATUS

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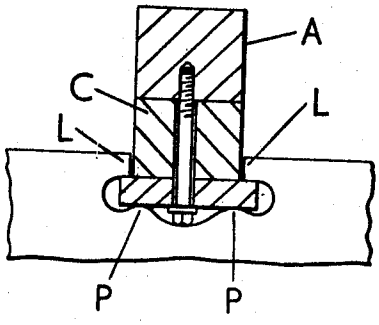


FIG. 1.

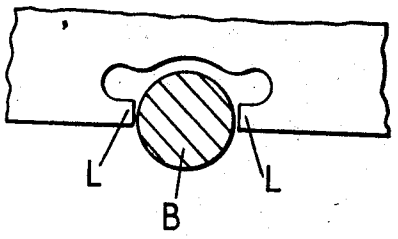


FIG. 2.

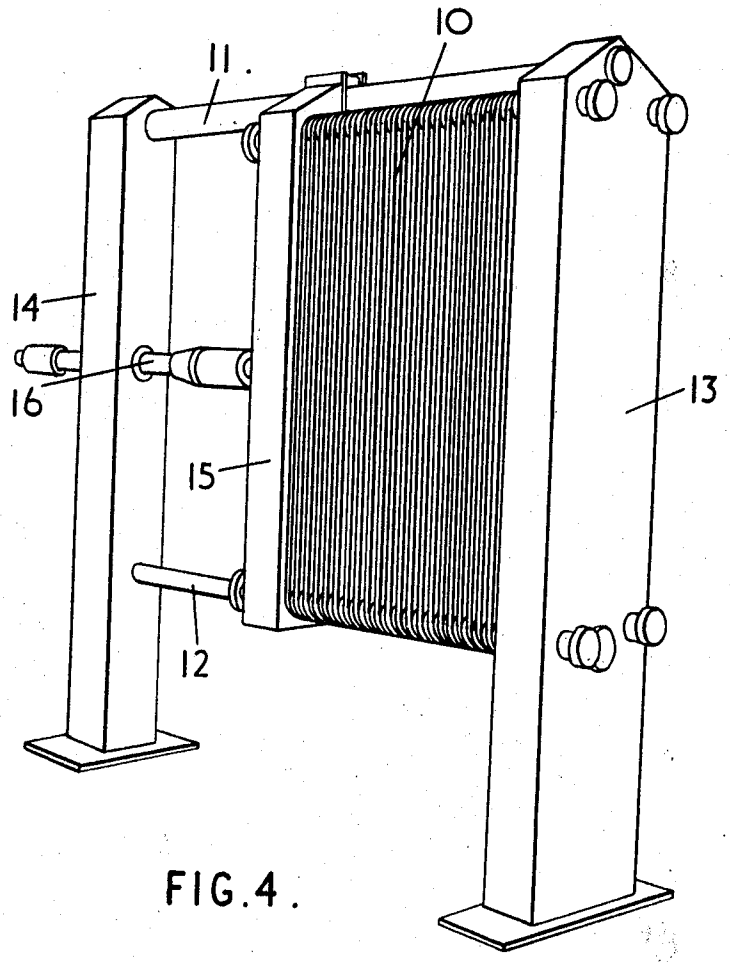


FIG. 4.

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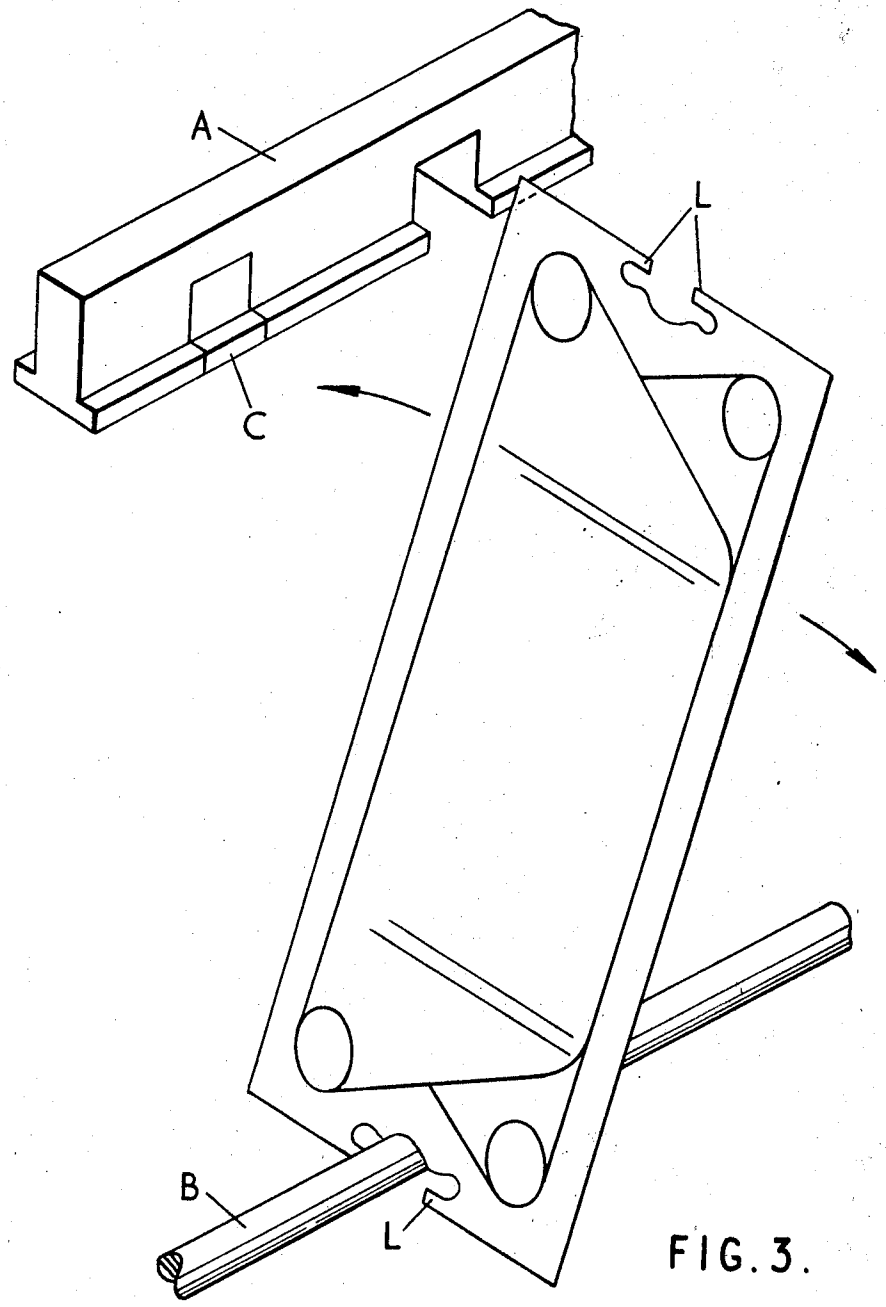


FIG. 3.

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PLATE HEAT TRANSFER APPARATUS

John Dennis Usher, Redhill, Surrey, England, assignor to The A.P.V. Company Limited, Crawley, Sussex, England, a British company

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Int. Cl. F28f 3/08
U.S. Cl. 165—78 6 Claims

ABSTRACT OF THE DISCLOSURE

A plate type heat transfer apparatus, and a frame therefor, wherein the top bar of the frame has a wider section at the bottom than at the top to provide suspension for the plates, and wherein the top bar as removable bottom portions at spaced intervals along its length to provide gaps through which the upper edges of the plates may be introduced or withdrawn.

This invention relates to plate heat transfer apparatus including heat exchangers and evaporators.

In a plate heat exchanger designed for heat interchange between two fluid media, the plates themselves take the form of pressings in stainless steel or other similar materials fitted with sealing gaskets around their outer periphery and with ports for the inlet and outlet of the two fluid media. The plates are normally so arranged that when they are clamped together in a frame each fluid medium is conducted to alternate spaces between plates. The frames in which the plates are carried normally take the form of a press consisting of two vertical members between which are fixed a top carrying bar on which the plates are hung and a bottom guide bar by which the lower end of the plates are located. A heavy clamping member is also suspended from the top carrying bar, and by means of tightening screws or tie bars this compresses the plates together against one of the end vertical member.

In order to render the plates leak-proof under pressure by obtaining efficient sealing of the outer gasket, accurate registration of all the plates must be ensured in order to give correct alignment of the gaskets, and this location is dependent on the method by which the plates are carried and guided by the top and bottom bars respectively. The method by which these two bars support and locate the plate must, while giving accurate registration, be such that the plates can easily be removed from the frame for inspection, cleaning or replacement, in order to take full advantage of this type of heat exchanger. Most methods of location known to the art locate the plates by hanging them downwards from the top bars, but in order to allow them to be removed a certain amount of movement is permitted, either upwards or sidewards or both, and because of this degree of freedom the plates can sometimes move laterally under their clamping pressure so becoming out of alignment and causing leaking and poor performance.

It is the object of the present invention to provide a method of plate location which is positive but which permits removal of the plates.

The invention consists in a frame for a plate heat transfer apparatus including a top bar adapted to support plates suspended therefrom, the said top bar having a cross-section wider at the bottom than at the top to provide support for suitably profiled cut outs at the top edges of the plates, the said top bar having, at intervals along its length, removable bottom portions to provide gaps through which the upper edges of the plates may be introduced or removed for assembling or dismantling the plates in or from the frame.

The invention further consists in a plate heat transfer apparatus comprising a frame according to the invention as set forth above, having a plurality of plates assembled thereon.

The cut outs on the plates may be profiled to fit over the lower section of the top bar to give lateral and vertical location.

Preferably, the plates are formed with identical cut outs top and bottom, each being profiled to fit over the lower section of the top bar or to engage a bottom bar of the frame.

The use of identical cut outs simplifies tooling for the plate manufacture as it enables the pressings of alternate plates to be identical.

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

FIGURE 1 is a section through a preferred form of top bar, with an adjacent portion of one plate shown in elevation;

FIGURE 2 is a similar view of a bottom bar;

FIGURE 3 is a perspective view showing a plate partially removed from between the top and bottom bars; and

FIGURE 4 is a perspective view of a plate type heat transfer apparatus.

Referring first to FIGURE 4, the apparatus includes a pack of plates **10** suspended on a top carrying bar **11** and guided by a bottom bar **12**. The frame is completed by a head **13**, and end support **14**, a follower **15** and a clamping member **16**.

The top carrying bar shown in FIGURE 1 embodies an inverted T section A, while the top edges of the plates are formed with a cut out profile which embodies two lugs L which fit closely into the corners of the T section A, and one or two projections P, which locate closely on the underside of the T, so ensuring that the plate is positively located against lateral movement either vertically or horizontally.

Plate removal is effected by making removable small sections C of the lower portion of the top bar A (see FIGURE 3). Removal of one of these sections C permits the plate to be removed by swinging it sideways as shown in FIGURE 3, the space previously occupied by member C allowing the corner of the plate to clear the top bar A. The plate when being removed can if necessary be tilted slightly out of its own vertical plane in order to reduce the clearance arc and minimise the cut out of the item C. The sections C may be held in place by bolts as shown in FIGURE 1.

A further advantage of this invention is that a similarly profiled cut out in the lower edge of the plate can be used to locate the plate over the bottom bar B as shown in FIGURE 2, where the bottom bar, which can either be circular or rectangular in form, fits closely in between the vertical terminations of the lugs L so preventing lateral movement of the bottom of the plates. Use of identical profiles in the top and bottom edges of the plates enables identical pressings to be used for the alternate plates necessary to take the two fluid media, the alternation being obtained by inverting alternate plates. By having the inlet and outlet ports at the opposite ends of one side of the plate for one fluid medium, inversion of the plate brings the inlet and outlet ports into the correct position for the inlet and outlet of the other fluid medium.

Various modifications may be made within the scope of the invention.

I claim:

1. In a frame for a plate heat transfer apparatus comprising a head, an end support, and a top bar and a bottom bar interconnecting the head and end support and adapted to support a pack of plates, the top bar having

a cross section wider at bottom than the top to provide suspension support for undercut profiled cutouts at the top edges of the plates: the improvement that the said top bar comprises detachably secured bottom portions at spaced intervals along the length thereof to provide gaps in the wider cross section of the bar through which gaps the profiled cutout at the top edges of the plates may be introduced or removed for assembling or dismantling the plates in or from the frame.

2. In a plate heat transfer apparatus comprising a frame and a pack of heat transfer plates assembled in the frame in spaced face to face relationship, the frame including a head, an end support, a top bar and a bottom bar interconnecting the head and the end support, the top bar having a cross section wider at the bottom than at the top, the plates in the pack having upper edges formed with undercut profiled cut outs cooperating with the bottom of the top bar to suspend the plates therefrom, the plates having lower edges located on the bottom bar, a follower suspended between the top and bottom bars and means for urging the follower to compress the pack of plates towards the head: the improvement that the said top bar comprises detachably secured bottom portions at spaced intervals along the length thereof to provide gaps in the wider cross section of the bar, through which gaps the profiled cutouts at the top edges of the plates may be

introduced or removed for assembling or dismantling the plates in or from the frame.

3. A plate heat transfer apparatus as claimed in claim 2, wherein the cut outs in the upper edges of the plates are profiled to locate the upper edges against the top bar both vertically and laterally.

4. A plate heat transfer apparatus as claimed in claim 2, wherein the lower edges of the plates have cut outs with recesses engaging the bottom bar.

5. A plate heat transfer apparatus as claimed in claim 4, wherein the cut outs at the top and bottom edges of the plates are identical.

6. A frame as claimed in claim 1, in which the top bar has a cross section in the form of an inverted T.

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MEYER PERLIN, *Primary Examiner.*

THEOPHIL W. STREULE, *Assistant Examiner.*

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