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STACKED CASELESS HEAT EXCHANGERS

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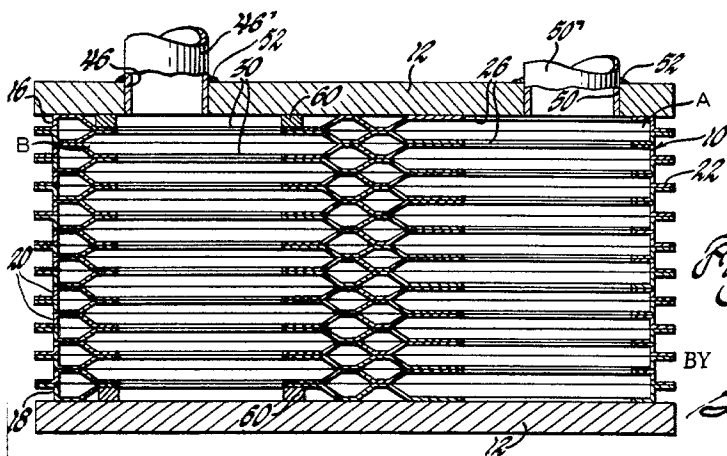
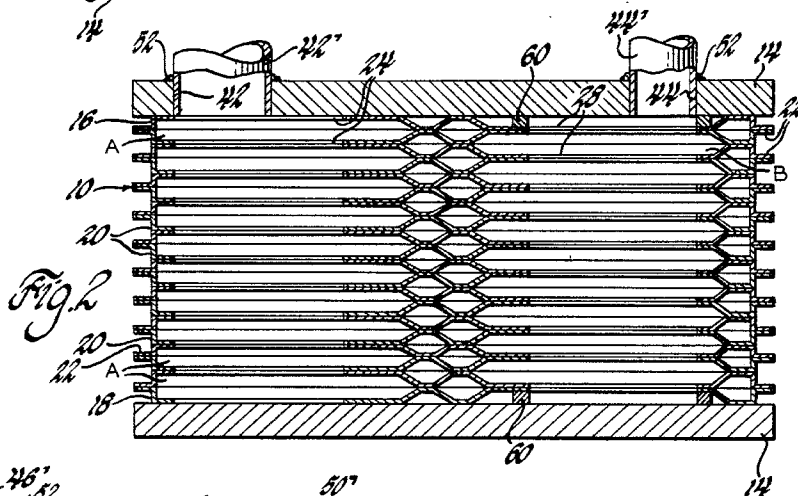
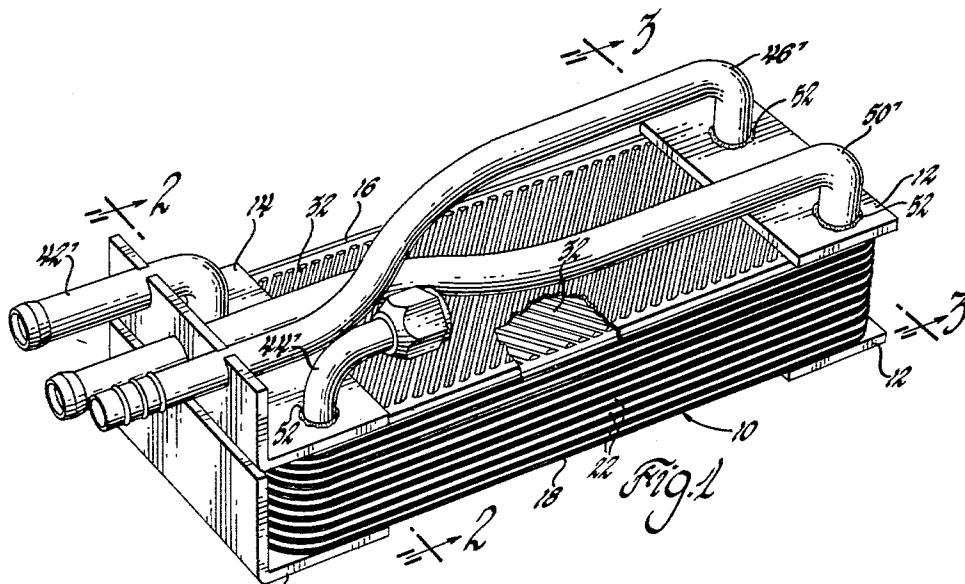


Fig. 3

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STACKED CASELESS HEAT EXCHANGERS

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This invention relates to heat exchangers and more particularly to liquid-to-liquid heat exchangers of the stacked metal plate type.

When providing stacked plate heat exchangers, it has been customary to use a casing, not only for supporting purposes with respect to the adjoining elements, but also to prevent outward deformation of the plates as the latter are internally subjected to fluid pressures. It also has been customary heretofore to use added sealing devices, such as gaskets or packing, between adjacent plates of the stack to prevent leakage therefrom.

An object of the present invention is to provide an improved liquid-to-liquid, stacked plate-type heat exchanger in which no casing or added sealing devices are required.

A feature of the present invention is a multiple plate heat exchanger in which the plates are such that they themselves form junctions sealing or containing liquids to be conducted between the plates in heat exchange relation. Another feature is a stacked plate heat exchanger which has plates of uniform thicknesses and which plates are self-constraining against the tendency to deform because of the application of internal fluid pressure.

These and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawings:

FIGURE 1 is a perspective view of a two-liquid heat exchanger presenting one embodiment of the present invention;

FIGURE 2 is a cross-sectional view looking in the direction of the arrows 2—2 in one plane in FIGURE 1 and drawn to a larger scale; and

FIGURE 3 is a view similar to that of FIGURE 2 but looking in the direction of the arrows 3—3 in another plane in FIGURE 1.

In the drawings, the heat exchanger is shown as constituting a stack of thin metal or aluminum plates, the stack being generally indicated at 10. At each end of the stack 10 are two heavy plates 12 and 14 and one thin plate 16 or 18, and between the ends are eighteen (18) intermediate plates 20. The number of intermediate plates 20 may be varied to suit requirements of the exchanger.

Each of the thin metal plates 16, 18 and 20 is formed with flat peripheral flanges or margins 22 and two openings 24 and 26 as well as two openings 28 and 30. The openings 24 and 28 are formed near one end of each plate, and the openings 26 and 30 are located near the other end of each plate. Each plate bears oblique corrugations 32 which are at an angle to the longitudinal dimension of the stack. As seen in FIGURE 1, the alternate thin plates have their corrugations 32 such that the ridges of one plate are transverse to and in contact with the ridges of the next plate. The openings 24 form a series of openings preferably in registry through the stack thereby establishing communication between chambers A as each is defined between adjacent plates. The openings 26 also preferably, but not necessarily, are in registry as shown in FIGURE 3, thereby connecting the chambers A at the other end of the stack and diagonally opposite the openings 24. The aligned openings 28 and 30 give intercommunication between chambers B formed by the plates and at diagonally opposite corner zones of

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such chambers, and FIGURES 2 and 3 clearly show that the chambers A alternate with the chambers B along the thickness dimension of the stack. It is to be noted that the thin metal margins defining the openings 24 and 26 are in planes offset from the planes of the margins of openings 28 and 30. The thick end plate 14 is provided with two openings 42 and 44, whereas the heavy upper plate 12 at the other end of the stack is provided with two openings 46 and 50. The openings 42, 44, 46, and 50 are fitted with inlet and outlet conduits 42', 44', 46' and 50', respectively. Each is fastened to its supporting plate by welding or soldering as at 52.

The conduit 42' serves as the inlet conduit supplying one fluid to the chambers A, and the conduit 50' serves as a discharge conduit for those chambers. The conduit 46' serves as an inlet for a second fluid to be introduced to the chambers B, and the discharge from these chambers is by way of the conduit 44'.

In the particular embodiment shown, the two thin end plates 16 and 18 have spacing rings 60 serving to brace them at the periphery of each of the corresponding plate openings 28 and 30. With the aid of the thick outside plates, these rings 60 are not necessary and could be eliminated by appropriately forming the heavy plates so that they are integral therewith.

From the above, it will be seen that a casing is not necessary for the stack of plates once they are soldered or brazed together to form a unitary and homogeneous structure exhibiting an unbroken wall extending around the stack and from one end to the other of the latter. The direction of flow of the fluids is shown as indicated by the arrows in FIGURE 1, as countercurrent flow is preferred; but it will be understood that parallel current flow also is possible with the structure given. One liquid is conducted through chambers A, and the second liquid is conducted through the chambers B which alternate with the chambers A. The turbulent flow of each fluid through its respective flow passage is conducive to effective heat interchange between the liquids, the turbulence being due to the corrugations which may be of various shapes, sizes, and also angles as measured with respect to the longitudinal dimension of the stack.

What is claimed is:

1. A heat exchanger for conducting two liquids in heat exchange relation, said exchanger comprising a stack of plates forming successively arranged flow chambers, said plates including two end plates at each end of said stack and corrugated intermediate plates, each of said intermediate plates having its corrugations extending transverse to and being in contact with the corrugations in an adjacent plate and its periphery joined to the periphery of said adjacent plate to form one of said flow chambers, said intermediate plates having four continuous flanges defining four flow openings, two of the continuous flanges of each intermediate plate being joined to and in registry with two continuous flanges of an adjacent intermediate plate giving continuity of communication within one set of said flow chambers as a first flow passage for one fluid, the other two continuous flanges of each intermediate plate being joined to and in registry with the other two continuous flanges of an adjacent plate giving continuity of communication within a second set of flow chambers alternating with the said one set of flow chambers as a flow passage for a second fluid, an inlet and an outlet leading to each of the first and second fluid flow passages whereby said fluids may be passed in heat exchange relation along opposite sides of each of said intermediate plates, and said stack forming an unbroken wall extending around its peripheral extent.

2. A heat exchanger comprising a stack of thin metal plates brazed together, each of said plates being of uni-

form thickness, some of said plates being intermediate plates within the stack, each of said intermediate plates having corrugations, peripheral margins and also openings defined by flanges, said corrugations extending from said margins and terminating short of said openings, each of said corrugations in said intermediate plates being at a substantial angle with and in contact with the corrugations of an adjacent plate, said peripheral margins and opening flanges being brazed together to form two sets of flow chambers, the stack presenting a homogeneous structure in which flow chambers of one set alternate with the flow chambers of the other set, means for admitting a separate fluid to each of said sets and at opposite ends of said exchanger, means for discharging a fluid from each of said sets at opposite ends of the exchanger, and said intermediate plates presenting a solid wall ex-

tending around the said stack and from one end to the other end of the latter.

References Cited by the Examiner

UNITED STATES PATENTS

800,977	10/1905	Brewtnall	165—167
1,966,133	7/1934	Pieper	165—166
2,064,931	12/1936	Lysholm	165—166
2,251,066	7/1941	Persson et al.	165—167
2,392,444	1/1946	Amand et al.	165—167
2,596,008	5/1952	Collins	165—167
2,617,634	11/1952	Jendrassik	165—167

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